Feasibility and effectiveness of two community-based HIV testing models in rural Swaziland

Lucy Anne Parker¹, Kiran Jobanputra¹, Lorraine Rusike², Sikhathelile Mazibuko³, Velephi Okello³, Bernhard Kerschberger², Guillaume Jouquet¹, Joanne Cyr¹ and Roger Teck¹

¹ Médecins Sans Frontières, Geneva, Switzerland
² Médecins Sans Frontières, Nhlangano, Swaziland
³ Swaziland National AIDS Programme, Mbabane, Swaziland

Abstract

OBJECTIVES To evaluate the feasibility (population reached, costs) and effectiveness (positivity rates, linkage to care) of two strategies of community-based HIV testing and counselling (HTC) in rural Swaziland.

METHODS Strategies used were mobile HTC (MHTC) and home-based HTC (HBHTC). Information on age, sex, previous testing and HIV results was obtained from routine HTC records. A consecutive series of individuals testing HIV-positive were followed up for 6 months from the test date to assess linkage to care.

RESULTS A total of 9,060 people were tested: 2,034 through MHTC and 7,026 through HBHTC. A higher proportion of children and adolescents (<20 years) were tested through HBHTC than MHTC (57% vs. 17%; P < 0.001). MHTC reached a higher proportion of adult men than HBHTC (42% vs. 39%; P = 0.015). Of 398 HIV-positive individuals, only 135 (34%) were enrolled in HIV care within 6 months. Of 42 individuals eligible for antiretroviral therapy, 22 (52%) started treatment within 6 months. Linkage to care was lowest among people who had tested previously and those aged 20–40 years. HBHTC was 50% cheaper (US$11 per person tested; $797 per individual enrolled in HIV care) than MHTC ($24 and $1698, respectively).

CONCLUSION In this high HIV prevalence setting, a community-based testing programme achieved high uptake of testing and appears to be an effective and affordable way to encourage large numbers of people to learn their HIV status (particularly underserved populations such as men and young people). However, for community HTC to impact mortality and incidence, strategies need to be implemented to ensure people testing HIV-positive in the community are linked to HIV care.

KEYWORDS AIDS, HIV testing and counselling, HIV prevention, community-based interventions, HIV diagnosis and management

Introduction

Despite intense global commitment to fight HIV/AIDS and years of preventative campaigns, there were an estimated 1.6 million AIDS-related deaths in 2012 (73% of which were in sub-Saharan Africa) and 2.3 million new infections [1]. There is a growing body of evidence showing that a reduction in HIV transmission at population level can be achieved through high coverage of regular HIV testing combined with access to lifelong antiretroviral therapy (ART) of all identified HIV-positive individuals [2–5]. Swaziland has the highest HIV prevalence in the world: approximately 31% of 18- to 49-year-olds are HIV positive, and it is estimated that each year 2.4% of HIV-negative Swazis become HIV positive [6]. Despite substantial efforts to expand access to HIV testing and counselling (HTC), more than one in three HIV-infected adults in Swaziland are unaware of their status [6].

In many generalised epidemics, including Swaziland, HTC coverage is higher among women than men [7]. This difference is largely explained by routine HIV testing in antenatal care services; in Swaziland, 94% of pregnant women undergo HIV testing [8]. Furthermore, the rural clinics in Swaziland were originally developed as maternal and child health services. Although they now provide primary health care including integrated HIV and tuberculosis care, it is possible that men are reluctant to attend as that they still perceive them to be ‘female’ spaces. Offering HTC in the community represents a crucial strategy for increasing HTC coverage among individuals who do not use health services regularly such as young men or individuals with work-related barriers [9].
Both home-based HTC (HBHCT) and mobile HTC (MHTC) have been successfully implemented in several sub-Saharan settings, demonstrating high uptake and high acceptability [10–12]. Relative to facility-based HTC, community-based strategies have been shown to reach HIV-positive populations earlier in the course of their HIV infection [12], thereby enabling earlier access to treatment and a reduction in avoidable morbidity, mortality and transmission of the virus. In 2012, Médecins Sans Frontières (MSF) introduced intensive community-based HTC in the rural Shiselweni region of the country in collaboration with the Regional Health Department of the Ministry of Health (MoH) of Swaziland.

While it is clear that community-based HTC increases the number of people who learn their status, it must also be recognised that it may increase the proportion of HIV-infected persons who know their positive status but fail to enrol in HIV programmes. A study from Malawi showed that of 837 individuals screened HIV-positive, only 209 (27%) completed CD4 staging [13]. In fact, significant drop-offs at all steps in the cascade from HIV testing to treatment have been described, for example between enrolment and ART initiation or poor adherence after initiation [14–16]. Gardner et al [17] showed that even with an ART coverage rate of 75%, this translated to only 19% of all persons with HIV being on treatment and adherent as shown by a suppressed viral load. It has been suggested that men, young adults and people with work-related barriers are at risk for not accessing care [18]. When evaluating HTC strategies, exploring the factors associated with failed linkage to care is essential, as this can enable development of more focussed interventions during and after post-test counselling which target those most at risk of not linking to care [15].

Here, we describe the characteristics of the population reached and the costs of HBHCT and MHTC in rural Swaziland. We also determine whether the people who tested HIV positive subsequently accessed HIV care services, underwent antiretroviral treatment eligibility determination and, for those who were eligible, started treatment. The overall objective of this study was to describe the experience of community-based HTC approaches in the generalised epidemic context of Swaziland, to inform national and regional HIV programming.

**Methods**

**Setting**

Swaziland is a landlocked lower-middle income country in Southern Africa, with a population of 1.2 million. This study was carried out in the Shiselweni region, approximately one quarter of the geographical area of the country, and has a relatively poor rural population. The region had an estimated 41 000 people who are HIV positive, of whom approximately 15 000 were thought to be unaware of their status [6, 7]. There were a total of 25 health facilities in Shiselweni during the time of the study, three secondary health facilities and 22 rural clinics. All facilities had integrated HIV and tuberculosis care and were owned and managed by the Swaziland Ministry of Health, supported by MSF. For HTC, the country uses a serial testing algorithm, starting with the Determine HIV1/2. If positive, the more specific Unigold HIV1/2 test is used for confirmation. If after these two tests, the HIV status remains indeterminate (e.g. one positive and one negative), a dry blood spot (DBS) sample is sent to the National Reference Laboratory for enzyme-linked immunosorbent assay (ELISA) testing [19].

Specific details of the testing strategy used are available in online Supplementary Information S1. Briefly, two different community-based HTC strategies were evaluated. The first strategy was mobile HTC (MHTC), introduced on an ongoing basis from September 2012. MSF testing teams visited community sites identified by community leaders, attended mobile ‘outreach’ clinics and set up testing sites at major events. The second strategy was home-based HTC (HBHTC), implemented on a campaign basis in August 2013. The campaign took place in three remote communities that were sensitised ahead of time via radio announcements. During the campaign, the testers moved through the community by foot visiting the households door to door.

In accordance with national HTC guidelines, individuals who gave informed consent were considered eligible for HTC provided they were over 12 years of age and deemed by the health worker to be competent to make this decision; those under 12, or lacking competence to consent, were tested if a legal guardian provided consent on their behalf [19]. No specific algorithm assessing was used to determine HIV risk among children and adolescents, such that all individuals aged over 18 months were considered eligible for testing. Children under the age of 18 months were referred to the nearest health facility in accordance with national guidelines, as a positive test would require virological confirmation which is currently only provided at health facilities. Individuals who tested HIV positive or had indeterminate test results were referred to the health facility of their choice at a date of their choice (recommended to be no later than 14 days). For the purpose of the study, we visited the structures to ascertain whether the individuals had attended their referral appointment and were subsequently enrolled in the
National HIV programme. Tracing individuals who missed their appointment followed national protocol and was led by the nurses and expert client counsellors in the health centres (see Supplementary Information S1; referral process). Antiretroviral treatment eligibility assessment through point-of-care (PoC) CD4 testing or WHO staging was not provided at the community testing events.

Population and data collection

To determine the characteristics of the population undergoing HTC in the community, individual level data were obtained from paper testing records of two consecutive samples (subgroups 1 & 2: Individuals tested from 01/08/2013 to 30/08/2013 for HBHTC; and individuals tested from 15/03/2013 to 17/0572013 for MHTC). For MHTC, detailed information was also collected regarding the type of event, and categorised as:

- Testing at comprehensive outreach: mobile ‘outreach’ clinics organised in collaboration with Ministry of Health (MOH) facilities. MOH staff were present offering primary healthcare services, while MSF provided logistical support and offered HTC.
- MSF-led mobile testing. MSF testing teams set up tents and offered HTC at community sites identified by community leaders or workplaces.
- Testing at major events such as football matches or world AIDS day.
- If more than one site was visited in 1 day, the information regarding each site was collected accordingly, and they were considered as two separate testing events.

To determine the proportion of HIV-positive patients who were successfully linked to HIV care (registered in the HIV programme at their chosen facility within 6 months), a consecutive sample of community-based testing participants who tested HIV positive (or had an indeterminate HIV result) was followed up for 6 months from the test date (subgroup 3: Individuals testing HIV positive from 11/02/2013 to 29/08/2013). MSF data clerks visited each of the health facilities in the region to trace referrals using the Swaziland HTC client record. This triplicate form has a unique form number allowing the data clerks to identify individuals who had attended their appointment. Given that some individuals may have sought care without using the referral form, the data clerks also performed a manual search of clinic HIV care records (paper ART and pre-ART registers) using name, age, village and date. Clients who were referred to a health facility outside Shiselweni region were excluded from the analysis of linkage to care. We did not follow referrals to preventative services for clients that tested HIV negative.

Costing

The cost of MHTC and HBHTC was estimated from a service provider perspective using an ingredient costing approach [20], whereby the total costs of each testing strategy was estimated and divided by the total number of tests performed, individuals newly identified as HIV positive, and HIV-positive individuals linked to HIV care within 6 months. Further details of the costing analysis can be found in Supplementary Information S2.

Data analysis

To estimate testing coverage through HBHTC, we obtained estimates regarding the number of homesteads and total population from the local councils. For MHTC, we did not estimate coverage or uptake due to the lack of a realistic target population (denominator) and the difficulty in determining who was really offered the test and who refused the test due to having a known HIV-positive status. With regard to the demographic characteristics of the population reached, statistical comparisons between the two strategies were made with regard to the main indicators (gender, previous testing and HIV positivity) among adults only (≥20 years) using a Pearson’s chi-squared test. Linkage to care was defined as attendance at the referral facility and registration in the pre-ART register within 6 months of the test date. Linkage status was established for all individuals who tested HIV positive, irrespective of their expressed motivation to seek treatment and care, unless they intended to access care outside Shiselweni (and thus could not be followed up). To analyse factors associated with linkage to care, odds ratios (OR) and 95% confidence intervals (95% CI) were calculated using unconditional logistic regression. Variables that were associated with linkage in univariable analysis with a P-value of <0.10 were included in the multivariable model. Data entry was carried out using EpiData (The EpiData Association, Odense, Denmark) data analysis used Stata/SE Version 12 (StataCorp, Texas, USA).

Ethics

This study used routine programme data without patient identifiers. The study was approved by the Swaziland Scientific and Ethics Committee and met the criteria for exemption from full ethics review from the international MSF ERB. Both institutional review boards waived the need for written informed consent.
Results

Testing coverage and uptake

We analysed a consecutive sample of 2,043 people tested through MHTC (Figure 1, subgroup 1.) There were a total of 135 events, of which 37 (27%) were comprehensive outreach events (run by clinics), 83 (62%) were MSF run mobile testing events and 15 (11%) were organised around a major event. In the month of August, 7,026 individuals were tested through an intensive HBHTC campaign in the three rural constituencies (Figure 1, subgroup 2). 2,005 (26%) of 7,681 homesteads were tested. The main reason for homesteads not being reached was lack of time; each constituency was tested over seven consecutive days, and this was not sufficient to reach all homesteads in this rural setting.

According to local council records, a total of 12,269 people lived in the 2,005 households that were visited during the HBHTC campaign. 8,768 (71%) were present the day of testing. 673 (8%) of those present had a known HIV-positive status and 395 (5%) reported that they knew their status as they had tested negative in the previous 2 months. Of the remaining 7,484 individuals, 6,452 (86%) were tested. A further 597 individuals were tested outside the households.

Demographics and previous testing among the population reached by MHTC and HBHTC

A higher proportion of children and adolescents were tested during the HBHTC campaign than by MHTC ($P < 0.001$). A total of 110 (5.4%) of those tested through MHTC were under the age of 10, 245 (12%) were adolescents (10–19 years old) and 1,679 (83%) were adults (20 years or older). By contrast, 2,086 (30%) of those tested by HBHTC were children under the age of 10, 1,924 (27%) were adolescents and 3,016 (43%) were adults. Given the equal gender distribution among children and the fact that children and adolescents were more likely to be first-time testers, comparisons between HBHTC and MHTC in terms of gender and previous testing were made among the adult population only. Details of the gender and previous testing characteristics among the children and adolescents can be found in Table 1.

Among adults, a higher proportion of men were tested by MHTC than HBHTC (702, 42% vs. 1,163, 39%, $P = 0.020$). The proportion of males tested was higher among the subgroup of MHTC that was categorised as major events, where 243 of 426 people tested were male (57%, data not shown in tables).

Of the adults tested through HBHTC, 1,013 (34%) were testing for the first time. This was significantly higher than for MHTC (359, 22%, $P < 0.001$). Similarly, the proportion of adults who had not tested within the last 12 months was higher among those tested by HBHTC compared to MHTC (Table 1, $P > 0.001$).

HIV positivity rate

Overall, the HIV positivity rate was highest among those tested though MHTC where 96 individuals (4.7%) tested
Table 1 Characteristics of the participants tested through community-based HTC in rural Swaziland

|                      | MHTC             | HBHTC            |
|----------------------|------------------|------------------|
|                      | Children (1–9 years) | Adolescent (10–19 years) | Adult (≥20 years) | Total* |
|                      | n | % | n | % | N | % | n | % | n | % | n | % | n | % | n | % | P† |
| Total                | 110 | 100 | 245 | 100 | 1679 | 100 | 2034 | 100 | 2086 | 100 | 1924 | 100 | 3016 | 100 | 7026 | 100 |
| Gender               |                |                 |                |                 |                 |                |                 |                |                 |                |                 |                |                 |                |                |                |
| Male                 | 50 | 46 | 142 | 58 | 703 | 42 | 895 | 44 | 1025 | 49 | 918 | 48 | 1163 | 39 | 3106 | 44 |
| Female               | 58 | 54 | 103 | 42 | 969 | 58 | 1130 | 56 | 1058 | 51 | 1005 | 52 | 1851 | 61 | 3914 | 56 |
| Previous HIV test    |                |                 |                |                 |                 |                |                 |                |                 |                |                 |                |                |                |                |                |
| Never                | 91 | 83 | 153 | 63 | 359 | 22 | 603 | 30 | 1899 | 92 | 1576 | 83 | 1013 | 34 | 4488 | 64 |
| Within last 12 months | 9 | 8 | 56 | 23 | 715 | 43 | 780 | 39 | 57 | 3 | 113 | 6 | 781 | 26 | 951 | 14 |
| Over a year ago      | 9 | 8 | 35 | 14 | 592 | 35 | 636 | 32 | 114 | 6 | 219 | 11 | 1181 | 40 | 1514 | 22 |
| HIV test result      |                |                 |                |                 |                 |                |                 |                |                 |                |                 |                |                |                |                |                |
| Negative             | 109 | 100 | 240 | 98 | 1578 | 95 | 1927 | 94 | 2058 | 99 | 1884 | 98 | 2806 | 94 | 6748 | 96 |
| Positive             | 0 | 0 | 5 | 2 | 91 | 5 | 96 | 6 | 21 | 1 | 32 | 2 | 189 | 6 | 242 | 4 |
| Indeterminate        | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |

*32 individuals had missing information on age and do not appear in this table. Furthermore, the sum of the subtotals does not add up to the total because 1 (0.01%) individual had missing information on gender, 75 (0.83%) had missing info for previous HIV testing and 42 (0.5%) had a missing HIV test result.

†P value from Pearson’s chi-squared test comparing proportions among adults only.
HIV positive vs. 243 (3.5%) of those tested by HBHTC ($P = 0.009$). The number needed to screen to identify one HIV-positive individual was 21 (95% CI: 17–26) for MHTC and 29 (95% CI: 26–33) for HBHTC. Among adults only, there was no difference in the HIV positivity rates between the two strategies (Table 1, $P = 0.285$), with 3-6% found to be HIV positive through either strategy. The number of adults needed to screen to identify one HIV-positive individual was 18 (95% CI: 15–23) for MHTC and 16 (95% CI: 14–18) for HBHTC. Of the 4 010 children and adolescents tested during the HBHTC campaign, 53 (1.3%) tested HIV positive and a further three had indeterminate test results.

**Linkage to HIV care**

We analysed a consecutive sample of 439 individuals that tested HIV positive at a MHTC event or during the HBHTC campaign (Figure 1, subgroup 3). Of the 398 HIV-positive individuals referred within Shiselweni, 135 (34%) were registered in pre-ART care within 6 months of the test date (figure 2). Of these, 103 (76%) had a CD4 count taken and completed ART eligibility assessment (equivalent to 26% of those tested HIV positive). Forty-two (41%) were eligible for combined ART according to national guidelines (CD4 < 350 and/or WHO clinical stages III or IV), of whom 22 (52%) initiated treatment. The median time from HIV testing to pre-ART enrolment was 12 days (IQR 6–29 days), and the median time from HIV test to ART initiation was 34 days (IQR 20–60).

There was no difference in linkage to care between the two testing strategies or between men and women (Table 2). Linkage to care was highest among children and older individuals (approximately half of the children aged 18 months to 9 years or adults aged over 50 were linked to care, Table 2). Particularly, low rates of linkage to care were observed for individuals aged 20–29 and 30–39 years old (Table 2). Enrolment in HIV care was highest among first-time testers (44% compared to 28% of those who had tested previously, $P = 0.004$). Single people were less likely seek HIV care than individuals

---

**Figure 2** Linkage-to-care, assessment of ART eligibility and treatment initiation among individuals testing HIV+ through community testing in Shiselweni, Swaziland. $^{(1)}$Treatment eligibility was defined as any client with CD4 < 350 and/or WHO III/IV stage.
who reported being married or living in stable partnership although this association lost statistical significance after controlling for age and previous testing (Table 2). Of four individuals who had indeterminate test results and were referred to a facility within Shiselweni, none were linked to care within 6 months, and hence, none were retested.

Cost of MHTC and HBHTC campaign

From service provider perspective, HBHTC was significantly cheaper ($11 per person tested, $343 per HIV-positive individual identified, and $797 per HIV-positive individual linked to care) than MHTC ($24, $543 and $1 698, respectively, Table 3). The main cost driver for HBHTC was accommodation and food for staff during the campaign, accounting for nearly one-third of the total costs (Table 3). The main cost drivers for MHTC were human resources, followed by transport costs.

Discussion

We found mobile- and home-based HTC to be feasible and affordable ways to reach a substantial number of

Table 2 | Factors associated with linkage to care among individuals testing HIV positive or with indeterminate test results in community-based testing events

| N | Linked to HIV care facility within 6 months (%) | P | Crude odds ratio (95% CI) | Adjusted odds ratio (95% CI) |
|---|---|---|---|---|
| Total | 398 | 135 (34) | 0.617 | 1 | – |
| Strategy type | | | | 1.1 (0.7–1.7) | – |
| MHTC | 228 | 60 (35) | 0.011 | 3.4 (1.1–10.6) | 3.1 (0.9–10.1) |
| HBHTC | 170 | 75 (33) | | 2.5 (1.1–5.7) | 2.5 (1.0–6.0) |
| Age | | | | | |
| Children (1–9 years) | 14 | 7 (50) | 0.001 | 2.5 (1.1–5.7) | 2.5 (1.0–6.0) |
| Adolescents (10–19 years) | 33 | 14 (42) | 1.0 | 1 | 1 |
| Adults (20–29 years) | 120 | 27 (23) | 1.3 (0.7–2.3) | 1.1 (0.6–2.1) |
| Adults (30–39 years) | 104 | 28 (27) | 2.7 (1.4–5.1) | 2.2 (1.1–4.5) |
| Adults (40–49 years) | 62 | 27 (44) | 3.4 (1.7–6.7) | 2.3 (1.1–5.0) |
| Adults (≥50 years) | 60 | 30 (50) | | | |
| Gender | | | | | |
| Female | 242 | 84 (35) | 0.711 | 1 | – |
| Male | 155 | 51 (33) | | 0.9 (0.6–1.4) | – |
| Previous HIV test | | | | | |
| Never | 161 | 71 (44) | 0.004 | 1 | 1 |
| Within last 12 months | 70 | 19 (27) | 0.4 (0.3–0.9) | 0.5 (0.3–1.0) |
| Over a year ago | 160 | 45 (28) | 0.5 (0.3–0.8) | 0.6 (0.3–0.9) |
| Marital status | | | | | |
| Single/separated | 153 | 44 (29) | 0.044 | 1 | 1 |
| Married/cohabitation | 194 | 67 (36) | 1.3 (0.8–2.1) | 1.5 (0.9–2.7) |
| Widowed | 38 | 19 (50) | 2.5 (1.2–5.1) | 2.1 (0.9–5.2) |

NB: 5 (1.3%) had missing information on age, 1 (0.3%) on sex, 7 (1.8%) on previous testing and 19 (4.7%) on marital status.

Table 3 | Cost of community-based HIV testing strategies led by MSF in Shiselweni, Swaziland, 2013

| | MHTC | HBHTC |
|---|---|---|
| Cost per person reached | 24 USD | 11 USD |
| Cost per HIV positive identified | 543 USD | 343 USD |
| Cost per HIV positive identified and linked to care | 1698 USD | 797 USD |
| Break-up of costs (%) | | |
| Transport | 25 | 6 |
| Human resources | 52 | 26 |
| Testing equipment | 16 | 30 |
| Infection control | 2 | 1 |
| Information, education and counselling | 1 | 3 |
| Other* | 3 | 33 |

*Other costs included trailers, tents, furniture for MHTC; accommodation, food, airtime for HBHTC.

people and hence have the potential to increase the number of people who know their HIV status, in this rural, low-resourced, high-prevalence setting of Swaziland. Rates of sero-positivity were similar between strategies, but HBHTC cost 50% less than the mobile strategies, and was a more effective strategy for reaching first-time
HIV testing models in rural Swaziland

L. A. Parker et al.

Tropical Medicine and International Health

© 2015 The Authors. Tropical Medicine & International Health Published by John Wiley & Sons Ltd.

Tropical Medicine and International Health

volume 20 no 7 pp 893–902 july 2015

Abstract

...
of testing, perhaps due to work commitments. Improving HBHTC testing coverage by visiting the homesteads in the evenings may be a useful strategy to reduce health inequalities caused by work-related barriers. HBHTC was introduced as a campaign, and it is not clear if uptake (acceptance) would be similarly high if HBHTC were to be carried out on a routine basis or if recurrent campaigns were to take place. Furthermore, it is important to respect the opt-in nature of HBHTC as concerns have been raised about HBHTC and the possibility of household members participating in HTC under coercion. In our analysis of factors associated with linkage to care, one key limitation was the lack of availability of CD4 or WHO staging to determine eligibility for ART. It is possible that individuals who feel healthy are less likely to attend the clinic, potentially acting as a confounder in our risk factor analysis. Finally, we must recognise as a limitation that our costing analysis is limited to the service provider’s perspective. However, if we had considered the patient perspective, both community-based HTC strategies are likely to be even more cost-effective because from a patient perspective the main costs are transport costs (to go to a site offering HTC) and opportunity cost (loss of time travelling to the HTC site and waiting for ones turn to test).

In conclusion, community-based testing appears to be an effective and affordable way to improve HTC coverage in high-prevalence settings. We found that HBHTC cost less than MHTC and was more effective at reaching first-time testers and people who had not tested in the past 12 months. Furthermore, in a setting with high antenatal HIV prevalence and low coverage of infant testing throughout breastfeeding, HBHTC enabled identification of HIV-positive children missed by the PMTCT program and child welfare services. MHTC, although more expensive, can still be a useful strategy to reach specific target groups with poor access to HTC (e.g. young men or people with work-related barriers). Community-based testing can thus contribute to increasing the number of people who know their HIV status. However, for it to have impact on HIV morbidity, mortality and incidence, it should include not only PoC treatment eligibility determination but also other ‘directive’ linkage strategies to help guide people testing HIV positive in the community into HIV care and treatment.

Acknowledgements

Tengetile Hlophe, the MSF community testing teams in Shiselweni and the MSF operational research data clerks without whom the study would have not been possible. Annick Antierens, Johnny Lujan, Elias Pavlopoulos and the MSF steering committee on operational research in Swaziland for their support and constructive comments and throughout the design and implementation and/or drafting the manuscript. This work was funded by Médecins sans Frontières (MSF), Geneva, Switzerland. Some of the authors are/were employed by MSF during the study implementation, analysis and write-up. The funding body also organised a steering committee comprised of staff and academics from different international organisations to guide operational research in Swaziland, thereby influencing study design, data collection and analysis. They had no role in decision to publish or preparation of the manuscript. The opinions and statements in this article are those of the authors and do not necessarily represent the official policy, endorsement or views of MSF.

References

1. Joint United Nations Programme on HIV/AIDS (UNAIDS). Global Report: UNAIDS Report on the Global AIDS Epidemic 2013. UNAIDS: Geneva, Switzerland, 2013.
2. Granich RM, Gilks CF, Dye C, De Cock KM, Williams BG. Universal voluntary HIV testing with immediate antiretroviral therapy as a strategy for elimination of HIV transmission: a mathematical model. Lancet 2009: 373: 48–57.
3. Jones A, Cremin I, Abdullah F et al. Transformation of HIV from pandemic to low-endemic levels: a public health approach to combination prevention. Lancet 2014: 384: 272–279.
4. Coates TJ, Kulich M, Celentano DD et al. Effect of community-based voluntary counselling and testing on HIV incidence and social and behavioural outcomes (NIMH Project Accept; HPTN 043): a cluster-randomised trial. Lancet Glob. Health. 2014: 2: e267–e277.
5. Cohen MS, Chen YQ, McCauley M et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med 2011: 365: 493–505.
6. Swaziland Ministry of Health. Swaziland HIV Incidence Measurement Survey (SHIMS). First Findings Report. Swaziland Ministry of Health: Mbabane, Swaziland, 2012.
7. Central Statistical Office and UNICEF. Swaziland Multiple Indicator Cluster Survey 2010. Final Report. Swaziland Ministry of Health: Mbabane, Swaziland, 2011.
8. Strategic information Department SM of H. PMTCT Programme Annual Report 2012. Swaziland Ministry of Health: Mbabane, Swaziland, 2013.
9. WHO. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection. World Health Organization, Geneva, Swaziland, 2013.
10. Van Rooyen H, Barnabas RV, Baeten JM et al. High HIV testing uptake and linkage to care in a novel program of home-based HIV counseling and testing with facilitated referral in KwaZulu-Natal, South Africa. J Acquir Immune Defic Syndr 2013: 64: e1–e8.
11. Mutale W, Michel C, Jürgensen M, Fylkesnes K. Home-based voluntary HIV counselling and testing found highly...
acceptable and to reduce inequalities. 

BMC Public Health 2010: 10: 347.

12. Suthar AB, Ford N, Bachanas PJ et al. Towards universal voluntary HIV testing and counselling: a systematic review and meta-analysis of community-based approaches. PLoS Med 2013: 10: e1001496.

13. Wringe A, Floyd S, Kazooba P et al. Antiretroviral therapy uptake and coverage in four HIV community cohort studies in sub-Saharan Africa. Trop Med Int Health 2012: 17: e38–e48.

14. Rosen S, Fox MP. Retention in HIV care between testing and treatment in sub-Saharan Africa: a systematic review. PLoS Med 2011: 8: e1001056.

15. El-Sadr WM, Gamble TR, Cohen MS. Linkage from HIV testing to care: a positive test often leads nowhere. Sex Transm Dis 2013: 40: 26–27.

16. McNairy ML, El-Sadr WM. The HIV care continuum: no partial credit given. AIDS 2012: 26: 1735–1738.

17. Gardner EM, McLees MP, Steiner JF, Del Rio C, Burman WJ. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. Clin Infect Dis 2011: 52: 793–800.

18. Govindasamy D, Ford N, Kranzer K. Risk factors, barriers and facilitators for linkage to antiretroviral therapy care: a systematic review. AIDS 2012: 26: 2059–2067.

19. Kingdom of Swaziland Ministry of Health. Swaziland National HIV Testing and Counselling Guidelines, August 2010. Swaziland Ministry of Health: Mbabane, Swaziland, 2010.

20. Levin HM, McEwan PJ. Cost-Effectiveness Analysis: Methods and Applications (2nd edn), Sage: Thousand Oaks, CA, 2001.

21. Labhardt ND. Comparison of home-based versus community gathering approach in providing HIV counselling and testing in Lesotho: a cluster randomized trial. In: ICASA International Conference on AIDS and STIs in Africa: Cape Town; 2013:1.

22. Ahmed S, Kim MH, Sugandhi N et al. Beyond early infant diagnosis: case finding strategies for identification of HIV-infected infants and children. AIDS 2013: 27(Suppl 2): S235–S245.

23. MacPherson P, Corbett EL, Makombe SD et al. Determinants and consequences of failure of linkage to antiretroviral therapy at primary care level in Blantyre, Malawi: a prospective cohort study. PLoS ONE 2012: 7: e44794.

24. Kranzer K, Zeinecker J, Ginsberg P et al. Linkage to HIV care and antiretroviral therapy in Cape Town, South Africa. PLoS ONE 2010: 5: e13801.

25. Shapiro AE, Variava E, Rakgokong MH et al. Community-based targeted case finding for identification of HIV-infected infants and children. AIDS 2013: 27(Suppl 2): S235–S245.

26. MacPherson P, Corbett EL, Makombe SD et al. Determinants and consequences of failure of linkage to antiretroviral therapy at primary care level in Blantyre, Malawi: a prospective cohort study. PLoS ONE 2012: 7: e44794.

27. Barnabas RV, van Rooyen H, Tumwesigye E et al. Initiation of antiretroviral therapy and viral suppression after home HIV testing and counselling in KwaZulu-Natal, South Africa, and Mbarara district, Uganda: a prospective, observational intervention study. Lancet. HIV 2014;1:1:9032. (Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4122816&tool=pmcentrez&rendertype=abstract.) Accessed November 2, 2014.

28. MacPherson P, Lalloo DG, Webb EL et al. Effect of optional home initiation of HIV care following HIV self-testing on antiretroviral therapy initiation among adults in Malawi: a randomized clinical trial. JAMA 2014: 312: 372–379.