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The Cost of Providing Combined Prevention and Treatment Services, Including ART, to Female Sex Workers in Burkina Faso

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Abstract

Background: Female Sex workers (FSW) are important in driving HIV transmission in West Africa. The Yerelon clinic in Burkina Faso has provided combined preventative and therapeutic services, including anti-retroviral therapy (ART), for FSWs since 1998, with evidence suggesting it has decreased HIV prevalence and incidence in this group. No data exists on the costs of such a combined prevention and treatment intervention for FSW. This study aims to determine the mean cost of service provision per patient year for FSWs attending the Yerelon clinic, and identifies differences in costs between patient groups.

Methods: Field-based retrospective cost analyses were undertaken using top-down and bottom-up costing approaches for 2010. Expenditure and service utilisation data was collated from primary sources. Patients were divided into groups according to full-time or occasional sex-work, HIV status and ART duration. Costs were converted to 2012 US$. Sensitivity analyses considered removal of all research costs, different discount rates and use of different ART treatment regimens and follow-up schedules.

Results: Using the top-down costing approach, the mean annual cost of service provision for FSWs on or off ART was US$1098 and US$882, respectively. The cost for FSWs on ART reduced by 29%, to US$781, if all research-related costs were removed and national ART monitoring guidelines were followed. The bottom-up patient-level costing showed the cost of the service varied greatly across patient groups (US$505–US$1117), primarily due to large differences in the costs of different ART regimens. HIV-negative women had the lowest annual cost at US$505.

Conclusion: Whilst FSWs may require specialised services to optimise their care and hence, the public health benefits, our study shows that the cost of ART provision within a combined prevention and treatment intervention setting is comparable to providing ART to other population groups in Africa.

Introduction

In 2011 there were 34 million people living with HIV/AIDS, with approximately two thirds in Sub-Saharan Africa [1] Anti-Retroviral Treatment (ART) has long been recognised as the mainstay therapy for HIV infected individuals, resulting in decreased mortality rates and increased life expectancy. HAART has also recently been shown to dramatically reduce the risk of HIV acquisition amongst HIV discordant couples [2–4], sparking heated debate regarding its use as a prevention strategy to reduce HIV transmission rates, including amongst high-risk groups such as Female Sex Workers (FSW) [5–7]. Early diagnosis and treatment of these individuals would not only benefit them but could also reduce HIV transmission to their clients and general population [2]. This could be especially important in concentrated epidemic settings, as seen in West Africa, where FSW are thought to drive HIV transmission [8–11].

This central role of FSW in HIV transmission has led to the development of numerous targeted prevention programmes, which can result in large reductions in risk behaviour and HIV prevalence amongst participants [12,13]. The cost-effectiveness of these interventions in middle income countries has already been shown [14–18] However, there is limited data on interventions offering combined HIV prevention and treatment services for FSW, with evidence suggesting this marginalised group may currently be underserved [19,20].
In Burkina Faso, the HIV prevalence amongst the general population was 1.2% in 2009 [21], and between 7.7% and 36.2% [22] amongst FSW depending on region. The Centre Muraz, a bio-medical research centre in Bobo-Dioulasso, initiated the Yerelon (“know yourself” in vernacular language) research project in 1998 to develop and test a programme of combined prevention and treatment services for FSW, including ART provision [23]. The clinic is sponsored and funded by Agence Nationale de Recherche sur le Sida. (ANRS).

With this current widespread financial crisis, economic evaluations have become crucial in guiding priority setting. To date, there is no cost data available on the provision of ART to FSW. Through the collection of resource use and cost data, we aimed to estimate the overall and per patient yearly cost of providing services to FSW attending the Yerelon project. We also investigated how costs varied between different occupational exposure categories or by ART duration.

Methods

Study Setting

The Yerelon project relies on peer educators to recruit, educate and ensure high follow-up rates of FSW. It is a specialised clinic that provides condoms, STI testing/treatment, HIV testing and counselling, ART, medical consultations and safer sex counselling and psychological support. Peer-educators are crucial to the clinic’s success as they identify FSW in the ‘milieu’, get them tested and treated at the clinic and retain them in care. They also conduct daily group education sessions with women in the waiting room. Both a pharmacy and laboratory are on site and all services are free of charge to participants.

The clinic offers a number of different visit types. As part of the research cohort, FSW are encouraged to attend the clinic every three months for a full medical visit (type “V”), which includes completion of a behavioural questionnaire, and meeting both a psychologist to discuss treatment or diagnosis issues and a doctor for a full medical examination with genital examination. The patients then undergo blood tests and microscopic examination of vaginal swabs in the laboratory, and conclude their visit at the pharmacy where a nurse dispenses any required medications. FSW also attend scheduled treatment adherence visits (type “T”) at different time intervals to receive ART medications and adherence support by a trained psychologist as required. Lastly, they can visit the clinic at any time if they are unwell to receive medical support based on their need (type “I”). Visits “T” and “I” generally do not require the psychologist, investigator or laboratory technician and are solely for medical reviews or ART dispensing. Both HIV positive and negative women follow the same clinical follow-up schedule, differing only in the laboratory investigations undertaken (Table 1).

Since 1998, the project has enrolled 917 women with evidence suggesting HIV incidence has reduced over this period [23]. Recently, the project has also demonstrated high adherence to ART in this marginalised group, with long-term virological and immunological responses being comparable to those in the general population [23–25].

Data collection

We collected cost and output data retrospectively from the Yerelon clinic in Bobo-Dioulasso, for the 12-month period from January to December 2010. Financial and economic costs were collected from the provider perspective and classified as capital or recurrent [26]. Separate start-up costs were not included as they preceded our study by 12 years and documentation was not available. They were deemed negligible by the principal investigator. Recurrent inputs included personnel, supplies and building operation and maintenance, while capital costs included building space, training and equipment. Capital costs were depreciated using the Burkina Faso Central Bank discount rate of 4.25% [26,27]. The life span of equipment was estimated from the German Government Technical Agency [28] and by interviewing staff.

Data on patient numbers and total visits were extracted from the project’s database. Pricing information was gathered from pharmacy and equipment catalogues and project accounts. Prices for anti-retroviral drugs were estimated using clinic receipts. All costs were collected in West African Francs (CFA), inflated to 2012 prices where appropriate (CPI 2.8%) [29], and converted to US$ using the 2012 average exchange rate (1US$ = 499.51 CFA) [30].

Firstly, a top-down approach [31] was used to calculate the total annual cost of running the clinic. Top-down costs included all costs required to deliver health services within the Yerelon clinic, and were estimated from clinic administrative records. Data on consumption of consumables such as small laboratory items including reagents, slides and swabs was not available. Thus, receipts of consumable purchases during the study period were used. All anti-retroviral drugs and female condoms were donated.

### Table 1. Comparison of follow-up schedule in National guidelines and at the Yerelon clinic.

<table>
<thead>
<tr>
<th>Time</th>
<th>Vo</th>
<th>D15</th>
<th>M1</th>
<th>M3</th>
<th>M6</th>
<th>M9</th>
<th>M12</th>
</tr>
</thead>
<tbody>
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<td>Clinical exam</td>
<td>N P</td>
<td>P</td>
<td>NPB</td>
<td>NPB</td>
<td>NPB</td>
<td>N P</td>
<td>PB</td>
</tr>
<tr>
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<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
</tr>
<tr>
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<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
</tr>
<tr>
<td>HIV Serology</td>
<td>N PB</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Vaginal swab</td>
<td>N PB</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
</tr>
<tr>
<td>Syphilis*</td>
<td>N PB</td>
<td>N PB</td>
<td>N PB</td>
<td>N PB</td>
<td>N PB</td>
<td>N PB</td>
<td>N PB</td>
</tr>
<tr>
<td>CD4 count</td>
<td>N PB</td>
<td>P</td>
<td>P</td>
<td>PB</td>
<td>P</td>
<td>PB</td>
<td>PB</td>
</tr>
<tr>
<td>Viral load</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
</tr>
<tr>
<td>bHCG**</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
<td>N P</td>
</tr>
</tbody>
</table>

*P = HIV Positive women; N = HIV Negative women; B = National guidelines; 
**VDRL test is used; 
Viral load

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goods and were consequently considered as economic costs and were priced according to central pharmacy price lists. Administration costs charged to the Yerelon project by Centre Muraz were 10% of the clinic’s budget and were included in building operation costs. Centre Muraz laboratory undertook all haematology and biochemistry investigations, and itemised bills to the Yerelon project were used to estimate costs.

Secondly, to estimate the costs of treating different patient types, we adopted a combined bottom-up (patient-level) and top-down approach [31]. We used an ingredients-based approach to estimate the cost per patient, based on observed resource use. Staff time allocation was estimated per visit type (V, I, T) through staff interviews. Data on frequency of visits and consumption of drugs, supplies and lab tests were collected from individual patient records and clinic stock records. All patient details were anonymized and de-identified prior to analysis. The Ethics Committee at the London School of Hygiene and Tropical Medicine approved the study.

Cost analysis
For the top-down analysis, we separated patients into ART and non-ART groups, with ART costs only being applied to the women on ART but all other costs being apportioned equally across all women. We then calculated the mean annual cost per woman treated in each group, and mean cost per visit as the main output measures. This costing methodology is likely to underestimate the difference in cost between women on and off ART with the costs per women on ART likely to be higher than our estimate. However, it gives good estimates of total annual cost of the project and proportion of costs for each cost category.

For the combined top-down/bottom-up analysis, we used information from the project database to categorise women into six groups to explore differences in costs between occupational exposures and ART duration. The groups were: 1) Full-time sex workers (FTSW) and 2) Occasional sex workers (OSW), both on ART; 3) HIV Negative women; 4) Women in pre-ART care; 5) Women commenced on ART in the last year; and 6) Women on long-term ART (started ART in or before 2006).

A sample of 40 women was then randomly selected [32] from facility records, with 10 selected from groups 1 and 2, and 5 selected from each other group. Unit prices were applied to all direct resources used by each patient over the relevant time period. The total cost of direct staff time for each type of visit (V, I, or T) was calculated and applied accordingly to each analysed visit. The cost of staff with no patient contact (such as security personnel) was divided equally across all visits. Indirect and overhead costs, such as rent and electricity, were estimated per patient visit using a top-down approach, and were added to direct patient costs to produce an estimated average cost of treating a woman from each group. All 30 sampled women on ART (groups 1, 2, 5 and 6) were then combined to obtain an average bottom-up cost estimate for treating one woman on ART. The data was also reanalyzed using the overlap between groups of occupational exposure and length of treatment to increase sample size.

As the only mutually exclusive groups were HIV negative, HIV positive on ART and HIV positive not on ART, the total annual cost of running the clinic was estimated by multiplying the average cost per woman in each of these groups by the total number of women in that group in 2010.

Sensitivity analysis
A one-way sensitivity analysis was performed on the top-down estimated mean cost per woman on ART, exploring the effects of different discount rates (1%, 3% and 10%); changing all stavudine-containing (dT4) regimens to ones containing zidovudine (AZT) or tenofovir (TDF); basing the laboratory follow-up schedule on National Guidelines and reducing consumable costs by 10% or 20%. Further sensitivity analyses considered removing all research-related costs such as additional visits, laboratory investigations and staff used for research purposes and using minimum staff and equipment required to operate the clinic for therapeutic purposes alone. The high staff wages were also replaced with public sector wages [33] to approximate a national therapeutic setting. Lastly, a ‘Best Case Scenario’ was developed where research costs were removed and National follow-up Guidelines with public system wages were used.

Results
Total outputs
In total, 305 women attended the clinic in 2010, of which 187 women were on ART by December 2010. Of these women on ART, 29 commenced treatment during the study period. The total number of visits was 3027. A total of 40 patient records (15% of all patients), detailing 449 visits (15% of all patient visits) were analysed. Of the 30 sampled women on ART, 10 were on Zidovudine/Lamivudine/Elavirenz (AZT/3TC/EFV). Three of the women were on second line therapy Abacavir/Lamivudine/Lopinavir/ritonavir (ABC/3TC/LPV/r) and one was on alternative therapy for HIV-2 Zidovudine/Lamivudine/Idinavir/Ritonavir (3TC/AZT/IDV/RTV). The remaining women sampled were either on Triomune (3TC/d4T+nevirapine (NVP)), or Avocomb® (3TC/AZT/r)+NVP.

Total Annual Cost
The total annual financial cost of running the clinic was US$ 261,140 (Table 2). The economic cost was US$ 309,165, representing the additional value of donated buildings and ARVs. Personnel costs accounted for the biggest proportion (36.4% or US$ 112,621) of economic costs, followed by building operations (17%) and laboratory costs (16%), ARVs only accounted for 13% of total costs (US$ 40,500).

Unit Costs
The average economic cost across the overall cohort (ART or no-ART) was US$1,014 per patient year and US$104 per visit. This increased to US$1,098 per patient year (US$111 per visit) for individuals on ART, and decreased to US$892 per patient year (US$89 per visit) if not on ART. Using the bottom-up approach, the average cost of a woman on ART was US$913 per patient year. When looking across different patient groups, the average annual cost of treating women on established ART therapy was the highest at US$1,117. Despite the more frequent visit schedule, the average cost of treating women just initiating ART was a third less (US$734 per year – Table 3) because of the cheaper first-line drugs used. Care for HIV negative women or those in the pre-ART group incurred the lowest annual cost at US$505 and US$543, respectively. As well as not being on ART these women also attended 68% fewer visits, thus incurring less cost.

Treatment costs for OSWs were higher than those for FTSWs because two OSW were on more expensive anti-retroviral therapies (second-line therapy or AZT/3TC/IDV/RTV), whereas one FTSW died and two others dropped out of the programme for 5–7 months. The cost per visit across patient groups ranged from US$57 to US$99 depending on staff time encountered, laboratory tests performed and whether ARTs were given. Using the overlap between groups increased sample sizes by 10%
(FSW) to 160% (OSW), but had little effect on the results obtained.

A major proportion of costs across all groups were overhead costs of US$356 for each patient, of which US$55 were non-direct staff costs. ART costs differed greatly between patients, depending on the regimen being taken. Second-line therapy (ABC/3TC/LPV/r) was three times more expensive (US$1,556 per patient year) than the most commonly prescribed first-line regimen AZT/3TC/EFV (US$394 per patient year). The total costs of non-ART medication were low across all patient groups (12%–17% of total cost). Laboratory costs were stable across all patient groups, except amongst the HIV-negative women who had HIV serology testing but no viral load and CD4 cell count tests.

When using the bottom-up or patient-specific data, the total annual cost of the program was estimated to be US$237,378, 23% less than the top-down approach. Discrepancies included total ART costs being 58% higher in the bottom-up calculations and personnel costs being 72% less than top-down estimates. These variations were also evident in the breakdown of the unit costs (Table 3). In the bottom-up approach, staff time was generally allocated according to patient contact time, but did not account for staff down time, or other staff activities such as monitoring and evaluation, resulting in only 55% of total staff time being allocated in the bottom-up approach. Laboratory costs were also estimated to be 23% lower than the top-down estimates.

**Sensitivity Analysis**

All sensitivity analyses (Table 4) were performed on the bottom-up costs estimates per patient year on ART. Firstly, varying the discount rates (1%, 5% or 10%) had very little effect (<1%), as did decreasing consumption of consumables (by 10% or 20%). Similarly, switching all patients on d4T regimens to AZT regimens, as per WHO guidelines [34], also had a small effect (<1%), whereas changing d4T to TDF increased the average cost by 12% (US$1,236). Changing AZT/3TC/NVP or EFV to TDF containing regimens, to decrease toxicity and improve outcomes [35], increased total ART costs for the clinic by 42% and the unit cost of a person on ART to US$1,407 per year. We also estimated the cost of increased capacity to include treatment of 500 additional women while assuming the same proportions of women on and off ART. This decreased the treatment costs to US$859 per year for women on ART and US$643 for those not on ART. When laboratory investigations and visits were restricted to those recommended in the National Guidelines, the mean cost per patient year on ART reduced to US$1,029 (6% reduction). It also fell to US$1,040 if staff salaries were adjusted to public health sector levels. If we adjusted both staff salaries and reduced the number of staff to what would be needed if no research was undertaken, personnel costs reduced by 59%. The mean cost per patient year on ART was US$920 when all research costs including behavioural survey visits, extra laboratory tests, clinical visits, staff and equipment necessary for these activities were excluded. In our best case scenario, when all research costs as above were excluded and remaining staff salaries were reduced to public sector levels, the mean cost per patient on ART was US$781 (29% reduction) per year.

**Discussion**

The cost-effectiveness of HIV prevention programmes aimed at FSW has already been established [14–16], as has the cost-effectiveness of providing HAART to HIV infected individuals in resource poor settings [36,37]. However, little is known about the cost of providing a combined intervention package, including peer-based HIV and STI prevention, counseling and ART to FSW in the same setting. Our study provides the first comprehensive costing of such an intervention- the Yerelon clinic in Burkina Faso. We found that the average annual cost for an HIV-positive FSW on ART, including research costs, was US$1,098, whereas it was US$882 for a FSW not on ART.

A large proportion of costs were attributable to personnel (36%) because the project employed 8 clinical staff and 17 support staff with higher wages than their counterparts in the public system. Laboratory costs exceeded ART costs because of elevated research laboratory costs and the high proportion of women on cheaper d4T containing therapy. The cost for non-ART medications was exceptionally low (3.5% of total); reflecting the low unit cost of generic medicines prescribed in this outpatient setting.

Analysis of bottom-up costs revealed that the difference in ART regimens was the main driver of difference in costs between groups. The average yearly cost of ART between groups ranged from US$121 amongst women recently commenced on ART up to US$515 amongst women on long established therapy. This latter group was found to have the highest overall annual cost because three women were on expensive ARV regimens costing more than US$1,356 per year. In HIV negative women, the cost of care

### Table 2. Top-down estimated financial and economic costs of running the clinic in 2010 (in 2012 US$).

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Financial US$</th>
<th>Total %</th>
<th>Economic US$</th>
<th>Total %</th>
</tr>
</thead>
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<tr>
<td>Capital</td>
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<td>3.5</td>
<td>20,611</td>
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<tr>
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<td>20.9</td>
<td>53,779</td>
<td>17.4</td>
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<tr>
<td>Personnel</td>
<td>112,621</td>
<td>43.9</td>
<td>112,621</td>
<td>36.4</td>
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<tr>
<td>Transport</td>
<td>8,006</td>
<td>3.1</td>
<td>8,006</td>
<td>2.6</td>
</tr>
<tr>
<td>Medications</td>
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<td>3.2</td>
<td>8,105</td>
<td>2.6</td>
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<tr>
<td>Consumables</td>
<td>12,465</td>
<td>4.9</td>
<td>12,465</td>
<td>4.0</td>
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<td>1,174</td>
<td>0.5</td>
<td>1,612</td>
<td>0.5</td>
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<tr>
<td>Laboratory</td>
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<td>19.5</td>
<td>49,968</td>
<td>16.2</td>
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<td>0.6</td>
<td>1,499</td>
<td>0.5</td>
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<tr>
<td>ART</td>
<td></td>
<td></td>
<td>40,500</td>
<td>13.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>256,454</strong></td>
<td><strong>100</strong></td>
<td><strong>309,165</strong></td>
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doi:10.1371/journal.pone.0100107.t002
<table>
<thead>
<tr>
<th>Cost Category</th>
<th>HIV-negative</th>
<th>HIV-positive not on ART</th>
<th>Started ART in 2010</th>
<th>Established ART</th>
<th>FTSW on ART</th>
<th>OSW on ART</th>
<th>Bottom-up on ART</th>
<th>Top-down on ART</th>
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<tr>
<td>Personnel</td>
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<td>Direct</td>
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<td>32.5</td>
<td>59.3</td>
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<td>ART</td>
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<td>121.3</td>
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<td>373</td>
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<td>Condoms</td>
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<td>21.5</td>
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<tr>
<td>Overhead</td>
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<td>311.1</td>
<td>311.1</td>
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<tr>
<td>Mean/patient</td>
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<td>544.8</td>
<td>733.5</td>
<td>1116.8</td>
<td>830.4</td>
<td>971.3</td>
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<td>500.6–591.7</td>
<td>706.9–775.2</td>
<td>675.1–2045.5</td>
<td>681.8–1196.7</td>
<td>694.8–1776.1</td>
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<tr>
<td>Mean/visit</td>
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<td>68</td>
<td>99.4</td>
<td>76.7</td>
<td>78.3</td>
<td>80.6</td>
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</table>

OSW denotes occasional sex worker; and FTSW denotes full time sex worker.

*In charge of patients seeking, education/behaviour session, patient tracking and involved in ART adherence support along with the psychologist, pharmacy nurse and physician.

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reflects the psychological support offered with every serology test.

costs. The high proportion of personnel costs (20%) in this group

yearly cost per patient was achieved, giving an average cost of

reduction in salaries to national levels then a 29% reduction in the

reduction in average patient cost. When we combine this with a

National Guidelines resulted in a 6% reduction in average cost,

performed. Decreasing the number of laboratory tests in line with

more expensive drugs at lower costs.

may also hinder universal coverage [40,41]. It is therefore essential

increasing number of patients on more costly second-line therapies

cost may hamper the achievement of universal coverage. The

important policy implications, because as evidence mounts to

containing tenofovir increased the mean cost per patient year by

average costs. However, swapping existing ART regimens to ones

used nor the uncertainty in consumables had any real impact on

methods. This is not unusual as the literature reports 15–25% as

performed but the sample is small, it does allow to examine cost

small, representing only 13% of our cohort – this resulted in a few

sensitivity analysis, it was difficult to truly separate out all resources

occurs. Also, though the major research costs were removed in our

could be significant when integration into the public system

Start-up costs were also not as they were not available. These

of the clinic was to provide both services in a combined package.

preventative and therapeutic, whereas the studies in Table 5

from our analysis reduce below many of the estimates included in

on HIV treatment costs; however, all comparative literature

Table 5) has examined costs of HIV treatment in the general adult

population and not FSWs. Existing studies from Africa have found

a large variation in costs with most being lower than ours but

many having higher ART costs. The difference between our

estimated annual cost and these published estimates can probably

be explained by two main factors. Firstly, the Yerelon clinic

incurred large research-related personnel and laboratory costs

described above. When these elevated costs are adjusted, the costs

from our analysis reduce below many of the estimates included in

Table 5. Secondly, the intervention provided at the clinic is both

preventative and therapeutic, whereas the studies in Table 5

focused solely on HIV treatment.

There are several limitations to our study. A provider

perspective can underestimate total economic costs. In addition,

we chose not to separate prevention and treatment cost as the aim

of the clinic was to provide both services in a combined package.

Start-up costs were also not as they were not available. These

could be significant when integration into the public system

occurs. Also, though the major research costs were removed in our

sensitivity analysis, it was difficult to truly separate out all resources

used for research purposes. Lastly, our patient-specific sample was

small, representing only 13% of our cohort – this resulted in a few

patients skewing the results for specific patient groups. However,

though the sample is small, it does allow to examine cost

differences between different exposure levels.

In this current economic climate, we must focus our limited

resources in innovative ways. The pivotal role of FSW in the

ranged between US$468-571, largely made up of high overhead

costs. The high proportion of personnel costs (20%) in this group

reflects the psychological support offered with every serology test.

We found discrepancies (23%) between our two costing

methods. This is not unusual as the literature reports 15–25% as

a modest discrepancy [38]. The large discrepancy in personnel

costs may mean the clinic was not working at full capacity (related
to a reduced research funding at the time), whereas discrepancies

in other cost categories may be due to heterogeneity within the

cohort and our samples. As our main output measure was the

mean cost per patient year, a larger sample may be required to

reduce the uncertainty in our estimates, especially for ART costs

where the bottom-up mean ART cost was 53% greater than the
top-down estimate. The smaller discordance in laboratory costs

was probably due to the lower rates of viral load testing recorded

in our patient-specific samples than in our whole cohort.

Our sensitivity analysis showed that neither the discount rate

used nor the uncertainty in consumables had any real impact on

average costs. However, swapping existing ART regimens to ones

containing tenofovir increased the mean cost per patient year by

13% for d4T regimens and 28% for AZT regimens. This has

important policy implications, because as evidence mounts to

support the use of tenofovir as a first line agent [35,39] its higher

cost may hamper the achievement of universal coverage. The

increasing number of patients on more costly second-line therapies

may also hinder universal coverage [40,41]. It is therefore essential

that low-income countries begin to explore ways to acquire these

resources in innovative ways. The pivotal role of FSW in the

Table 4. Results of sensitivity analysis on mean cost of care per woman treated in 2012 US$.

<table>
<thead>
<tr>
<th></th>
<th>ART women</th>
<th>Non-ART women</th>
<th>All women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base case</strong></td>
<td>1098</td>
<td>882</td>
<td>1014</td>
</tr>
<tr>
<td><strong>Costs of consumables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-10%</td>
<td>1094</td>
<td>877</td>
<td>1010</td>
</tr>
<tr>
<td>-20%</td>
<td>1090</td>
<td>873</td>
<td>1005</td>
</tr>
<tr>
<td>Remove research costs</td>
<td>928</td>
<td>712</td>
<td>845</td>
</tr>
<tr>
<td>Assume national wages for staff</td>
<td>1040</td>
<td>824</td>
<td>956</td>
</tr>
<tr>
<td>National guidelines for laboratory testing</td>
<td>1029</td>
<td>812</td>
<td>945</td>
</tr>
<tr>
<td>Best case (combine 3 above)</td>
<td>781</td>
<td>564</td>
<td>697</td>
</tr>
<tr>
<td><strong>Remove research cost and increase of 500 women</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use AZT instead of d4t</td>
<td>1107</td>
<td>882</td>
<td>1019</td>
</tr>
<tr>
<td>Use TDF instead of d4T</td>
<td>1236</td>
<td>882</td>
<td>1098</td>
</tr>
<tr>
<td>Use TDF instead of d4T and AZT</td>
<td>1407</td>
<td>882</td>
<td>1203</td>
</tr>
<tr>
<td><strong>Discount rate (3% in base case)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>1095</td>
<td>879</td>
<td>1012</td>
</tr>
<tr>
<td>2%</td>
<td>1097</td>
<td>881</td>
<td>1013</td>
</tr>
<tr>
<td>10%</td>
<td>1104</td>
<td>887</td>
<td>1020</td>
</tr>
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transmission of HIV in many settings demands a targeted programme of combined prevention and treatment for these women. Such a dedicated service, as the Yerelon clinic, can produce good results in terms of behaviour change, virological suppression and decreases in HIV incidence and prevalence, at costs which does not differ from those of routine HIV care clinics for the general population [23,24]. Our study is the first to report on the costs of such a combined intervention for FSWs. Even at a time of severe budgetary constraints, investing in “difficult to reach”, high-risk groups should be a priority in countries with modest HIV prevalence in the general population (mainly West/ North Africa and South-East Asia regions), because of the large public health gains in controlling the HIV dynamics. In addition, our study shows that the cost of this combined approach is comparable to other treatment-only interventions in the general population. This, coupled with the good biological and behavioural results seen in our cohort, suggests that this intervention may be cost-effective. The cost of this important intervention should, therefore, not be a prohibitive factor in scaling it up across Burkina Faso and elsewhere with the average costs likely to decrease as this is done [42,43]. Of priority now, is combining impact evaluation to our cost data to determine the cost-effectiveness of such an intervention.

Author Contributions
Conceived and designed the experiments: IK NN AL PM PV. Performed the experiments: FC. Analyzed the data: FC. Contributed reagents/materials/analysis tools: SS AL PV. Wrote the paper: FC SS NN AL PM PV.

References

Cost of Providing ART for Female Sex Workers

Table 5. Comparing costs of HIV treatment and care across similar studies in sub-Saharan Africa.

<table>
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<td>432**</td>
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<td>17.8 (2009)</td>
<td>1177</td>
<td>1428</td>
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*converted from Rand **result given per month.
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