Sexual Behaviours of People Living with HIV: Implications for Prevention with Positives

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Dedicated to my parents Jessie and Bakhshish Singh Kahlon

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Preface

HIV infection was first detected in the early 1980s and for the past 30 years has been associated with transmission related to sexual behaviours more than with other routes of infection. HIV prevention programmes across the globe have distributed condoms and spread awareness for more than two decades. Yet, HIV infection continues to spread, albeit more slowly than before. While one could expect persons who are not aware of HIV as a disease and do not know their HIV status, to indulge in sexual risk behaviours, it is of concern to see people who have tested HIV-positive, who have experienced the infection first hand to continue to practice risky behaviours. Clearly, we do not know enough about the motivations and compulsions that govern the decision to practice risky behaviours among people living with HIV and programmes are missing vital cues that could improve the impact and outcomes of prevention interventions. A better understanding of these behaviours is necessary to design effective interventions, reduce HIV transmission and achieve a reduction in overall HIV prevalence.

Abbreviations

ART	Antiretroviral Therapy
BCC	Behaviour Change Communications
CHW	Community Health Worker
FACS	Fluorescence Activated Cell Sorting
FP	Family Planning
FSW	Female Sex Workers
GEE	Generalised Estimating Equations
HAART	Highly Active Antiretroviral Therapy
IDU	Injecting Drug Users
IEC	Information Education and Communication
MSM	Men who have Sex with Men
MSW	Male Sex Workers
MARP	Most At Risk Populations
KAIS	Kenya AIDS Indicator Survey
KDHS	Kenya Demographic Health Survey
KNASP	Kenya National AIDS Strategy Plan
NACC	National AIDS Control Committee
OR	Odds Ratio
OVC	Orphans and Vulnerable Children
PMTCT	Prevention of Mother to Child Transmission
PTC	Post Test Clubs
PWP	Prevention with Positives
STI	Sexually Transmitted Infections
UNAIDS	Joint United Nations Programme on HIV/AIDS
USAID	United States Agency for International Development
VMMC	Voluntary Medical Male Circumcision
VCT	Voluntary Counselling and Testing
WHO	World Health Organization

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Chapter 1: Introduction

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1.1 The Global HIV epidemic

It has been three decades since HIV started its march across the globe with a devastating impact on populations and economies of countries and regions, some more than others. A concerted effort by the United Nations, through the Joint United Nations Programme on HIV/AIDS (UNAIDS), and member states to address AIDS as a priority health and development issue has started to show an effect. The overall growth of the global AIDS epidemic appears to have stabilised. [1] UNAIDS estimates that there were 33.3 million [31.4 million – 35.3 million] people living with HIV (PLHIV) at the end of 2009 compared with 26.2 million [24.6 million - 27.8 million] in 1999, a 27 percent increase globally. At the same time, in 2009, there were an estimated 2.6 million [2.3 million – 2.8 million] people who became newly infected with HIV. Although, this is 19 percent less than the 3.1 million [2.9 million - 3.4 million] people newly infected in 1999, and 21 percent less than the 3.2 million [3.0 million - 3.5 million] new infections in 1997, when the annual number of new infections peaked, it remains a significantly large number of new HIV infections. The decline in new infections is offset by the reduction in AIDS related mortality as a result of improved availability of antiretroviral medications contributing to an overall increase in numbers of PLHIV. The number of annual AIDS related deaths declined from a peak of 2.1 million [1.9 million - 2.3 million] deaths in 2004 to 1.8 million [1.6 million - 2.1 million] in 2009. [1]

In all this, sub-Saharan Africa continues to bear the brunt of the epidemic. The majority of new HIV infections still occur in this region; in 2009, an estimated 1.8 million [1.6 million – 2.3 million] people became infected with HIV in sub-Saharan Africa. The vast majority of people newly infected with HIV in this region are infected during unprotected sex and onward transmission of HIV to newborns and breastfed babies. [1] There is increasing evidence that unprotected paid sex and sex between men contribute in a large way to the HIV epidemic in several countries in this region, while injecting drug use, a relatively recent phenomenon in sub-Saharan Africa, remains a minor factor in the HIV epidemic. [2, 3] Globally the proportion of women in the PLHIV population has remained stable at around 52 percent; in sub-Saharan Africa the corresponding proportion of women living with HIV is higher at 60 percent. [1]

1.2 HIV in Kenya

Following the global trend, HIV prevalence in Kenya has been declining and there is evidence that the epidemic may have stabilised. [1, 4] The prevalence of HIV infection among the sexually active population of 15-49 years old was 6.3 percent [5.8% - 6.5%] in 2009, down from 8.4 percent [8.1% - 9.0%] in 2001. An estimated 1.5 million [1.3 million - 1.6 million] Kenyans were living with HIV in 2009; and 1.3 million [1.2 million - 1.4 million] of those were adults over 15 years of age. [1] As a result of increased availability of antiretroviral therapy AIDS related deaths have come down from 120,000 deaths [100,000 - 150,000] in 2001 to 80,000 deaths [61,000 - 99,000] in 2009, adding to the numbers of PLHIV.[1] The incidence rate has, however, declined only marginally from 0.55 [0.38 - 0.76] in 2001 to 0.53 [0.34 - 0.70] in 2009. [1] An estimated 110,000 [81,000 - 150,000] new HIV infections occurred in 2009, of these 92,000 [61,000 - 120,000] new infections were among adults (15+ years).[1]

There are significant differences in prevalence across the various provinces and regions of the country. HIV prevalence is lower among the sexually active population (15-49 years) in rural areas compared to urban areas (6.0% vs. 7.2%). [5] As 75 percent of the population lives in rural areas, a large number of HIV infected people have limited access to health care providers and services. Regionally, higher HIV prevalence has been observed in Nyanza (13.9%), Nairobi (7.0%) and Western province (6.6%) compared to Eastern (3.5%) and North-Eastern province (0.9%). The Coast Province falls in between the range at 4.2 percent. [5]

Women have a higher HIV prevalence than men in Kenya (8% vs. 4.3%) and younger women (15 - 24 years) have a four times higher prevalence than young men of the same age (4.5% vs. 1.1%). [5] HIV prevalence has also been documented among older adults (50 - 64 years) at 5 percent with no significant gender differences. [6] The KDHS (2008 - 09) reports significant differences in HIV prevalence by marital status; the highest prevalence was observed among widowed respondents (44.4%). The HIV prevalence among married or cohabiting respondents was 14.3 percent.

The HIV epidemic in Kenya is a mixed epidemic. The Modes of Transmission study (2009) highlights the role Most at Risk Populations (MARPs) play in driving the epidemic. [3] Around 14.1 percent of new HIV infections could be attributed to sex

workers and their clients, 15 percent to Men who have Sex with Men (MSM) and prison populations, 3.8 percent to Injecting Drug Users (IDU) and 2.5 percent to health facility related transmission. Heterosexual sex remains as the leading cause of new HIV infections. The study concluded that 44.1 percent of new HIV infections occurred within married or cohabiting couples (regular partnerships) and 20.3 percent among casual sexual partnerships. Thus heterosexual sex among regular, casual or commercial relationships contributes almost 78 percent of new HIV infections.

The two waves of the Kenya Demographic Health Survey (KDHS) reveal a significant increase in the proportion of the population ever tested for HIV, going up from 14.3 percent males and 13.1 percent females in 2003 to 40.4 percent males and 56.5 percent females in 2008. [5] Despite this increase, KAIS (2007) estimates that around 83 percent of HIV infected people do not know their HIV status and may continue to transmit HIV infection unaware of their infection. [6]

Resources for HIV Programmes in Kenya

Financial resources available for national HIV and AIDS spending have increased progressively over the past three years in Kenya. The total funding went up from US$ 418 million in 2006/07, to US$ 660 million in 2007/08 and 687 million in 2008/09. [7] Most of this funding is donor driven. In 2008/09 the Government of Kenya contributed around 15 percent of the total funding while bilateral donors contributed over 70 percent of the funding for HIV and AIDS programmes (Figure 1).[7] Interestingly, the allocation of funds to various programmes has remained unchanged over the past three years, with the bulk of HIV programme funding, to the tune of 55 percent, spent on care and treatment. HIV prevention programmes receive around 25 percent of the total funds available, while programme management uses 10 percent and OVC programmes around 7 percent. The remaining 3 percent is used by human resources, social and protection services and research activities. Thus, the national HIV prevention program which is the driver of the effort to reduce the spread of HIV receives only a quarter of the HIV funds to cover a wide range of activities: HIV awareness activities in the community, condom distribution, promotion of HIV testing and counseling, targeted interventions for high risk groups, Prevention of Mother to Child Transmission, blood safety and STI prevention and management.

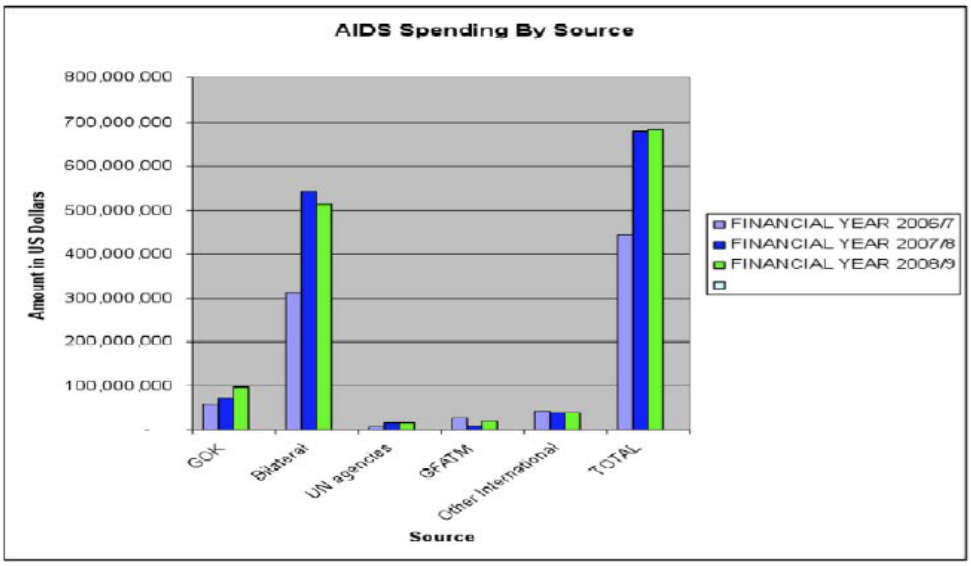

Figure 1: AIDS spending by Financing Sources (NACC: UNGASS Country Report 2010)

1.3 Focus of HIV prevention programmes

A recent Kenya country report on UNGASS HIV and AIDS indicators suggests that over the last several years the national HIV prevention programme has largely focussed on HIV counselling and testing, Information Education and Communication (IEC) and Behaviour Change Communications (BCC) in the general population; and Prevention of Mother to Child Transmission (PMTCT), and Sexually Transmitted Infections in selected populations.[7] Blood safety was added later and national standards for blood banks and transfusion services were developed in 2007. In 2008 the HIV programme added two new interventions to the prevention basket namely Prevention with Positives and Voluntary Medical Male Circumcision (VMMC). [7]

The Kenya National AIDS Strategy Plan (KNASP III) for 2009 - 2013 has recently been finalized with four key strategies. Strategy 1: Provision of cost-effective prevention, treatment, care and support services, informed by a rights-based approach, to realise universal access. Strategy 2: HIV mainstreamed in key sectors through long-term programming, addressing both the root causes and effects of the epidemic. Strategy 3:

Targeted, community based programmes supporting achievement of Universal Access and social transformation into an AIDS competent society. Strategy 4: All stakeholders coordinated and operating within a nationally owned strategy and aligned results framework, grounded in mutual accountability, gender equality and human rights.

1.4 Prevention with Positives

HIV transmission can only occur from an HIV infected person to an uninfected person and in some cases to an already infected person with a new or different viral strain.[8] This makes people living with HIV a key target group for prevention programmes. PLHIV intersect all high-risk and vulnerable groups or MARPs: sex workers, MSM and IDUs. And yet, for several years, the HIV prevention programme in the country focussed largely on the general population with the goal of protecting people from getting infected with HIV, thus placing the onus on the HIV-negative population. The focus has shifted to MARPs (MSM, IDU and SW) and to PLHIV only as recently as in 2008. [3, 7]

The journey of a PLHIV starts with undertaking a HIV test at a health facility or Voluntary Counselling and Testing centre (VCT). With a positive test result the national policy requires newly diagnosed HIV-positive persons to receive post-test counselling on risk reduction and prevention of onward transmission of HIV to partners and unborn children, and a referral to an ART centre. This process divides the HIV-positive population into various groups. Newly diagnosed HIV-positive persons who register at ART centres bifurcate into those who are eligible for ART and able to initiate treatment and those who are healthy and do not need to initiate ART. PLHIV initiating ART enter into a well monitored programme with visits to health facilities and regular contact with health workers. Those who are not eligible for treatment further bifurcate into those who visit health centres for regular follow up visits and those who do not take up follow up visits or discontinue regular follow up visits and disappear into the community. Of the newly diagnosed HIV-positive persons a proportion may never reach an ART centre for various reasons such as stigma, denial of their HIV-positive status, family pressure, poor geographic access and financial difficulties. [9-11] These PLHIV continue living in the community with little or no contact with the health system. Prevention programmes need to address all the different PLHIV subgroups.

Of the estimated 1.3 million [1.2 million - 1.4 million] people over 15 years age living with HIV in Kenya in 2009; around 336,980 adults were receiving Antiretroviral Therapy (ART) at the end of 2009. [1] UNAIDS estimates that around 555,000 PLHIV were eligible for /required ART at the end of 2009 (60.7% of eligible PLHIV receiving ART), while, the National AIDS Control Council estimates that 70.4 percent of those eligible for treatment were receiving ART (308,610/438,000) at the end of 2009.[1, 7] Either way we do not know what proportion of the remaining (around 750-800,000) HIV-positive persons in the country have been evaluated for eligibility for ART or what proportion have contact with health services, health providers or prevention programmes. For those PLHIV who are not accessing ART services, and have limited or no contact with health workers post-test counselling offered at the time of HIV testing may well be the only window to receive HIV related information.

Unprotected sex among HIV infected persons is of concern because of the risk of transmission to sero-discordant partners, or the risk of re-infection with new and/or drug resistant viral strains. [12, 13] With increased availability of ART in Kenya more PLHIV are receiving ART and as a result of this treatment are experiencing lower HIV related morbidity and mortality. Thus PLHIV on ART are living longer, healthier and possibly more sexually active lives.[14] Treatment with antiretroviral medications may suppress viral loads to undetectable level but not necessarily eliminate the risk of sexual transmission of HIV infection.[12] Viral shedding continues to variable levels possibly related to separate reservoirs of infection or type of ART regimen. [15-17] Recent evidence from a multi-country randomized controlled HIV Prevention Trials Network (HPTN 052 Press release of 11 May 2011) has demonstrated that early treatment with antiretroviral medications resulting in undetectable viral loads confers protection against transmission of HIV among discordant couples. The study found a 96 percent reduction in transmission rates in the early ART arm compared to the delayed treatment arm. These new findings support the 'Swiss Statement' made by Vernazza et al (2008) that HIV infected persons on ART with undetectable viral loads are not sexually infectious and can discontinue use of condoms.[18] Around the same time Wilson et al (2008) undertook a mathematic modelling study on HIV transmission probabilities and concluded that the risk of HIV transmission in heterosexual partnerships in the presence of effective treatment is low but not non-zero and that the transmission risk in male homosexual partnerships is high over repeated exposures.

[18, 19] In this situation the link between poor adherence resulting in treatment failure, development of viral resistance to ARV medications and sexual transmission of resistant viruses becomes an important concern for prevention programmes. [20, 21] There is also a concern that PLHIV on ART may continue or resume high risk behaviours when their health improves with treatment. There is evidence of a resurgence of unsafe sex among high risk groups, such as MSM, emerging from western countries. [22] This behavioural 'disinhibition' is a serious concern for developing country programmes where resources are limited and balanced precariously between treatment and prevention needs. In Kenya prevention programmes receive around 25 percent of the annual HIV and AIDS budget compared to 55 percent of the budget allocated for treatment, care and support programmes. [7]

Given that the vast majority of PLHIV are not on treatment it is important to assess HIV transmission risks without ART. A review and meta-analysis of hetero-sexual risk of HIV 1 infection by Boily et al (2009) concluded that pooled female-to-male (0.38% per act [95% CI 0.13-1.10]) and male-to-female (0.30% per act [95% CI 0.14-0.63]) estimates in the absence of commercial sex exposure (CSE) in low-income countries were higher than those in high-income countries. The pooled receptive anal intercourse estimate was much higher (1.7% per act [95% CI 0.3-8.9]). After adjusting for CSE, presence or history of genital ulcers in either couple member increased per-act infectivity 5.3 (95% CI 1.4-19.5) times versus no sexually transmitted infection and estimates among non-circumcised men were at least twice those among circumcised men. Low-income country estimates were more heterogeneous than high-income country estimates, which indicates poorer study quality, greater heterogeneity of risk factors, or under-reporting of high-risk behaviour.[23]

Most HIV prevention programmes focus mainly on safe sex behaviours, disclosure and partner reduction interventions delivered through counselling. A meta-analytic review of 12 intervention studies, conducted in the USA, concluded that HIV prevention interventions significantly reduce unprotected sex (OR 0.57; 95% CI 0.40-0.82) and decrease the acquisition of sexually transmitted infections (OR 0.20; 95% CI 0.05-0.82). [24]As a whole, interventions with the following characteristics significantly reduced sexual risk behaviours: (1) based on behavioural theory; (2) designed to change specifically HIV transmission risk behaviours; (3) delivered by health-care providers or counsellors; (4) delivered to individuals; (5) delivered in an intensive manner; (6)

delivered in settings where PLWH receive routine services or medical care; and (7) provided skills building. This evidence can be used to design community based interventions in low income countries. In the absence of the availability of ART for the vast majority of PLHIV, prevention efforts will need to continue emphasizing safe sex behaviours, partner reduction and disclosure even though the overall effectiveness of consistent condom use in prevention of heterosexual transmission of HIV is around 80 percent (Weller et al. 2001).

Research has shown that learning one's HIV status is associated with safer sexual behaviours, more so among persons testing HIV-positive and to a lesser extent among those receiving a negative test result. [25-28] In recent years, Kenya has adopted a multi pronged approach to the provision of HIV testing and counseling services including provider initiated testing and counseling at health care facilities, home based testing, and mobile or outreach counseling and testing such as Moonlight testing for MARPs.[7] Despite higher uptake of HIV testing reported by the KDHS (2008/09) the majority of HIV infected people do not know their status (KAIS 2007). This is especially relevant for untested partners of PLHIV. It is estimated that 400,000 married couples in Kenya are discordant placing partners at risk of infection. [6, 29]

The modes of transmission study suggests that three-fourths of all new infections in Kenya can be attributed to heterosexual sex with regular, casual and commercial partners. [3] The KDHS (2008/09) reveals that men were more likely than women to report multiple sexual partners in the 12 months preceding the survey; men were also more likely to report sex with a person who was not a spouse or cohabiting partner and to report not using condoms at last sex. [5] While this information is available at a national level for the general population participating in demographic health surveys, there is little or no information regarding high risk behaviours among HIV-positive persons and their partners in the community – a key population in the HIV epidemic. To design effective prevention programmes that can bring about behaviour change in this population and prevent onward transmission of HIV infection an understanding of sexual risk behaviours among PLHIV is crucial.

This thesis focuses on HIV-positive persons and explores high risk behaviours and factors influencing these behaviours among PLHIV in the Coast Province of Mombasa, Kenya. Four papers are presented in the main body of the thesis document addressing various PLHIV subgroups in Mombasa:

- ***PLHIV receiving co-trimoxazole prophylaxis but not ART***
  A cross sectional study comparing sexual risk behaviours of HIV infected persons on HAART and on preventive therapy with co-trimoxazole in Mombasa, Kenya.

- ***PLHIV on ART***
  This is a prospective cohort study documenting change in sexual behaviours after 12 months of antiretroviral treatment in Mombasa, Kenya, using quantitative methods

- ***PLHIV on ART***
  This study uses qualitative methods to explore change in sexual behaviours in the context of ART and existing gender and social norms in the community

- ***PLHIV in the community who are not accessing HIV treatment.***
  This is a cross sectional study using quantitative methods to understand sexual behaviours of HIV-positive persons not accessing HIV treatment in Mombasa, Kenya

Five papers are included as annexures. These provide supportive evidence from other countries as well as contextual information from other research on adherence and stigma

- 'Sexual behaviour of HIV-positive men currently on antiretroviral therapy'.
  This cross sectional study describes sexual risk behaviours among HIV-positive men receiving ART from two cities in India. The study uses quantitative methods.

- ‘Access to treatment for adults and children with HIV infection in developing countries: Horizons studies 2002-2008’. This article highlights research experiences in the context of ART from other countries in Asia and Africa. The paper presents a brief overview of sexual behaviour among PLHIV from other studies.

- ‘Short- and long-term efficacy of modified Directly Observed antiretroviral treatment in Mombasa, Kenya: A randomized trial’. This study provides the background context for the first three articles presented in the thesis.

- ‘HIV prevention in the context of scaled-up access to HIV treatment.’ This chapter, from WHO document, focuses on the rationale for researching sexual behaviours of PLHIV on treatment and provides guidance related to generic tools for operational research.

- ‘Perceived stigma among patients receiving antiretroviral treatment: A prospective randomized trial comparing an m-DOT strategy with standard-of-care in Kenya’.

Photo Credit: Richard Lord

Chapter 2: Objectives

Mother and child © Richard Lord

Chapter 2: Objectives

2.1 General Objective

The overall objective of this thesis is to improve the understanding of sexual risk behaviours of HIV-positive persons to provide evidence based information to guide the national HIV prevention programme in Kenya. The evidence generated may also be relevant to prevention programmes in other countries

2.2 Specific Objectives

2.2.1 Article 1

- To compare sexual risk behaviours of PLHIV receiving ART with those receiving preventive therapy with Co-trimoxazole but not ART

2.2.2 Article 2

- To assess change in sexual behaviours over 12 months of ART
- To identify factors associated with unsafe sex with sexual partners among PLHIV receiving ART

2.2.3 Article 3

- To examine change in sexual behaviours and the contextual factors that affect sexual behaviours among PLHIV receiving ART

2.2.4 Article 4

- To examine sexual behaviours of PLHIV who are not receiving any treatment
- To identify factors associated with unsafe sex with partners in this subgroup

This work seeks to provide recommendations for the National HIV Prevention Programme to design and implement targeted prevention interventions that address the specific needs of the HIV-positive population and addresses all subgroups of PLHIV.

Photo credit: Paul Munyao

Chapter 3: Methods

Community Health Workers from Mombasa © Paul Munyao

Chapter 3: Methods

3.1 Study settings

Research activities took place in Mombasa in the Coast Province of Kenya. Mombasa is east Africa's largest port city and Kenya's major tourist destination. Mombasa's population of around 500,000 is made up of ethnically diverse African, Arab and Asian people following various faiths. Kenya Ports Authority and the tourism industry are the two major employers in the province that attract migrant workers from neighbouring provinces. Many of these workers live in crowded, low income neighbourhoods without families. Catering to the tourist industry and migrant community, Mombasa has a large population of male and female sex workers [30, 31]. The HIV prevalence in the province is around 4.2 percent, with a higher prevalence among females (5.8%) compared to males (2.3%). [5] Following the national trend, the Coast Province has also witnessed a decline in HIV prevalence in the general population as a result of behavioural change taking place in the wake of large scale prevention efforts that began in 2000 [4-6]. HIV prevalence has not declined to a similar extent in the high risk groups such as sex workers. Successive surveys conducted among female sex workers in Mombasa in 2000 and 2005 documented an increase in HIV prevalence from 30.6 percent to 33.3 percent. [31, 32]. High HIV prevalence has also been documented among male sex workers and antenatal populations. [33]

In 2004, the Government of Kenya with support from USAID initiated the first ART program for PLHIV in Kenya, in Mombasa. The pilot program was designed to provide treatment for a total of 300 PLHIV (90% adults and 10% children). To be eligible for initiating ART a HIV-positive person had to have WHO clinical disease stage III or IV and/or a CD4 cell count $\leq$ 200 cells/mm^3. HIV-positive persons who presented at the clinic were first screened clinically and those found clinically eligible were asked to undergo a CD4 test. A limited number of CD4 cell tests were available for PLHIV deemed clinically eligible for initiating ART. Viral load assessments were not available through the program. Co-trimoxazole prophylaxis was available for HIV-positive persons who presented at the clinic but were not found eligible to receive ART based on clinical criteria and in some cases CD4 cell counts. Thus, PLHIV were receiving co-trimoxazole prophylaxis at the same ART centres.

Concurrently with the roll out of the pilot ART program, the Population Council undertook a study to assess the effectiveness of a modified DOT strategy to promote adherence among HIV positive persons initiating ART. Nested within this adherence study we undertook observational studies to assess change in sexual behaviour and to assess change in perceived and experienced stigma in the context of ART. (See annexures 3 and 5).

Three of the studies (articles 1-3) included in this thesis were conducted within the broader framework of a modified DOT adherence intervention study within health care facilities in Mombasa, namely Coast Province General Hospital, Port Reitz District Hospital, and Bomu Community Clinic (see annexure 3). Quantitative data on sexual behaviour was collected from HIV-positive persons participating in the m-DOT adherence study at the time of ART initiation, and after 6 and 12 months. The cohort study presented in article 2 focussed on change in sexual behaviour among study participants over 12 months of ART (used baseline and 12 month data). HIV positive persons who were receiving co-trimoxazole prophylaxis treatment for 6 months at the same clinics were interviewed and their sexual behaviours compared to participants receiving ART for the study presented in article 2 (used 6 month data). Qualitative data was collected from a sub-sample of participants selected on key characteristics of interest presented in article 3. The fourth study (article 4) addressing PLHIV not receiving treatment was conducted among PLHIV from the community in Mombasa during a later period.

3.2 Study design

3.2.1 Comparative study of HIV infected persons on HAART and on Preventive Therapy in Kenya

A cross sectional study design was used to compare sexual behaviours of HIV positive adults completing six months on ART and HIV positive adults receiving preventive therapy with cotrimoxazole prophylaxis for atleast five months. Participants in both groups were in regular contact with health providers through monthly visits to health clinics and were recruited as they came for follow up services. PLHIV receiving ART were participating in a randomized controlled trial evaluating the effectiveness of a modified DOT strategy to promote adherence described in annexure 3.

A structured questionnaire was used to collect data through face to face interviews conducted by trained research interviewers. Interviews were conducted in Swahili or English per client preference.

The reference period for all measures was six months. A regular partner was defined as a spouse or cohabiting sexual partner. A casual partner referred to a partner with whom the respondent had sex infrequently and was not living with or married to. A sex worker was a partner to whom money was paid in exchange for sex. Condom use at last sex referred to the most recent sexual act in the last six months. Consistent condom use was defined as always using condoms in the past six months; it was assessed as 'always', 'sometimes', 'never' and excluded last sex. Unprotected sex (UPS) was defined as condoms not used at last sex or inconsistent condom use in the last six months. STIs were self-reported episodes of genital discharge (GD) or genital ulcer (GU) in the past six months; laboratory confirmation of STI was not available. Respondents were asked to report whether they knew their partner's HIV-status and whether they had disclosed their own HIV-status to their partners. Economic status was derived from type of housing and ownership of assets; the scores were categorized into quartiles.

A total of 179 HIV positive persons on HAART and 143 HIV positive persons receiving co-trimoxazole prophylaxis were interviewed.

3.2.2 Safer sexual behaviours after 12 months of antiretroviral treatment in Mombasa, Kenya

This study of sexual behaviours among patients receiving ART was nested in a randomized controlled trial assessing the efficacy of modified directly observed therapy (m-DOT) to improve adherence to ART described in annexure 3. Adults living in Mombasa who were 18 years and older, ART-naïve, and with indications for ART as per the Kenyan national treatment guidelines were invited to participate in the adherence study. Study participants (149 women and 85 men) were randomly assigned to m-DOT and standard-of-care groups.

Data on sexual behaviour were collected using structured questionnaires administered in Swahili by trained research assistants. Information was obtained at the start of treatment and after 6 and 12 months. The questionnaire captured information on: heterosexual and homosexual contacts with regular, non-regular, and commercial partners; condom use; disclosure of HIV status to partners and knowledge of their partner's HIV status; knowledge and attitudes toward ART and its effects on risk for HIV transmission; and history of sexually transmitted infection (STI). The recall reference period for most outcome measures was 12 months. Depression was assessed using Beck's Depression Inventory II®; the tool was culturally adapted and translated into Swahili. Perceived stigma was assessed using an adapted Berger scale with 16 items and categorized as minimal or low, moderate, or high stigma levels. For study purposes, unsafe sex was defined as any unprotected sex act in the last 12 months with a partner of HIV negative or unknown status (primary outcome). A regular partner was defined as a spouse or sexual partner with whom the respondent lived or had a stable relationship. A non-regular partner referred to a partner with whom the respondent was not living or married to and only had sex with once or very rarely. Commercial partners were those who were given money or gifts in exchange for sex. Participants were asked two questions to assess their concern about HIV transmission while on ART at the 12 month visit: "Treatment with ARV medications can reduce the risk of transmission" and "HIV/AIDS has become less serious because of ARV medications." Agreeing with either one or both of these questions categorized them as having lower

levels of concern about transmission. STI events were self-reported episodes in the past 12 months; laboratory confirmation of infection was not available.
Laboratory investigations CD4 cell counts were determined at baseline, at 6 and 12 months. PARTEC (Partec-GmBH, Münster, Germany) and FACS counters (Becton & Dickinson Immunocytometry Systems, San Jose, CA) were used for enumerating CD4 cell counts. Plasma viral load (Roche Amplicor HIV-1 Monitor test version 1.5, Roche Molecular Systems, Branchburg, NJ) was measured at 12 months.

3.2.3 Changes in sexual risk taking with antiretroviral treatment: influence of context and gender norms in Mombasa, Kenya

Qualitative research methods were used for this study which was nested in the randomized controlled trial assessing the efficacy of modified directly observed therapy (m-DOT) to improve adherence to ART (annexure 3). In-depth interviews were held with sexually-active adults receiving ART (11 women and 12 men). The interviews set out to obtain a more comprehensive understanding of sexual activity, desire and risk behaviours; and included enquiry about: multiple and concurrent sex partners; condom use in different types of partnerships; gender roles and gender-based violence; vengeance and anger related to unsafe sex; and fertility intentions.

Participants were selected using stratified purposeful sampling. This selects samples within samples, by choosing cases that vary on a key dimension (cases nested within specific stratum).[34] In this case, a random sub-sample was selected from individuals with varying condom use and HIV status of sexual partners, based on self reported information given during baseline interviews for the sexual behaviour study at the time of ART initiation. Efforts were also made to include those participants considered most likely to share their experiences openly. Three people were chosen from those reporting inconsistent condom use with HIV-negative partners and four from each of the following groups: consistent condom use with HIV-negative partners; consistent condom use with partners of unknown HIV status; inconsistent condom use with partners of unknown HIV status; consistent condom use with HIV-positive partners; and inconsistent condom use with HIV-positive partners.

The interview guide was developed in consultation with the field team and

HIV-positive peers. The guide was translated into Swahili, and field tested for clarity of language, comprehension and content. Interviews were held in English or Swahili in line with interviewee preference. In an attempt to reduce social-desirability bias, same-sex interviewers were used who had not been involved in providing care or patient counselling. The interviewers, all with some prior tertiary-level education and experience in HIV research, had received specific training in qualitative data collection techniques and in gathering information in a non-judgmental manner.

3.2.4 Sexual behaviours of HIV-positive persons not accessing HIV treatment in Mombasa, Kenya: Prevention with healthy positives in the community

A cross sectional study design was used for this study. Study participants were recruited using modified snowball sampling, through Community Health Workers (CHW) and HIV-positive Peers from Post Test Clubs (PTC). Four CHWs from all four Mombasa districts (n=16) were each asked to recruit 20 PLHIV. Five Peers from eight PTCs (n=40) across the city were each tasked with recruiting 12 PLHIV. HIV-positive adults who were 18 years or older, not currently taking ART or co-trimoxazole prophylaxis were eligible to participate. Recruitment followed a detailed protocol on approaching PLHIV, maintaining confidentiality and verifying HIV-positive status.

Data were collected using structured questionnaires administered in Swahili by trained research assistants.

Demographic variables were categorized and time since diagnosis of HIV classified as less than 12 months, 12-24 months and $\geq$24 months. Contraception was categorized as: male/female condoms for contraception, other FP methods (IUD, hormonal methods, permanent methods, diaphragm, foam/jelly, or rhythm) and no contraception. Perceived stigma was assessed using an adapted Berger's Stigma Scale (Cronbach's alpha of adapted scale: 0.81) and was categorized as minimal or low (16-40), moderate (41-52) or high stigma (53-64). [35, 36] The recall reference period for sexual behaviour was the previous six months. Data were collected on sexual activity, lifetime number of sexual partners, number of sexual partners in the past six months, type of partners, partner's HIV status and disclosure of own status to partners. A regular partner was defined as a spouse or cohabiting partner, or a long-term friend with whom the respondent has sex frequently. A casual partner was defined as a partner with whom

the respondent was not living and had sex once or rarely. Commercial or transactional partners were those where money or gifts were exchanged for sex.

To assess transmission concerns, participants were asked a binary question: "Are you worried about transmitting HIV to this partner?" Attitudes to condom use were assessed with two statements: "I am tired of always having to make sure that I use a condom every time I have sex" and "Using a condom takes away the romance from sex" – responses were scored as agree, disagree or don't know. STI events were self-reported episodes of genital discharge or genital ulcer in the past six months (laboratory confirmation was unavailable). Unprotected sex (UPS-6 months) was defined as inconsistent condom use with partners in the past 6 months. Unsafe sex (US), the primary outcome, was defined as inconsistent condom use with partners of HIV-negative or unknown status in the past six months (US-6 months). Participants were asked to report UPS for up to six partners in the past six months. UPS at last sex and US at last sex were also reported.

A total of 720 PLHIV not receiving ART or preventive therapy were interviewed.

3.3 Ethical consideration

The Institutional Review Board of the Population Council in New York and the Ethical Review Committee at Kenyatta National Hospital, the in-country authority responsible for research in Kenya approved all research presented here. In all four studies, participants provided written informed consent prior to the initiation of any research activities.

3.4 Data management and analysis

As three of the studies presented here were nested in one randomized controlled trial to evaluate effectiveness of a modified-DOT intervention to promote adherence, standardised definitions were used for key variables such as unprotected sex and unsafe sex, in describing the different categories of partners, categorisation of stigma and depression levels and socio-economic categories. Efforts were made to retain similar categorization of partners and definition of key outcome variables such as unsafe sex and unprotected sex for the fourth study as well. Data analysis and interpretation of findings for all four studies was conducted in consultation with local

partners. As the objectives and study design for each of the four studies was different details about data analysis procedures are presented for each study below.

3.4.1 Article 1:

SPSS 11.0 (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis. Chi-square tests were used to compare sociodemographic characteristics and behaviours between the groups. Logistic regression analysis was undertaken to determine predictors of sexual activity and UPS in the last six months. Variables found to be associated with sexual activity and UPS by having odds ratios (OR) that reached significance (P, 0.05) on univariate analysis were included in multivariate models.

3.4.2 Article 2:

Data were double-entered in a Microsoft Access 2003 database and analysed using Intercooled Stata, version 8.0 (Stata Corporation, College Station, TX). The Chi squared test and Mann-Whitney *U* test were used for univariate comparisons of baseline characteristics for each gender. To assess factors associated with unsafe sex, a bivariate analysis was done, restricted to participants who had been sexually active in the past 12 months at baseline and/or at 12 months follow-up. Associations were assessed between unsafe sex and sociodemographic, HIV knowledge and beliefs, disclosure, health status and ART characteristics. Bivariate cross-sectional logistic regression models were constructed using generalized estimating equations (GEE), taking into account that observations were repeated on the same participant. Participant's sexual behaviour before starting ART and after 12 months of treatment was compared using GEE. Multivariate models are presented for the primary outcome and for any sexual activity, unprotected sex at last sex act with any partner and self-reported STI. Variables associated with the primary outcome in the bivariate analysis described above or in similar studies were included in the model and retained if removal from the model markedly altered the model fit. Similar methods were used for constructing the other three multivariate models.

3.4.3 Article 3

Qualitative methods were used to collect data through in-depth interviews with selected participants. Interviews, each taking about an hour, were recorded verbatim on audio tape with accompanying interviewer notes and then translated and transcribed in

English. During data analysis, two members of the research team read the interviews independently, identified broad themes and generated descriptive categories and codes. Codes were then compared, a final code list prepared by consensus and data coded as per the agreed list. Coded text was then read by the two researchers and results were discussed and interpreted jointly. Content analysis was done using Atlas ti version 5.0 (Berlin, Germany).

3.4.4 Article 4

Data were entered into handheld computers (Dell Axim X 51) and then uploaded into Microsoft Access 2003 using Perseus 7.0.044 software. The data were analysed on two levels (respondent-level and partner-level) using Intercooled Stata 8.0 (Stata Corporation, College Station, Texas, USA).

Respondent-level analysis compared demographic and behavioural characteristics of male and female participants. Unpaired Student's *t* test and the Mann-Whitney *U* test compared continuous variables with normal or non-normal distributions respectively, and a chi-square test identified differences between categorical variables. Unadjusted Mantel Hanzel odds ratios were reported.

Analysis at the level of sexual partner included data for up to six partners for each respondent in the last six months. Univariate logistic regression, controlling for clustering by participant identity number, was performed on each variable to identify associations between the variable and unsafe sex at 6 months and last sex. Variables significant, at alpha level of 0.05, on univariate regression were included in the multivariate model.[37] Also, *a priori*, disclosure of HIV status and type of partner were included in initial models, based on previous evidence.[38-42] For multivariate analysis, logistic regression models controlled for clustering were constructed as there were multiple measures on the same participant, and each participant's sexual behaviour with one partner may not be independent from her or his behaviour with other partners. A main effects model was used. [43] Separate multivariate models were developed for US-6 months and US-last sex.

3.5 Data dissemination

The following articles have been published or submitted to peer-reviewed journals for publication forming the basis of the evidence for this thesis.

1 Sexual risk behaviour and HAART: A comparative study of HIV infected persons on HAART and on preventive therapy in Kenya.
International Journal of STD & AIDS 2008; 19: 85-89 (First author)

2 Safer sexual behaviours after 12 months of antiretroviral treatment in Mombasa, Kenya: A prospective cohort study
AIDS Patient Care and STDs 2008; 22(7):587-594 (Shared first authorship)

3 Changes in sexual risk taking with antiretroviral treatment: influence of context and gender norms in Mombasa, Kenya
Culture Health and Sexuality 2009; 11(8):783-797 (First author)

4 Sexual behaviours of HIV-positive persons not accessing HIV treatment in Mombasa, Kenya: Prevention with healthy positives in the community.
Submitted to: AIDS and Behavior (First author)

Photo credit: Avina Sarna

Chapter 4: Results

Nurse Counsellors at Mkomani Bomu Clinic in Mombasa talking to a study participant © Avina Sarna

Article 1

Sexual risk behaviour and HAART: a comparative study of HIV infected persons on HAART and on preventive therapy in Kenya

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ORIGINAL RESEARCH ARTICLE

Sexual risk behaviour and HAART: a comparative study of HIV-infected persons on HAART and on preventive therapy in Kenya

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Summary: Unprotected sex (UPS) among persons receiving highly active antiretroviral therapy (HAART) remains a concern because of the risk of HIV-transmission. A cross-sectional study comparing the sexual risk behaviour of 179 people living with HIV/AIDS (PLHA) receiving HAART with that of 143 PLHA receiving preventive therapy (PT) with cotrimoxazole/isoniazid was conducted in Mombasa, Kenya. Forty-five percent of all participants were sexually active in the last six months. Participants receiving PT were more likely to report $\geq$2 partners (13% vs.1%; $P = 0.006$). Participants receiving PT reported more UPS with regular partners (odds ratio [OR]: 3.9; 95% confidence interval [CI]: 1.8–8.4) and also more sexually transmitted infections (STI) symptoms (OR: 1.7; 95% CI: 1.0–2.8; $P = 0.059$). More than 40% of all participants did not know the HIV-status of regular partners. Therefore, HAART was not associated with increased sexual risk behaviours though considerable risk of HIV-transmission remains. HIV-care services need to emphasize partner testing and consistent condom use with all partners.

Keywords: sexual behaviour, HIV, antiretroviral treatment, sexually transmitted infections

INTRODUCTION

With an increased access to highly active antiretroviral therapy (HAART) there has been a dramatic decline in morbidity and mortality from HIV disease.[1] As of August 2006, 8800 HIV-infected persons were receiving antiretroviral therapy (ART) in Kenya.[2] Unprotected sex (UPS) among persons receiving HAART is of concern because of the risk of HIV-transmission to sero-discordant partners, possibly with resistant viruses or the risk of re-infection with new, drug resistant viral strains.[3] An increase in risk behaviours has the potential to undo gains achieved by prevention and antiretroviral initiatives.

There is a widespread concern that a reduction in preventive behaviours may occur among HIV-infected persons once they feel better with ART. UPS and the incidence of sexually transmitted infections (STI) including HIV have increased among men who have sex with men (MSM) since HAART became more widely available.[4–5] Among HIV-infected MSM receiving ART, risk behaviour was associated with immunological and virological improvements, related in part to a perception of lower infectivity due to lower viral loads.[6] An increased risk of acquiring STIs, an epidemiological marker of UPS, has been also reported among heterosexual HIV-infected persons receiving ART.[7] A recent review found that while people's beliefs about lower infectivity with ART and undetectable viral loads promote UPS, HIV-positive patients receiving ART did not exhibit increased sexual risk behaviour, even when therapy achieved undetectable viral loads.[8] Currently, limited evidence is available from resource poor settings.[9–11]

Our study examines the sexual risk behaviour of HIV-positive persons accessing care and whether HAART is associated with increased sexual risk behaviour in Mombasa, Kenya.

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METHODS

This cross-sectional study compares the sexual risk behaviour of HIV-infected adults $\geq$18 years of age who were receiving either HAART or preventive therapy (PT) with cotrimoxazole and/or isoniazid without HAART.

Study setting and subject recruitment

Participants receiving HAART comprised of adult HIV-infected persons completing six-months on ART; five persons refused the interview. Participants receiving PT comprised of HIV-infected persons completing at least five months on treatment; there were no refusals. Participants were recruited as they came for follow-up services.

Participants in both groups were in regular contact with health workers through monthly visits to the HIV-clinics. All patients received messages on positive prevention at the time of HIV testing, when starting their respective treatments and during follow-up; information provided consisted of routes of transmission, condom use, disclosure and partner testing. Those receiving HAART also had intensive counselling on treatment adherence.

Data collection

A structured questionnaire was used. Face-to-face interviews were conducted (September 2003 and June 2005) in English or Swahili as per patient preference. Interviewers were trained in rapport building and non-judgmental information gathering. The reference period for all measures was six months. Study participants provided a written informed consent. Ethical approval for the study was obtained from the Kenyatta National Hospital Ethics Committee and the Ethical Review Committee of the Population Council.

Study variables and measures

A regular partner was defined as a spouse or cohabiting sexual partner. A casual partner referred to a partner with whom the respondent had sex infrequently and was not living with or married to. A sex worker was a partner to whom money was paid in exchange for sex. Condom use at last sex referred to the most recent sexual act in the last six months. Consistent condom use was defined as always using condoms in the past six months; it was assessed as 'always', 'sometimes', 'never' and excluded last sex. UPS was defined as condoms not used at last sex or inconsistent condom use in the last six months. STIs were self-reported episodes of genital discharge (GD) or genital ulcer (GU) in the past six months; laboratory confirmation of STI was not available. Respondents were asked to report whether they knew their partner's HIV-status and whether they had disclosed their own HIV-status to their partners. Economic status was derived from type of housing and ownership of assets; the scores were categorized into quartiles.

Statistical methods

SPSS 11.0 (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis. Chi-square tests were used to compare sociodemographic characteristics and behaviours between the groups. Logistic regression analysis was undertaken to determine predictors of sexual activity and UPS in the last six months. Variables found to be associated with sexual activity and UPS by having odds ratios (OR) that reached significance ($P < 0.05$) on univariate analysis were included in multivariate models.

RESULTS

Sociodemographic characteristics

We interviewed 179 HIV-infected persons six months after initiating HAART (first-line regimen: stavudine, lamivudine plus nevirapine or efavirenz) and 143 HIV-infected persons receiving PT with cotrimoxazole and/or isoniazid for median of six months (interquartile range [IQR]: 5, 7). Mean age of participants was 37 years (Standard deviation: eight years). There were no differences between groups with regard to age, marital status, sex or educational level (Table 1). Participants receiving PT were more likely to be employed ($P = 0.007$) and belong to higher economic status ($P = 0.01$) than those receiving HAART. For participants receiving HAART, the median CD4 cell-count at start of treatment was 100 cells/mm^3 (IQR: 50, 152) and median increase in CD4 cell-counts over six months was 216 cells/mm^3 (IQR: 128, 334). CD4 cell-counts were not available for those receiving PT.

Table 1 **Sociodemographic characteristics of participants receiving HAART and participants receiving PT at HIV care clinics in Mombasa**

	HAART% (n = 179)	PT% (n = 143)	P value
Age (years)			
≤30	24 (42)	28 (40)	0.585
31–40	45 (81)	45 (64)	
≥41	31 (56)	27 (39)	
Sex			
Male	35 (63)	34 (49)	0.862
Female	65 (116)	66 (94)	
Education level			
Never attended school	7 (13)	14 (20)	0.181
<7 years school	47 (84)	39 (55)	
8–12 years school	40 (71)	41 (59)	
College/technical/ university	6 (11)	6 (9)	
Marital status			
Married/cohabiting	48 (86)	45 (64)	0.830
Single	12 (21)	12 (17)	
Widowed/separated	40 (72)	43 (62)	
Employment			
Yes	18 (33)	32 (45)	0.007
No	82 (146)	69 (98)	
Economic status			
Lower ES (Q1)	18 (33)	7 (10)	0.010
Middle ES (Q2)	55 (99)	61 (87)	
Higher ES (Q3 and Q4)	26 (47)	32 (46)	

HAART = highly active antiretroviral therapy; PT = prevention therapy

SEXUAL ACTIVITY

Forty-five percent of study participants reported sexual intercourse in the reference period. There was no difference in self-reported sexual activity between participants receiving HAART and those receiving PT (44 and 47%; $P = 0.476$). Sex, education, employment and study group were not associated with sexual activity. On multivariate analysis, age and marital status emerged as independent predictors of sexual activity. Older participants were less likely to report sex than younger patients (OR: 0.94 per unit increase in age; 95% confidence interval [CI]: 0.91–0.97; $P = 0.001$). Married or cohabiting respondents were 8.3 times more likely to report sex than single/divorced/widowed respondents (95% CI: 4.96–14.14; $P < 0.001$).

SEXUAL PARTNERS

The majority of sexually active study participants reported sex with one partner (136/146). Patients receiving HAART were less likely to report multiple partners than those receiving PT ($P = 0.006$) (Table 2). The majority of respondents reported sex with regular partners. No male-to-male sex was reported. More participants receiving HAART reported sex with

Table 2 **Sexual risk behaviour variables by study group**

	HAART% (*n*/*N*)	PT% (*n*/*N*)	*P* Value
Number of partners (*n* = 146)			
1	99 (77/78)	87 (59/68)	0.006*
≥2	1 (1/78)	13 (9/68)	
Type of partners (*n* = 146)			
Regular	97 (76/78)	88 (59/68)	0.044
Casual	2 (2/78)	23 (15/68)	0.000*
Sex worker	1/78	1/68	
Knowledge of partner status			
Regular (n = 135)			
HIV-positive	45 (34/76)	36 (21/59)	0.248
HIV-negative	13 (10/76)	24 (14/59)	
Unknown	42 (32/76)	41 (24/59)	
Casual (n = 17)†			
HIV-positive	–	4/15	
HIV-negative	–	2/15	–
Unknown	2/2	9/15	
Sex worker (n = 2)†			
Unknown	1/1	1/1	–
Disclosed status to			
Regular (*n* = 135)	82 (62/76)	73 (43/59)	0.228
Casual (*n* = 17)†	0/2	10/15	–
Sex worker (*n* = 2)†	1/1	0/1	–
Condom use with			
Regular (n = 135)			
Last sex	93 (71/76)	77 (45/59)	0.012
Consistently	53 (40/76)	22 (13/59)	0.000
Casual (n = 17)†			
Last sex	2/2	5/15	–
Sex worker (n = 2)†			
Last sex	0/1	0/1	–

*Fisher's exact test
†Absolute numbers, statistical testing not undertaken

regular partners ($P = 0.044$) and fewer with casual partners ($P < 0.001$) than those receiving PT.

Over 40% of respondents in both groups were unaware of the HIV-status of their regular partners. There was no difference between groups with regard to knowledge of partner's status or disclosure of HIV-status to regular partners (Table 2). Similarly, the majority of respondents in both groups did not know the HIV-status of and did not disclose their HIV-status to their casual and sex-worker partners (Table 2).

CONDOM USE WITH PARTNERS

Participants receiving HAART were more likely to report condom use at last sex (OR: 4.1; 95% CI: 1.37–12.28) and consistent condom use (OR: 3.9; 95% CI: 1.83–8.43) with regular partners than those receiving PT (Table 2). More participants receiving HAART reported consistent condom use with HIV-positive partners (56% vs. 14%; $P = 0.004$) and partners of unknown status (56% vs. 16%; $P = 0.004$) than those receiving PT. There was no difference between groups with regard to HIV-negative partners (30% vs. 42%).

Participants receiving HAART were more likely to report condom use with casual partners; there was no difference with regard to sex workers (Table 2).

SEXUALLY TRANSMITTED INFECTIONS

Participants receiving PT were more likely to report STI symptoms (22% vs. 13%; OR: 1.7; 95% CI: 0.98–2.81; $P = 0.059$) than those receiving HAART (GU: 27% vs. 18%; OR: 1.9; 95% CI: 1.41–3.45; $P = 0.03$; GD: 15% vs. 9%; $P = 0.12$).

Women respondents were more likely to report STI symptoms (30% vs. 8%; OR: 4.91; 95% CI: 2.33–10.31; $P < 0.001$) compared with men (GU: OR: 3.05; 95% CI: 1.43–6.51; $P = 0.005$; GD: OR: 22.310; 95% CI: 3.01–165.21; $P < 0.001$).

There were no differences between groups in seeking treatment (82% vs. 76%) and informing partners about the STI (59% vs. 58%).

FACTORS ASSOCIATED WITH UPS WITH REGULAR PARTNERS

Sixty percent of respondents reported UPS with regular partners in the last six months. Patients receiving PT were more likely to report UPS than those on HAART (78% vs. 47%; $P < 0.001$).

On univariate analysis, male respondents, married respondents and those receiving PT were more likely to report UPS. Partner's HIV-status, disclosure of HIV-status, number of partners, reporting an STI were not found to be associated with UPS. On multivariate analysis (Table 3), married or cohabiting respondents were three times more likely to report UPS with regular partners. After controlling for marital status and gender, patients receiving PT were four times more likely to report UPS than those receiving HAART ($P < 0.001$).

DISCUSSION

There has been widespread concern that providing ART to HIV-infected patients may lead to an increase in sexual activity and sexual risk behaviour. Fifty-five percent of our study population was sexually inactive; the proportions were similar among patients receiving ART and those receiving PT. Despite marked improvements in health status of patients on HAART (mean CD4 cell count increase: 239 cells/mm^3) there was no difference in self-reported sexual activity between the two groups six months after treatment. Our findings are similar to those reported from Uganda[9] and Cote d'Ivoire.[11]

We found fewer multiple partners and fewer casual partners among PLHA receiving HAART compared with those receiving PT, consistent with findings from Cote d'Ivoire.[11] Overall, 12% of our sexually active participants reported casual partners; Bateganya (2005) report a much higher proportion (around 35% among ART-experienced and ART-naïve respondents).[9] Our findings are also consistent with those reported from Uganda[9] and Cote d'Ivoire[11] with regard to a higher proportion of participants on HAART reporting condom use with regular partners compared with those not receiving HAART.

Although sexual risk behaviour was lower among patients receiving HAART compared with those receiving PT, it is important to emphasize that risk of HIV-transmission remains. More than 40% of respondents in both groups reported regular partners of unknown status and between 13% and 24% of respondents reported HIV-negative regular partners. Overall, 60% of respondents reported UPS with regular partners, a third with casual partners and all with sex workers in the last six months. Importantly, almost half the respondents receiving HAART (14/32) and more than four-fifths (20/24) receiving PT who had regular partners of unknown status did not use condoms consistently and around two-thirds of respondents receiving HAART (7/10) and those receiving PT (8/14) who

Table 3 **Multivariate analysis of predictors of unprotected sex with regular partners ($n = 135$)**

Variable	Univariate OR (95% CI)	*P* value	Multivariate OR (95% CI)	*P* value
Age (years)*				
≤30 ($n = 82$)	1.0			
31–40 ($n = 145$)	0.997 (0.455–2.204)	0.997		
≥41 ($n = 95$)	0.892 (0.343–2.321)	0.892		
Sex				
Female ($n = 80$)	1.0		1.0	0.111
Male ($n = 55$)	2.097 (1.012–4.349)	0.047	1.934 (0.860–4.349)	
Marital status				
Single/widowed/divorced ($n = 32$)	1.0	0.003		
Married/cohabiting ($n = 103$)	3.535 (1.547–8.081)		3.067 (1.251–7.519)	0.014
Education (years)*				
≤7 ($n = 68$)	1.0	0.915		
>7 ($n = 67$)	1.038 (0.520–2.072)			
Number of sexual partners*				
One ($n = 127$)	1.0	0.404		
≥2 ($n = 8$)	2.009 (0.390–10.337)			
Partner's HIV-status*				
HIV-positive ($n = 55$)				
HIV-negative ($n = 24$)	1.111 (0.414–2.981)	0.834		
Unknown ($n = 56$)	1.030 (0.482–2.205)	0.939		
Disclosure of own HIV-status*				
Yes ($n = 105$)	1.0	0.348		
No ($n = 30$)	0.675 (0.298–1.532)			
STI*				
No ($n = 101$)	1.0	0.585		
Yes ($n = 34$)	1.253 (0.559–2.810)			
HIV treatment				
HAART ($n = 76$)	1.0	0.000	1.0	0.005
PT ($n = 59$)	3.932 (1.834–8.430)		4.269 (1.902–9.581)	

*Variables not included in multivariate model
HAART = highly active antiretroviral therapy; PT = preventive therapy; STI = sexually transmitted infection

had HIV-negative regular partners did not use condoms consistently. Although disclosure rates to regular partners were slightly higher in patients receiving HAART, almost a fifth of the sexually active respondents did not disclose their HIV-status to regular partners, and more than two-thirds to casual and sex-worker partners. Lack of knowledge of partner's sero-status and low levels of disclosure of HIV-status, coupled with inconsistent condom use sets the stage for HIV-transmission to sero-discordant partners, especially in regular partner relationships. Bunnell (2006) reports from Uganda that 85% of risky sexual acts occurred within married couples.[10] In such a setting the risk of HIV-transmission of resistant viral strains and re-infection with new strains poses a serious public health risk.[6–7] UPS can also carry the risk of unwanted pregnancy and subsequent HIV-transmission to the child.

STIs are often used as epidemiological markers of UPS. In our study, patients receiving PT were more likely to report STI symptoms in the last six months than patients on HAART. We also found that women were more likely to report STI symptoms than men. In the absence of confirmatory laboratory results, it is difficult to assess how many of the reported GD/GU were actual STIs.

Although prevention is stressed during counselling around HIV-testing and at the time of initiating ART, most counselling in HIV-care services is directed toward treatment adherence. Patients on HAART in this study received at least three preparatory counselling sessions on adherence followed by ongoing support. This emphasis on adherence may have contributed to the differences between groups. In addition, patients receiving HAART may perceive the seriousness of their illness differently, which could modify sexual behaviour.

Traditionally, the focus of HIV prevention programmes has been on high-risk groups. For HIV-positive persons' counselling on prevention occurs mostly around HIV-testing, at the time of initiating ART and prevention of mother-to-child transmission (PMTCT) services for women. Prevention messages emphasizing sero-status disclosure, partner testing and consistent condom use with all partners are needed on an ongoing basis in HIV-care services.

This study has limitations. A cross-sectional study does not address the change in sexual behaviour over time. Although well-trained research staff, unlinked to the health facility, interviewed patients, recall and social desirability biases may have occurred. Our study used self-reports to elicit information on sexual behaviours; however, we feel that this does not unduly influence our results as almost 60% of sexually active respondents reported UPS in the last six months. Reviews of validity and reliability of HIV research have found that sexual behaviour data are fairly consistent and self-reported data on sexual acts and condom use are reasonably congruent especially for infrequent acts and relatively short recall periods.[12] We did not distinguish between types of sexual intercourse (vaginal or anal), but limited the enquiry to penetrative sexual intercourse.

The study design is strengthened by the fact that we had a comparison group and that the patients in that group (receiving PT) were exposed to health workers, received prevention messages and some form of treatment making them comparable with the HAART group and thereby minimizing biases.

In conclusion, we found that sexual risk behaviour is a concern among HIV-positive persons accessing HIV-care services although treatment with HAART is not associated with

higher sexual risk behaviour. Prevention interventions targeting HIV-positive persons are needed on an ongoing basis in HIV-care services.

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Article 2

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Safer Sexual Behaviors after 12 Months of Antiretroviral Treatment in Mombasa, Kenya: A Prospective Cohort

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Abstract

Roll-out of antiretroviral treatment (ART) raises concerns about the potential for unprotected sex if sexual activity increases with well-being, resulting in continued HIV spread. Beliefs about reduced risk for HIV transmission with ART may also influence behavior. From September 2003 to November 2004, 234 adults enrolled in a trial assessing the efficacy of modified directly observed therapy in improving adherence to ART. Unsafe sexual behavior (unprotected sex with an HIV-negative or unknown status partner) before starting ART and 12 months thereafter was compared. Participants were a mean 37.2 years (standard deviation [SD} = 7.9 years) and 64% (149/234) were female. Nearly half (107/225) were sexually active in the 12 months prior to ART, the majority (96/107) reporting one sexual partner. Unsafe sex was reported by half of those sexually active in the 12 months before ART (54/107), while after 12 months ART, this reduced to 28% (30/107). Unsafe sex was associated with nondisclosure of HIV status to partner; recent HIV diagnosis; not being married or cohabiting; stigma; depression and body mass index $<18.5 kg/m^2$. ART beliefs, adherence, and viral suppression were not associated with unsafe sex. After adjusting for gender and stigma, unsafe sex was 0.59 times less likely after 12 months ART than before initiation (95% confidence interval [CI] = 0.37–0.94; $p = 0.026$). In conclusion, although risky sexual behaviors had decreased, a considerable portion do not practice safe sex. Beliefs about ART's effect on transmission, viral load, and adherence appear not to influence sexual behavior but require long-term surveillance. Positive prevention interventions for those receiving ART must reinforce safer sex practices and partner disclosure.

Introduction

Access to antiretroviral therapy (ART) in Africa is expanding rapidly, providing life-sustaining treatment and demonstrating that high-quality services can be provided in low- and middle-income countries. It is estimated that 1.3 million people have initiated ART in sub-Saharan Africa.[1] Although this number is still less than a third of those who require ART, it is a marked improvement from a coverage of 2% in the region in 2004. The growing number of people living longer with HIV could form a potential source of transmission, and of the spread of drug-resistant virus.[2,3] It is thought that improvements in physical health and well-being with ART could be accompanied by an increase in sexual desire and activity, including unsafe sex. There are concerns that increases in unsafe sexual practices occur as communities become aware that HIV is a manageable chronic illness.[4] This phenomenon has been referred to as treatment optimism or behavioral disinhibition. Also, changes in sexual practices may result from the perception among those receiving ART (or their partners) that they are no longer infectious, especially when the viral load is undetectable.[4–8]

Concerns about the potential impact of ART on sexual behavior are supported by findings of several studies in high-income countries showing increases in risky behaviors.[9,10] However, a meta-analysis of 25 studies among HIV-infected people showed that receiving ART (with or without viral

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suppression) was not associated with higher prevalence of unprotected sex.[4] The analysis, however, did demonstrate higher levels of unprotected sex among those who believed that receiving ART or having an undetectable viral load protects against HIV transmission. Similarly, unsafe sex was higher among those who believed HIV is a less severe or threatening disease due to the availability of ART. These studies were predominately among men who have sex with men and may not reflect changes in other settings and population groups.

Thus far, four studies in Africa provide information on changes in sexual behaviour with ART. Three of these studies were cross-sectional[11–13] and the longitudinal study included data only up to 6 months after ART initiation.[14] A systematic review including three of these studies, showed that access to ART was not associated with an increase in risky sexual behaviors.[15] The review also concluded that more studies were needed, especially to build an evidence base necessary to inform development of safer sex messaging and related interventions for people receiving ART in Africa.[16] In this study we evaluated factors associated with unsafe sexual behavior as well as changes in sexual behavior 12 months after initiating ART in Mombasa, Kenya.

Methods

This study of sexual behaviors among patients receiving ART was part of a trial assessing the efficacy of modified directly observed therapy (m-DOT) to improve adherence to ART. The study was conducted at two public sector hospitals and one private, not-for-profit clinic. Adults living in Mombasa who were 18 years and older, ART-naïve, and with indications for ART as per the Kenyan national treatment guidelines were invited to participate.

Study participants (149 women and 85 men) were randomly assigned to m-DOT and standard-of-care groups. Treatment and care were provided within routine services at HIV clinics within respective facilities. Prior to initiating ART, all participants attended three one-on-one counseling sessions with trained nurse counselors. These counseling sessions included information on: the importance of adherence; the treatment regimen and dosing instructions; routes of HIV transmission; condom use; and the importance of disclosure and partner testing. Participants also received messages on positive prevention when starting ART and during routine follow–up visits.

Following initiation of ART, patients visited treatment centres every four weeks for clinical follow-up. In addition to receiving standard of care, those in the intervention arm had an m-DOT intervention for the first 6 months of treatment. This entailed twice-weekly visits to the health center, where participants met with m-DOT observers (nurses) who observed the ingestion of one ART dose, performed pill counts, collected used medication bottles, enquired about difficulties encountered and provided individualized adherence support. At m-DOT visits, medication was dispensed for the subsequent 3 or 4 days. Participants who missed visits or were unable to visit the health center were traced by community workers. Adherence measures consisted of monthly clinic-based pill counts. A summary measure of adherence over 12 months was calculated from the number of pills taken in this period divided by the number of pills expected to be taken. The result was dichotomized to 95% or more and less than 95% adherence. Additional details and trial results will be presented elsewhere.

Ethical approval for the study was obtained from the national Kenyan ethical committee (KNH-ERC) as well as the Institutional Review Board of the Population Council.

Data collection and outcome measures

Data on sexual behavior were collected using structured questionnaires administered in Swahili by trained research assistants. Information was obtained at the start of treatment and after 6 and 12 months. The questionnaire captured information on: heterosexual and homosexual contacts with regular, nonregular, and commercial partners; condom use; disclosure of HIV status to partners and knowledge of their partner's HIV status; knowledge and attitudes toward ART and its effects on risk for HIV transmission; and history of sexually transmitted infection (STI). The recall reference period for most outcome measures was 12 months. Depression was assessed using Beck's Depression Inventory I®; the tool was culturally adapted and translated into Swahili. Perceived stigma was assessed using an adapted Berger scale with 16 items and categorized as minimal or low, moderate, or high stigma levels.

For study purposes, unsafe sex was defined as any unprotected sex act in the last 12 months with a partner of HIV negative or unknown status (primary outcome). A regular partner was defined as a spouse or sexual partner with whom the respondent lived or had a stable relationship. A nonregular partner referred to a partner with whom the respondent was not living or married to and only had sex with once or very rarely. Commercial partners were those who were given money or gifts in exchange for sex. Participants were asked two questions to assess their concern about HIV transmission while on ART at the 12 month visit: "Treatment with ARV medications can reduce the risk of transmission" and "HIV/AIDS has become less serious because of ARV medications." Agreeing with either one or both of these questions categorized them as having lower levels of concern about transmission. STI events were self-reported episodes in the past 12 months; laboratory confirmation of infection was not available.

Laboratory investigations

CD4 cell counts were determined at baseline, and months 6 and 12. PARTEC (Partec-GmBH, Münster, Germany) and FACS counters (Becton & Dickinson Immunocytometry Systems, San Jose, CA) were used for enumerating CD4 cell counts. Plasma viral load (Roche Amplicor HIV-1 Monitor test version 1.5, Roche Molecular Systems, Branchburg, NJ) was measured at 12 months.

Data management and statistical analysis

Data were double-entered in a Microsoft Access 2003 database and analysed using Intercooled Stata, version 8.0 (Stata Corporation, College Station, TX). The χ^2 test and Mann-Whitney *U* test were used for univariate comparisons of baseline characteristics for each gender. To assess factors associated with unsafe sex, a bivariate analysis was done, restricted to participants who had been sexually active in the

past 12 months at baseline and/or at 12 months follow-up. Associations were assessed between unsafe sex and sociodemographic, HIV knowledge and beliefs, disclosure, health status and ART characteristics. Bivariate cross-sectional logistic regression models were constructed using generalized estimating equations (GEE), taking into account that observations were repeated on the same participant.

Participant's sexual behavior before starting ART and after 12 months of treatment was compared using GEE. Multivariate models are presented for the primary outcome and for any sexual activity, unprotected sex at last sex act with any partner and self-reported STI. Variables associated with the primary outcome in the bivariate analysis described above or in similar studies were included in the model and retained if removal from the model markedly altered the model fit. Similar methods were used for constructing the other three multivariate models.

Results

Between September 2003 and November 2004, 234 participants were enrolled and randomized to the m-DOT intervention or control group. The majority of those who met study eligibility criteria agreed to participate (234/249). At study entry, participants had a mean age of 37.2 years (SD = 7.9 years; Table 1). ART was not initiated in 7 participants who: withdrew from the study (2), died (3), were lost to follow-up (1), or could not participate due to severe illness (1). In the year following ART initiation, 19 people died, 9 were lost to follow-up, and 8 discontinued study participation (4 transferred to other hospitals and 4 discontinued ART).

While socioeconomic characteristics were similar between women and men, women were more likely to be a widow (30%; 43/145 versus 12%; 10/84) or unemployed (85%, 123/145 versus 74%, 62/84; $P = 0.041$). Median CD4 cell count was 99 (interquartile range [IQR] = 49–]147), similar for both genders.

Women perceived higher levels of stigma than men, and were less likely to have disclosed their HIV status to a regular partner or spouse. A substantial proportion of both women and men were mildly depressed (35%; 75/224), or had moderate to severe depression (32%; 71/224) at baseline.

Sexual behavior

In the year preceding the initiation of ART, nearly half the participants (48%; 107/225) were sexually active, mainly with their regular partner or spouse (93%; 99/107). Sex with nonregular partners and commercial partners was reported by 12% (13/107) and 2% (2/107) of sexually active participants, respectively. Men reported having sex with multiple partners more frequently than women (7/41, 17% versus 4/66, 6%; $p = 0.068$). Only one man reported having had sex with another man. Over three quarters (77%; 82/107) of sexually active participants reported having had unprotected sex with any partner in the 12 months preceding ART. The majority (54) of those had unprotected sex with people who were HIV negative or of unknown status and included regular, nonregular, and commercial partners. Six sexually active participants did not provide information on condom use in the past 12 months and were not included in the analysis of the primary outcome.

At the 12-month follow-up visit, 107 of 185 participants (58%) said they had been sexually active since initiating ART. They reported sex with regular (97 participants), nonregular (8 participants), and commercial partners (2 participants). Few reported more than one partner in the last 12 months (6%; 6/107). Unprotected sex was mentioned by 63% (67/107) of sexually active participants, 30 of whom said this partner was HIV negative or of unknown status. Ten sexually active participants, reporting sex with 2 positive and 6 negative partners or of unknown HIV status (2 missing), did not provide complete information on condom use at this visit.

Association of other factors with unsafe sex

To measure the effects of factors other than ART, GEE models assessed associations between potential risk factors and unsafe sex in the past year with a partner who was HIV negative or of unknown status (Table 2). After adjusting for intraclient clustering, unsafe sex was more likely among participants who had not disclosed their HIV status to their partner; were aware of their HIV status within the last year; were not married or cohabiting; had experienced moderate or high stigma; with moderate or severe depression, or with a body mass index below 18.5 kg/m^2. In particular, nondisclosure of HIV status to a regular partner/spouse and high levels of perceived stigma were strongly associated with unsafe sex. No association was detected between gender and unsafe sexual behavior. Study group was not associated with unsafe sex, even at the 6-month visit. Using pill count measures of adherence in the first 12 months of ART, 83.5% (182/218) of participants had taken 95% or more of their pills in this period. Levels of adherence were not associated with unsafe sex. Also, no association was observed between unsafe sex and decreased concern about HIV transmission with ART or plasma viral suppression.

Effect of antiretroviral treatment on sexual behavior

The effect of ART on sexual behavior was assessed comparing data collected at baseline and after 12 months of treatment (Table 3). With adjustment for intraclient clustering, sexual activity increased in the 12 months after ART initiation (OR = 1.44, 95% CI = 1.07–1.94; $p = 0.017$). However, in a multivariate model, no difference was detected in levels of sexual activity after 12 months of ART, adjusting for intraclient clustering, gender, marital status, and stigma (AOR = 1.30; 95% CI = 0.86–1.96; $p = 0.21$).

For the primary outcome (unprotected sex with a person with HIV-negative or unknown status in the past 12 months), adjusted odds ratios were calculated, including gender, disclosure of status to regular partner/spouse as well as intraclient clustering. In this multivariate model, after 12 months of ART as compared to before starting ART, unsafe sex was 0.59 less likely (95% CI = 0.37–0.94; $p = 0.026$) among the whole study population (including sexually-active and non-active participants). No adjustments were done for body mass index and depression as these were highly correlated with ART exposure (colinear). Also, after 12 months follow-up, the duration of which participants were aware of their HIV status had surpassed the 1-year period and this variable was not included in the final model.

TABLE 1. BASELINE CHARACTERISTICS OF WOMEN AND MEN AT INITIATION OF ANTIRETROVIRAL TREATMENT

Variable grouping	*Variable*	*Total* (n = *234*)	*Women* (n = *149*)	*Men* (n = *85*)	p *value*[a]
Socio-demographic	Age: mean years (SD)	37.2 (7.9)	35.3 (7.5)	40.4 (7.4)	<0.001[b]
	Highest education level: % (*n/N*)				
	Never attended school	6% (13/228)	7% (10/145)	4% (3/83)	
	Primary education	50% (113/228)	50% (73/145)	48% (40/83)	
	Secondary or higher education	45% (102/228)	43% (62/145)	48% (40/83)	0.50
	Marital status: % (*n/N*)				
	Never married	14% (32/229)	15% (22/145)	12% (10/84)	
	Married or cohabiting	48% (111/229)	39% (57/145)	64% (54/84)	
	Divorced or separated	14% (33/229)	16% (23/145)	12% (10/8)	
	Widowed	23% (53/229)	30% (43/145)	12% (10/84)	0.002
	Employment status: % (*n/N*)				
	Employed	19% (44/229)	15% (22/145)	26% (22/84)	
	Unemployed	81% (185/229)	85% (123/145)	74% (62/84)	0.041
Sexual behavior	Sexual partner(s) in past 12 months[c]: % (*n/N*)				
	Regular partner(s)/spouse	93% (99/107)	94% (62/66)	90% (37/41)	
	Nonregular partner(s)	12% (13/107)	11% (7/66)	15% (6/41)	
	Commercial partner(s)	2% (2/107)	0% (0/66)	5% (2/41)	0.58
	Number of sex partners in past 12 months (among sexually active: % (*n/N*)				
	1 partner	90% (96/107)	94% (62/66)	83% (34/41)	
	≥2 partners	10% (11/107)	6% (4/66)	17% (7/41)	0.068
HIV knowledge and beliefs	Duration since known HIV positive: % (*n/N*)				
	<1 year	52% (118/226)	52% (74/143)	53% (44/83)	
	1–5 years	38% (86/226)	38% (55/143)	37% (31/83)	
	≥5 years	10% (22/226)	10% (14/143)	10% (8/83)	0.98
	Perceived stigma: % (*n/N*)				
	Minimal or low	31% (69/225)	27% (38/143)	38% (31/82)	
	Moderate	57% (129/225)	57% (81/143)	59% (48/82)	
	High	12% (27/225)	17% (24/143)	4% (3/82)	0.008
HIV status disclosure	Disclosed status to regular partner/spouse: % (*n/N*)				
	Yes	42% (96/229)	37% (54/145)	50% (42/84)	
	No	58% (133/229)	63% (91/145)	50% (42/84)	0.059
	HIV status of regular partner/spouse: % (*n/N*)				
	HIV positive	34% (55/161)	38% (34/90)	30% (21/71)	
	HIV negative	11% (18/161)	10% (9/90)	13% (9/71)	
	Do not know	55% (88/161)	52% (47/90)	58% (41/71)	0.53
Health status	Depression: % (*n/N*)				
	No depression	33% (75/224)	30% (43/142)	39% (32/82)	
	Mild depression	35% (78/224)	35% (50/142)	34% (28/82)	
	Moderate or severe depression	32% (71/224)	35% (49/142)	27% (22/82)	0.34
	WHO clinical HIV stage: % (*n/N*)				
	Stage 1	9% (20/228)	10% (15/144)	6% (5/84)	
	Stage 2	21% (47/228)	19% (27/144)	24% (20/84)	
	Stage 3	64% (145/228)	64% (92/144)	63% (53/84)	
	Stage 4	7% (16/228)	7% (10/144)	7% (6/84)	0.60
	Body mass index: % (*n/N*)				
	<18.5 kg/m^2	27% (59/215)	30% (40/134)	23% (19/81)	
	≥18.5 kg/m^2	73% (156/215)	70% (94/134)	77% (62/81)	0.31
ART	CD4 cell count: median cells/mm^3 (IQR)	99 (49–147)	100 (50–152)	93 (47–134)	0.27
	Randomized intervention: % (*n/N*)				
	DOT	50% (116/234)	50% (74/149)	49% (42/85)	
	Standard care	50% (118/234)	50% (75/149)	51% (43/85)	0.97

[a]χ^2 test unless indicated.
[b]Student's *t* test.
[c]Multiple responses possible.
SD, standard deviation; WHO, World Health Organization; IQR, interquartile range; M-DOT, modified directly observed therapy; ART, antiretroviral therapy.

Table 2. Correlates of Unsafe Sex in the Last Twelve Months with HIV Negative or Unknown Status Partners among Sexually Active Participants, Adjusted for Intraclient Clustering

Variable grouping	*Variable*	*All measures*	
		Adjusted odds ratio (95% CI)	p *value*
Sociodemographic characteristics	Gender		
	Female	1.0	
	Male	0.79 (0.44–1.43)	0.43
	Age:		
	<36 years	1.0	
	≥36 years	1.12 (0.62–2.04)	0.71
	Baseline marital status:		
	Never married	3.06 (1.07–8.76)	0.038
	Married or cohabiting	1.0	
	Divorced, or separated	2.59 (1.07–6.25)	0.034
	Widowed	2.35 (0.92–6.01)	0.074
	Baseline education level:		
	Never attended school	1.0	
	Primary education	0.46 (0.12–1.74)	0.25
	Secondary or tertiary education	0.34 (0.09–1.29)	0.11
	Baseline employment status:		
	Employed	1.0	
	Unemployed	0.67 (0.33–1.36)	0.27
HIV knowledge and beliefs	Duration since known positive:		
	<1 year	1.0	
	1–5 years	0.26 (0.15–0.46)	<0.001
	5 or more years	0.30 (0.11–0.80)	0.016
	Concern of transmission risk:		
	Concern	1.0	
	Lessoned concern	1.66 (0.43–6.42)	0.46
	Perceived stigma:		
	Minimal or low	1.0	
	Moderate	3.11 (1.57–6.15)	0.001
	High	5.20 (1.94–13.93)	0.001
Disclosure	Disclosed HIV status to regular partner/spouse:		
	Yes	1.0	
	No	4.93 (2.51–9.69)	<0.001
Health status	Depression:		
	No depression	1.0	
	Mild depression	1.65 (0.86–3.18)	0.13
	Moderate or severe depression	2.62 (1.26–5.45)	0.01
	Body mass index:		
	<18.5 kg/m^2	1.0	
	≥18.5 kg/m^2	0.26 (0.10–0.66)	0.005
	Pre-ART WHO clinical HIV stage:		
	Stage 1 or stage 2	1.0	
	Stage 3 or stage 4	1.06 (0.57–1.96)	0.86
	CD4 cell count:		
	<100 cells/μL	1.0	
	100–350 cells/μL	0.88 (0.45–1.71)	0.71
	≥350 cells/μL	0.47 (0.18–1.24)	0.13
	Plasma viral load at 12 months:		
	Undetectable (<400 cps/mL)	1.0	
	Detectable (≥400 cps/mL)	0.64 (0.16–2.58)	0.53
ART	Adherence to ART:		
	<95% adherence	1.0	
	≥95% adherence	1.21 (0.30–4.84)	0.79

CI, confidence interval; ART, antiretroviral therapy; WHO, World Health Organization.

Table 3. Effect of Twelve Months of Antiretroviral Treatment on the Sexual Behavior in Mombasa, Kenya: Multivariate Generalized Estimating Equations

Variable	*Baseline, % (n/N)*	*12-months FU % (n/N)*	*Crude odds ratio (95% CI)*	*Adjusted odds ratio (95% CI)*[a]	p *value*
All participants					
Sex in last 12 months	48% (107/225)	58% (107/185)	1.44 (1.07–1.94)	1.30 (0.86–1.96)	0.21
Unprotected sex with negative/ unknown partner in past year	24% (54/225)	16% (30/185)	0.61 (0.38–0.96)	0.59 (0.37–0.94)	0.026
Unprotected sex at last sex act	22% (49/225)	6% (11/185)	0.22 (0.12–0.43)	0.23 (0.12–0.44)	< 0.001
Self-reported STI	20% (44/220)	8% (15/184)	0.34 (0.19–0.62)	0.37 (0.20–0.67)	0.001
Sexually active participants					
Unprotected sex with negative/ unknown partner in past year	50% (54/107)	28% (30/107)	0.37 (0.23–0.60)	0.52 (0.32–0.87)	0.012
Unprotected sex at last sex act	46% (49/107)	10% (11/107)	0.14 (0.08–0.27)	0.16 (0.08–0.32)	< 0.001
Self-reported STI	31% (32/104)	8% (9/106)	0.19 (0.09–0.41)	0.20 (0.09–0.43)	< 0.001

[a]Models included the following variables: All participants: sex in last 12 months: gender, marital status and disclosure to regular partner/spouse; Unprotected sex with negative/unknown partner: gender and stigma; Unprotected sex at last sex: gender; Self-reported STI: gender, disclosure to regular partner/spouse and stigma.

Among sexually active participants: Unsafe sex with negative/unknown partner: gender, disclosure to regular partner/spouse and stigma; Unprotected sex at last sex: gender and disclosure to regular partner/spouse; Self-reported STI: gender and disclosure to regular partner/spouse.

FU, follow-up; STI, sexually transmitted infection.

Among sexually active participants, a decrease was noted in unsafe sex from 50% (54/107) in the 12 months preceding ART to 28% (30/107) in the subsequent 12 months. The odds ratio adjusted for intraclient clustering, gender disclosure to regular partner/spouse and stigma was 0.52 (95% CI = 0.32–0.87; $p = 0.012$). These findings were consistent with changes in reported condom use at last sex act. Using self-reported sexually transmitted infections as a proxy for unprotected sex, a decrease was noted over the course of the study in the total population (AOR = 0.37; 95% CI = 0.20-0.67; $p = 0.001$), as well as among sexually active participants (AOR = 0.20; 95% CI = 0.09–0.43; $p < 0.001$).

Discussion

This study showed no evidence of increased risky sexual behaviors among those receiving ART for 12 months. Specifically, a substantial reduction in risk taking were seen when examining unprotected sex with HIV-negative or unknown HIV status persons, condom use at last sex act, number of sexual partners or reported STI. Similar findings were reported in previous studies in sub-Saharan Africa.[11,12,14]

Risk factors for unsafe sex among people receiving ART were similar to those found in previous studies.[12] A few studies have examined ways of increasing disclosure rates and assessed negative and positive outcomes of disclosure.[17–21] However, additional efforts are needed to increase disclosure rates to sexual partners in Africa,[20] making this a more routine practice, while protecting the rights of persons with HIV.[16]

No association was detected between plasma viral suppression or adherence and risky behaviors. While having an undetectable plasma viral load does not eliminate the possibility of transmitting HIV, those with detectable viral levels are at substantially higher risk for transmitting HIV.[22–24] Similarly, those with poor adherence may have a greater likelihood of transmitting HIV, especially drug resistant strains. High levels of adherence were noted in this study, as in previous reports from resource-constrained settings.[25–27] Several other studies of m-DOT among diverse population groups have also reported high adherence levels,[28–30] although not all.[31] In this study, the lack of an association between viral suppression or adherence and sexual behavior may be important from a public health perspective. However, the study has limited power to detect these effects. Caution is therefore required in the interpretation of these findings.

This study could assist in guiding development of prevention messages for this population. These messages need to reinforce their safer-sex practices, assisting to prevent potential long-term "safer sex fatigue." In addition, contextual and sociocultural factors (such as gender roles, stigma, social norms and economic status) need to be considered as individual behavioral changes do not occur in isolation.[32,33] While evidence is accruing that prevention interventions can reduce HIV risk behavior among people living with HIV in high-income countries,[34] little is known about these interventions in resource-constrained settings, or whether these interventions are efficacious among people receiving ART. Encouragingly, a cohort study in rural Uganda found that partner VCT, prevention counseling, and condom provision together with home-based ART reduced risky sexual behavior by 70%.[14] The reduction in risk observed among ART patients may not be solely attributable to ART *per se*, but rather to more frequent encounters with health workers and improvements in counseling, condom provision, and other services associated with ART introduction. With our study design, it is not possible to disaggregate the relative effects of these interventions and of ART on changes in risk behavior over time. Interestingly, those in the m-DOT study arm who had more contact with health services for the first 6 months of ART, had similar changes in sexual behavior to the control group.

It may also be necessary to establish mechanisms for tracking changes in community-level beliefs about the effects of ART on risk for HIV transmission, which may occur as public awareness increases that HIV is a manageable disease and that risk of transmission is reduced with an undetectable viral load. In high-income countries, several studies among men who have sex with men have suggested that since ART became available, the prevalence of unprotected sex and incidence of STIs, including HIV, have increased.[10,35,36] This increase in unprotected sex—regardless of HIV status—has been causally linked with the belief that HIV is a less severe or threatening disease since ART became available.[7] Potentially, treatment optimism at a population level may be more important than treatment optimism among HIV-positive individuals.

This study reports changes in sexual behavior up to 1 year after initiating ART, in a population with relatively advanced immune suppression at initiation of ART. It is possible that there is a critical threshold of time after starting ART at which increases in unprotected sex will occur. Persons with symptomatic disease may have less interest in sex or adverse effects of ART could diminish sexual desire. While it is not possible to predict changes in sexual behavior in the longer term from this study, it is encouraging to note that those with higher CD4 cell counts or less advanced clinical disease were not more likely to have unsafe sex. Moreover, the finding that people who were aware they were HIV infected for more than 1 year had safer practices may indicate that changes in behaviour with knowledge of HIV status are sustained or improved over time.[12]

Study outcomes are self-reported, mostly sexual behaviors, which are subject to both recall and social-desirability bias. Ensuring that the interviewers were not the same people as those who provided positive prevention counseling aimed to reduce this bias. The study also lacks a control group, limiting its rigor.

In conclusion, using several outcomes measures, ART was associated with reduced sexual risk behavior. Other studies have shown that once people become aware they have HIV infection they reduce behaviors that place others at risk for HIV acquisition.[37,38] This phenomenon, together with regular contacts with the health system for ART follow-up may facilitate safer sexual behavior among those receiving ART. Nevertheless, a considerable proportion still do not consistently practice safer behaviors and remain a cause for concern. Moreover, it may be difficult to sustain safer behaviors over a lifetime, making longer term studies essential to examine changes in social and behavioral outcomes in the long run. Overall, evidence of the influence of ART on behaviors in resource-constrained settings is limited, nevertheless, the evidence from this study and information from other settings can be used to design interventions to promote and sustain safer behaviours for those receiving ART.

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Article 3

Changes in sexual risk taking with antiretroviral treatment: influence of context and gender norms in Mombasa, Kenya

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Changes in sexual risk taking with antiretroviral treatment: influence of context and gender norms in Mombasa, Kenya

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In-depth interviews were conducted with 23 sexually-active adults receiving antiretroviral treatment (ART) in Mombasa Kenya to understand changes in sexual behaviour after treatment initiation and factors influencing condom use. Advanced HIV disease had previously led to marked decreases in sexual desire and function. After HIV testing, numbers of partners reduced and monogamous relationships began to predominate. Receipt of ART strengthened these changes, while improving sexual health. However, concurrent sexual partnerships continue within polygamous marriage and unprotected sex occurs with regular partners, even those who are HIV-negative. Those who used condoms inconsistently prior to ART often remained inconsistent users thereafter. While disclosure of HIV status appeared to support condom use, this does not always predict protected sex. In addition to classic perceptions about condom's effect on intimacy and trust, traditional gender roles, misconceptions about potential harm from condoms and fertility desires hinder condom use.

Keywords: HIV/AIDS; HIV prevention; Kenya; sexual behaviour; sexuality

Introduction

Access to antiretroviral treatment (ART) has expanded rapidly in low- and middle-income countries (WHO 2007). Antiretroviral treatment leads to dramatic declines in morbidity and mortality from HIV disease and to improved wellbeing, including in sexual health and function (Crum et al. 2006). There is, however, concern that sexual risk taking may increase with ART, especially in the long run once health improves and people resume or increase sexual activity. In recent years, studies in high-income countries with men who have sex with men have documented a rise in unprotected sex and incidence of sexually transmitted infections (STIs) including HIV (Stolte et al. 2001; Chen et al. 2002). Among heterosexual people receiving ART in those settings, an increased risk of acquiring STIs has also been documented (Scheer et al. 2001). Research in some African settings suggests that although some risk behaviours actually decrease with ART, a substantial proportion continue to have unsafe sex, even with partners known to be HIV-negative (Moatti et al. 2003; Bunnell et al. 2006; Luchters et al. 2008; Sarna et al. 2008a). A Côte d'Ivoire study reported a short-term increase in unsafe behaviours commencing after ART initiation (Diabate, Alary, and Koffi 2008).

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Several frameworks can be used to analyse sexual behaviour in those receiving ART. Based on the theory of reasoned action, for example, one might assume that individuals consider the consequences of sexual behaviours before performing them (Fishbein and Ajzen 1975). According to this theory, intention determines behaviour and people make systematic use of the information provided to them. Enquiry about attitudes to condoms and how a person intends to behave, all provide useful insights consistent with this theory. However, human sexual behaviours – already intrinsically complex – are situated within multidimensional contexts and people's intentions may be thwarted by lack of behavioural control (Miller 2005). Socio-cultural and structural factors also shape the world in which we live.

The theory of planned behaviour is more cognisant that circumstances may limit an individual's perceived ability to execute a particular behaviour (Ajzen 1985). This can usefully explore factors that account for differences between a person's intended and actual sexual behaviour. For example, in sub-Saharan Africa some attempts have been made to create a legislative and structural environment that is more conducive to making rational choices, which are, in turn, health promoting. This includes national policies on wider access to HIV testing and free-at-point-of-care ART services; prohibition of discrimination on the basis of HIV status; and social support from non-governmental or community-based organizations.

Yet these changes may be insufficient in and of themselves. Importantly, culturally-sanctioned gender roles influence sexual relationships (O'Sullivan et al. 2006). Safer sex practices may be difficult for women to enact because self-protection is compromised by fears of reduced intimacy, by experience of abusive partners, economic constraints or by prevailing social norms about women's passivity within sexual relationships (Kaufman et al. 2005; Strebel et al. 2006). Gender attitudes and sexual power differentials also manifest as gender-based violence, which in turn may be fuelled by unemployment, poverty and alcohol use (Kaufman et al. 2005). Further, disclosure of HIV status is often associated with a marked anxiety and fears of rejection, which hinders safe sex (Olley, Seedat, and Stein 2004; Kaplan, Scheyett, and Golin 2005; Kerrigan et al. 2006; Kiene et al. 2006).

Overall, however, there is little information on how the above considerations impact on people receiving ART in sub-Saharan Africa. This qualitative study examined changes in sexual behaviour with ART and the contextual factors that affect control over these behaviours among persons receiving ART in Kenya. Participants were drawn from a longitudinal study investigating quantitative changes in sexual behaviour over 12 months. Both studies were nested within a trial evaluating effectiveness of modified directly-observed therapy to promote ART adherence (Sarna et al. 2008b). Here, we report aspects of sexual health, gender roles and relationship functioning that influence safe sex after ART initiation.

Methods

In-depth interviews were held with sexually-active adults receiving ART (11 women and 12 men). The interviews, from January to March 2005, set out to obtain a more comprehensive understanding of sexual activity, desire and risk behaviours; and included enquiry about: multiple and concurrent sex partners; condom use in different types of partnerships; gender roles and gender-based violence; vengeance and anger related to unsafe sex; and fertility intentions.

Participants were selected using stratified purposeful sampling. This selects samples within samples, by choosing cases that vary on a key dimension (cases nested within

specific stratum) (Patton 2001). In this case, a random sub-sample was selected from individuals with varying condom use and HIV status of sexual partners, based on self-reported information given at the time of ART initiation. Efforts were also made to include those participants considered most likely to share their experiences openly. Three people were chosen from those reporting inconsistent condom use with HIV-negative partners and four from each of the following groups: consistent condom use with HIV-negative partners; consistent condom use with partners of unknown HIV status; inconsistent condom use with partners of unknown HIV status; consistent condom use with HIV-positive partners; and inconsistent condom use with HIV-positive partners.

Participants' age ranged from 25 to 54 years, with a median age of 36 years (IQR: 33–40). Median duration between HIV diagnosis and initiating ART was 6 months (range: 1–60; IQR: 1–18). Thirteen of the 23 participants had been tested less than 6 months before initiating ART, while 7 had been tested more than 18 months prior to initiation. At the time of interview, participants had been receiving ART for between 9–12 months. All were taking first-line regimens containing zidovudine or stavudine; lamivudine and either efavirenz or nevirapine. At ART initiation, the CD4 cell count was a median 91cells/mm^3 (IQR: 45–153), but had increased by a median 199cells/mm^3 (IQR: 126–270) after 6 months ART.

Interviews and data analysis

Participants gave written informed consent. Ethical approval for the study was obtained from the Kenyatta National Hospital Ethical Research Committee and Institutional Review Board of the Population Council. Prior to initiating ART, all participants attended three one-on-one counselling sessions with trained nurse counsellors that included counselling on routes of HIV transmission; the benefits of condom use; and the importance of disclosure and partner testing. During routine follow–up visits, participants also received positive prevention messages.

The interview guide was developed in consultation with the field team and HIV-positive peers. The guide was translated into Swahili, and field tested for clarity of language, comprehension and content. Interviews were held in English or Swahili in line with interviewee preference. In an attempt to reduce social-desirability bias, same-sex interviewers were used who had not been involved in providing care or patient counselling. The interviewers, all with some prior tertiary-level education and experience in HIV research, had received specific training in qualitative data collection techniques and in gathering information in a non-judgmental manner.

Interviews, each taking about an hour, were recorded verbatim on audio tape with accompanying interviewer notes and then translated and transcribed in English. During data analysis, two members of the research team read the interviews independently, identified broad themes and generated descriptive categories and codes. Codes were then compared, a final code list prepared by consensus and data coded as per the agreed list. Coded text was then read by the two researchers and results were discussed and interpreted jointly. Content analysis was done using Atlas ti version 5.0 (Berlin, Germany).

Results

We look first at the effects of ART on sexual activity and desire. These effects are contrasted with changes in sexual behaviour that previously occurred with progression of HIV disease and around the time of HIV diagnosis. How improvements in sexual function impact

on partner number and condom use is also explored. Subsequently, we detail the contextual factors that influence sexual behaviour in people receiving ART. In addition to social and economic issues, the pivotal influence of prevailing gender norms is focused upon.

Effects of antiretroviral treatment on sexual function, partnering and condom use

Variation in sexual activity and desire

Male respondents, almost without exception felt that sexual function had been severely affected by HIV disease, with a marked reduction in both sexual desire and activity, including prolonged periods of abstinence. These changes were, in part, reversed by ART, as explained below:

> Before I started using my drugs [ART] my health had deteriorated so much, that I could not do sex completely … since I started drugs, I have gained back my health as compared to the past when it had deteriorated. Like two years [in the past] I have lived without any sexual relationship. (Otieno, 40 years, unemployed)

Otieno's CD4 cell count increased by 380cells/mm^3 after 12 months ART from a baseline 34cells/mm^3. Although men reported a gradual return of interest in sex once ART was initiated, the physical ability to engage in, and in their words 'satisfactorily complete', sexual intercourse was, however, not completely restored.

Among female participants, some reported that sexual desire had reduced with HIV disease, while nearly half had experienced no long-term fluctuation in sexual function. Mariam, described her experiences this way:

> I don't have any urge at all … I used to be fine before … I have no worries or sadness, but I see it [sex] as if I am being troubled, I don't see the need [for sex] at all as of now, considering my status. (Mariam, 48 years, unemployed)

In contrast, a few actually stated that sexual desire had increased markedly with ART. For example, a woman with an HIV-positive regular partner, candidly declared:

> When I use these medications [ART] the sexual urge is very high … yes, higher than before; I become like a teenager … you just feel hot. If you don't know how to control yourself you can mess up [have unprotected sex and infect someone]. (Jacinta, 36 years, housewife)

Misconceptions about interactions between sexual activity and antiretroviral medication were fairly common. A widowed, sexually-active female, for example, linked sexual activity with reduced effectiveness of ART:

> You know if you do that [sex], the drugs won't work properly, the more you do sex, the medicine doesn't work. So if you want it to work you have to reduce [sex] and you know I value my body. (Njeri, 25 years, unemployed)

Apart from one woman, none reported having had anal or oral sex and they attributed such sexual practices to foreigners. The woman had not used condoms during anal sex.

Antiretroviral treatment and monogamy

It was evident that people had made concerted and conscious efforts to change sexual behaviour and reduce partner number after initiating ART. Excepting one man and one woman, all participants reported having only one sexual partner at present:

> I have changed, I am not like before, I have actually been using protection so that I do not infect my HIV-negative wife, I also avoid having extra-marital affairs. [After knowing my HIV-status] I am able to control myself, this is the initiative I have taken now to control myself and have one partner. (Mwaru, 33 years, unemployed)

All, barring one woman, reported multiple sexual partners in the past, prior to learning of their HIV-status. In describing their sexual behaviour in the period before HIV diagnosis, men indicated that paying for sex and having concurrent relationships was common. Men also associated multiple partners with being a bachelor, having uncontrollable desire and consuming alcohol – a previous high-risk lifestyle, as described by this married man:

> Truly, before I knew my status I had so many loves. On the way sometimes [when] I had desire to have sex just like that, I stopped … I could have sex with a woman who was not my friend … they were one-time lovers. (Paul, 44 years, unemployed)

Another said:

> You know I cannot even remember some of these partners; I met them while I was drunk. I did not even know their faces in most cases I had blacked out. (Mutisya, 39 years, unemployed)

Among women, even prior to an HIV diagnosis, serially monogamous relationships were generally the norm as described by a widow:

> The one before [my second partner] was my husband, he died … Actually the first boyfriend was a high school friend and he is okay [alive and well]. I was with my present husband [third partner] for one year then he died [since] then [I am with] this one [current HIV-negative partner]. (Njeri, 25 years, unemployed)

A few women did, however, mention previously having concurrent partners. For both male and female participants, then, a transition from multiple partners to a single regular partner began at the time of HIV testing and the resolve to stay monogamous was further strengthened by commencement of ART.

Disclosure effects

The only two women who were not sexually active at the time of interview had disclosed their status to their partners, but they declined to be tested. This, the women said had led them to adopt abstinence for fear of infecting their partner, with one female framing this as:

> I told him 'if you get infected with a disease you will go around telling people that I have infected you and spoil my name' … so for now I don't have any sexual relations. (Agnes, 54 years, unemployed)

For most, however, disclosure and couple counselling with enhanced mutual support played a central role in sustaining safe sex. Several men reported that while the decision to disclose was difficult to make, once this had occurred, their partners' initial and subsequent reaction had been characterized by acceptance. One man, with an HIV-negative spouse, who was tested a month before initiating ART describes his experience:

> … after around two months since I started taking this medication … a community health worker told me the best thing to do was ask her [his wife] to accompany me to the clinic … at the clinic she learnt, that I am positive and that I take ARVs … she told me she has forgiven me … she is a very generous woman. (Kariuki, 39 years, unemployed)

With the exception of one man, all respondents had disclosed their HIV status to their regular partners. Both sexes mentioned that disclosure actually strengthened the relationship between partners and they were able to 'get on with life' and increase mutual support. Disclosure was associated with a sense of relief, a lifting of the burden of guilt and an enhancing sense of 'comfort' in a relationship, as described by this man about his HIV-positive wife:

> She took it [disclosure of HIV-status] well, so I told her to go with me to be tested so that we know our status and know how we are going to live … it has helped me a lot because after she knew [her status], anytime I get problems she helps me …. (Khamis, 44 years, unemployed)

In both concordant and discordant couples, disclosure of HIV status reportedly was often a confirmation of a long-standing suspicion that the partner was infected.

Increased condom use with antiretroviral treatment

As with partner reduction, consistent condom use seems to have increased following diagnosis of HIV and then been further reinforced by the experience of receiving ART and associated services. Prior to having an HIV test, the majority of study participants (19/23) reported never using condoms, with the remainder having used them intermittently, mostly for family planning purposes. One woman even said that the first time she ever saw a condom was at the VCT centre at the time of HIV testing. Interviewees in general acknowledged having a low level of awareness about HIV infection and safe sex practices prior to HIV testing, this married man offered:

> I never used to worry at all; I never knew there was such a disease like AIDS. I used to have sex indiscriminately. (Chale, 39 years, unemployed)

Similarly a Grace, 38-year-old housewife said:

> I got to know how a condom looks like and how it is worn while already infected with HIV. I had not used one before ... when I tested positive at Port Reitz [hospital] that is when I first saw a condom because it was given to me.

Among those who used condoms consistently at the time of initiating ART, almost all (11/12) indicated they had used condoms with each sex act since then. At the same time, three of the ten who reported inconsistent condom use at the time of initiating ART had started using them consistently, while the remaining seven remained inconsistent. Participants who reported consistent condom use at present often exhibited a strong resolve to maintain such use in the long run. This was most often seen with those who had an HIV-negative or unknown-status partner. None reported difficulties with condom availability or procurement.

Knowledge about HIV disease and transmission, apparently mostly obtained from health providers at the time of HIV diagnosis and during ART counselling, appeared to make a substantial contribution to consistent condom use. A man with an HIV-negative spouse stated that:

> I have so much confidence because I have realized that using a condom can prevent infection. You see, if I had earlier used a condom I would not have been in the situation that I find myself in now. (Chale, 39 years, unemployed)

Another male respondent with a girlfriend of unknown HIV-status said:

> When you have sex without condoms, the person you are having sex with, whether she is infected or not, there are dangers on you is what I believe. (Mwaru, 40 years, unemployed)

Though increased knowledge helped, condom negotiation remained challenging. A man with a spouse of unknown HIV status commented how his quest for protected sex occasionally met with refusal:

> I explained to her we use condoms, because I have the disease, so I will keep on adding more infections to her and also she will be adding more infections to me and then she tells me, she does not believe in that, lets do away with it. (Omondi, 45 years, unemployed)

It appeared clear that respondents with partners of unknown HIV status who adamantly refused to test had experienced difficulties negotiating safe sex. A woman described this struggle with her husband of unknown HIV status as:

> He says 'when I use them [condoms] I don't feel any pleasure' ... I force him, I tell him that if he doesn't want I leave him, we stay for a long time until in the end he accepts and uses it ...

> then he complains the whole time, he quarrels. At times I try to dodge him; I dodge and dodge until I get tired … (Zainab, 36 years, housewife)

In long relationships between discordant partners, a false sense of immunity interwoven with expressions of fatalism also obstructed condom use. A male with an HIV-negative spouse related:

> She told me that we have been having sex all these years and if it is death then I am ready to die with you; but since that day I was counselled on the importance of using condoms and I told her it is important we use condoms I feel like sleeping with her but sometimes I just restrain myself [do not have sex]. (Gideon, 34 years, gardener)

On the whole, both women and men were generally able to successfully negotiate, and even to make sex contingent on, condom use, like this unmarried man:

> After knowing that I was infected, I refused completely to do sex without condoms. We negotiated, I explained to her that she should only use those other family planning methods and [that] I will use condoms; whether she uses family planning pills or injections. (Mwaru, 40 years, unemployed)

Thus, in summary, though sexual function was restored, if not completely, by ART, a concomitant reduction in concurrent partners and a general increase in condom use meant that unsafe sex appears to not increase overall. Many factors, however, influence the likelihood that safe sex will occur, including the prevailing structural environment and gender norms. These are discussed below.

Influence of contextual factors on sexual behaviour

Not surprisingly, social behaviours and the economic context remain important influences on sexual risk taking and shape the meanings of sexual relations for those receiving ART. Changes in sexual behaviour often occurred together with changes in other social behaviours, which participants linked to unsafe sex and multiple partnering, most notably use of alcohol. Additional lifestyle changes, apparently reinforced by receipt of ART and contact with related services, were smoking cessation, healthier eating habits and having a regular routine:

> I used to drink a lot, but not anymore. I even used to chew mira [khat, addictive herb], not anymore .... (Kariuki, 39 years, unemployed)

While several respondents recounted having lengthy relationships of up to 20 years with their primary partners, new relationships were common after the death of a spouse, among both males and females interviewed. A longing for companionship, desire for remarriage and a need for financial support for childcare were common reasons motivating women to seek new partners. The latter motivation was frequently cited for new relationships both before and after ART. A widow, who later re-married and divorced, now has a boyfriend of unknown HIV-status and recounted the following:

> I had 'friends' to take care of my children. My [first] husband died in 1982 … I just started 'friendship' with people just like that .... I don't know whether it was madness or something else? Because I see other women also, we had a way of doing things, we could just make 'friendship' with anyone without knowing their background as long as they helped. (Agnes, 54 years, unemployed)

New relationships presented challenges with condom negotiation, as this male reported:

> … you see when you meet a person for the first time if you start discussing such details [condom use and safe sex] she would take you for a confused person .... (Chale, 39 years, unemployed)

Sero-sorting, one strategy to overcome these difficulties, was mentioned:

> When I went for the Ambassadors of God [church group meetings], I met another friend who told me that he was positive and his wife had passed away … he wanted us to meet [start a relationship] … later I called him and told him his proposal [to start a relationship] had gone through. (Jane, 28 years, unemployed)

Role of local beliefs and attitudes

While the beliefs and attitudes of those receiving ART often appeared to be somewhat distinct from those of the general population, participants indicated that overcoming common local beliefs required a deliberate rational process. Local clashes between moral, religious and cultural beliefs about condoms, on the one hand, and scientific evidence, on the other, provides one example of this. Although respondents justified condom use in the face of religious opposition, this conflict appeared to contribute to inconsistent condom use. A woman with an HIV-negative spouse, who reported using condoms inconsistently said:

> Christian ethics teach about in such and such dilemma you choose the less of the two [evils] …. I think, what is the point which is worse … God will forgive us for that because I am doing it for a just cause. I am preventing him and protecting myself. My son needs us around …. (Susan, 35 years, teacher)

In addition, notions about condom ineffectiveness remained prevalent among respondents and their partners. For example, a married male discounted the effectiveness of condoms saying:

> … honestly, I am not interested in them [condoms], I do not use them, neither will I start using them. I have unprotected sex with my wife and I ejaculate out of her … the only thing that can prevent infection is [to avoid] promiscuity …. (Charo, 40 years, unemployed)

Aside from effects on sexual pleasure, several men and women reported that their partners complained that condoms could cause skin problems and other physical effects:

> Condoms affect all of us … especially the man. It affects him a lot. It makes him itch a lot. He scratches himself until the skin almost comes off …. (Grace, 38 years, housewife)

Another said:

> It reduces [pleasure] it makes the penis of a man become tight and small and he does not finish well. (Jacinta, 36 years, housewife)

Still another respondent raised concerns about the oil-based lubricants on condoms:

> God himself created man to have sex flesh-to-flesh, now when you start wearing condoms, that oily stuff, I don't know what it is, it may even be chemical that can affect your penis and make it stop working. (Charo, 40 years, unemployed)

Most had, however, gone through a process of rationalising the use of condoms as an essential part of their sexual life and had even learned to like them. One young woman said:

> These days we take condoms positively. Earlier, we used to see it like a problem having sex with a condom. These days if there is no condom, I stay without sex … I do not feel like it. (Jane, 28 years, unemployed)

Interestingly, several male respondents reported asking their partners to stop using family planning methods (pills, injections) after HIV diagnosis and treatment began. This appears to be based on a perception that hormonal contraceptives cause severe side-effects in people with HIV as reported by this woman with an HIV-positive partner:

> I was told by a person with AIDS … [that] some of these family planning methods can cause cancer [and that] some other people who are not even HIV-positive can suffer from those

> cancers, and I think if I start using those drugs I will expose myself to those cancers .... (Margret, 32 years, unemployed)

Another male respondent with an HIV-negative spouse said:

> The condom is good because you cannot affect the woman or the man; I see this as the safest way compared to other methods. (Chale, 39 years, unemployed)

Intersection between condom use and cultural norms around fertility

Some participants use condoms for the purposes of both family planning and prevention of HIV transmission. They mostly reported consistent condom use and generally were not using other family planning methods. By contrast, others expressed a desire for children and this was an important reason for not using condoms. This desire appears to supersede concerns about the risk of HIV transmission.

According to male respondents, their partners, both HIV-negative and -positive, expressed a strong desire for children, seemingly reflecting an internalized social norm about fertility and motherhood. One man said this about his HIV-negative spouse:

> She kept asking me how we would get a child if we keep on using condoms ... initially we agreed to use but later on she turned her back and says that I am mistreating her ... this puts me in a tricky situation ... sometimes I think that I should let her go out with other men .... My wife sees no use of using a condom because she wants to have a baby. (Gideon, 34 years, gardener)

Women, however, were also pressured by their partners to bear children as related by a widow with an HIV-positive live-in partner:

> He told me that he wanted a child because I do not have a child with him, the children I have are my late husband's ... [I told him] I am taking strong medications and if I conceive now I may be badly affected, but he said that because I am taking [medications] there is no problem ... he doesn't have another wife, so if I don't want to have children he will marry another wife. (Jacinta, 36 years, housewife)

As these findings show, underlying culturally-defined gender norms and expectations have a major influence on sexual behaviour. In the section that follows, we focus on how our respondents invoked local gender norms to make sense of and craft responses to their experiences of being HIV-positive and receiving ART.

Gender roles and responsibilities in sexual relationships

Respondents were asked where the burden of responsibility lay for protecting long-term partners from HIV. The consensus view was that responsibility lay with HIV-positive partners in discordant relationships and especially with men as they were the ones 'to wear a condom'. Only a few felt that the HIV-negative partner bears some responsibility for protecting themself. Participants were generally less clear about responsibilities towards partners of unknown status.

A sense of being responsible for protection appears to contribute to a reduction in sexual performance and desire, adding to the effects loss of strength and fatigue associated with HIV disease. One man with a partner of unknown status said:

> [My sex life] has kind of slowed down ... [sexual desire] it is back now, but there is that fear [of infecting my partner], it does not come out of my mind. (Saleh, 34 years, clerk)

Interestingly, those who have HIV-positive partners also feel responsible:

> I usually have the desire to have sex but it is not much ... it is not like before ... I don't know or maybe every time I want to have sex, I have to remember a condom. (Khamis, 44 years, unemployed)

Interestingly, women often took responsibility for ensuring male fidelity. Several women felt that men 'go out' when they do not get sex at home. Among women there appeared to be a broad acceptance that men will have multiple partners, as one divorced respondent cites:

> the wife is the one who has a long life [stays in a relationship] … the husband belongs to all women. (Julie, 45 years, housewife)

This view, women felt, reinforces the need for women to accept sex even when they do not want to. This dynamic, depicted as a form of 'protection', here means protecting the man from himself as illustrated by this widow:

> The wife should protect the husband, meaning she should satisfy the husband, if you protect him in that way he won't see the need of going out …. (Njeri, 25 years, unemployed)

Female participants also sometimes took on the task of procuring condoms, as expressed by this woman with an HIV-negative spouse:

> No day have I missed [using condoms]; when they get out [run out], I take them from here [ART clinic], and if they get finished before my next appointment, I buy them from the shop. (Akinyi, 33 years, unemployed)

More traditional views about male and female roles were, however, also expressed. Here, men framed this as the need to guide or protect women:

> it is the responsibility of the man to protect the woman … after counselling and discussing with her she will be satisfied, because she is weak in mind and soul … it is believed as the man you are the leader and driver of your partner. (Mwaru, 40 years, unemployed)

These gendered notions of women as 'weak in mind and soul' and of the consequent need to 'protect one's wife' also emerged in reference to disclosure. One man, despite having received an HIV diagnosis five years ago and taking ART for a year, had not disclosed his status to his wife, apparently to avoid harming her psychologically. Married for seven years, he described this as:

> … if I could be sure that she [wife] will [not] be affected psychologically … I will disclose my status to her … but [till now] I have been telling her to stop using injections for family planning [as] it will bring or cause problems … it is better we use condoms [for family planning] so I use it without her consent. (Kimathi, 40 years, unemployed)

Even though most participants reported having one current partner, several women described themselves as co-wives (women in polygamous relationships). In many instances, they apparently were not aware of the existence of co-wives and children until late in the relationship, as co-wives lived in separate households, sometimes in other parts of the city or country:

> I am in the house thinking I am the only wife in the house, [when] a letter came from home. It was written by another wife; she had sent photographs of the children … (Jane, 28 years, unemployed)

Driven by underlying suspicion and fear of abandonment, these women found it difficult to discuss safe sex and condom use with their husbands and between them and other co-wives. A married woman said the following:

> he finds it hard to approach her [his other wife] about condoms. He worries that the wife will wonder why condoms this time since they have been living together and since they have children. (Atieno, 48 years, housewife)

Men reported being the main initiators of sex. Women concurred, adding that they never ask directly for sex, for fear of being perceived as a woman of loose morals or because they

felt embarrassed. Women did, however, signal their sexual desires indirectly, as cited by a married woman:

> He is the one who has to start … I cannot just tell him I want sex, he will wonder what kind of woman I am … [laughter] … [When I desire sex] I lie down, touch my feet and turn around in bed … he then realizes that I will not let him sleep …. (Grace, 38 years, housewife)

At the same time, some male respondents reported being pressured to have sex – as described by this male:

> my former wife would force me to have sex with her. I think she had more sexual urge than I did … I think she was used to sleeping around with many men and she was used to doing this. (Saleh, 34 years, clerk)

To explore the feasibility of changes in sexual behaviour within stable relationships, such as where a partner could decline sex or insist on condom use, we enquired about local notions of coercive sex within long-term relations. Most stated that sex with long-term partners was, by nature, consensual and could not be forced. Several women did report verbal coercion and threats from their partners to have sex, highlighting the prevailing gender and power dynamics among couples:

> … when I refused, he would ask me whether I knew I was in his house or did I not know that. I would tell him that I was aware of that but ask him whether this body was his or mine …. (Jane, 28 years, married, unemployed)

> … but sometimes he forces me. He asks me if I want him to go for sex outside marriage. (Grace, 36 years, housewife)

We enquired further about forced sex and other forms of violence. Some men reported perpetrating violent sex, but only in the time prior to ART, often under the influence of alcohol and mostly with sex workers:

> … when I was a young boy, I go to a bar, find a woman, we agree on an amount of money to pay her, now she let me down by cutting short the sexual process and when I say I need more she refused … now because of that and alcohol influence it made me to cause violence a bit. (Mwaru, 40 years, unemployed)

Concerns that HIV-positive people may deliberately spread infection through unprotected sex often emerged. While respondents unanimously agreed that infecting someone deliberately is wrong, several did say they knew or had heard of persons who had intentionally engaged in unsafe sex with the objective of spreading HIV infection. The participants suggested several reasons for such behaviour such as anger, emotional distress and a desire for revenge, all conflated with a denial of HIV-infection:

> I knew of a person, and this person has since died. He was a teacher in a primary school … once he knew about his status he infected many unsuspecting school girls … (Gideon, 34 years, gardener)

Discussion

This study provides insight into changes in sexual behaviour that occur in HIV-infected people receiving ART and factors influencing this. The results concur with findings from a quantitative study in the same population (Luchters et al. 2008; Sarna et al. 2008a) and evidence elsewhere that found no overall increase in unsafe sex among persons receiving ART (Moatti et al. 2003; Bateganya et al. 2005; Bunnell et al. 2006). Advanced HIV disease among participants in the study was associated with marked sexual dysfunction, especially among men, which was somewhat reversed as health improved with ART. Moderate increases in sexual function after ART initiation has also been noted in similar

settings (Moatti et al. 2003). Importantly, some men reported that the above changes were accompanied by a reduction in sexual violence.

While the majority of respondents had one current partner, several women said that their husband had other partners in stable polygamous relationships. HIV testing and condom use were uncommon within these sexual networks. A detailed history of multiple partners and co-wives, a discussion of the risks associated with concurrent sexual partners and the importance of HIV testing and condom use with all partners are clearly critical components of prevention counselling in ART and other HIV programmes (Chersich and Rees 2008).

In this study, unprotected sex remains a critical issue, especially in stable relationships, many of which contain HIV discordant couples (Bunnell et al. 2006). The longitudinal cohort study in the same population found that among sexually-active participants, self-reported unprotected sex did decrease from 77% (82/107) in the 12 months prior to initiating ART to 63% in the 12 months after ART (67/107). Thirty of the 67 who had unprotected sex while receiving ART said this was with an HIV-negative or unknown status partner (Luchters et al. 2008).

In addition to religious and cultural barriers to condom use, misconceptions about the harmful effects of condoms hindered their use. High levels of knowledge, about condoms as well as other topics investigated here, are a necessary precursor to shift in attitudes and intentions and, ultimately, to behaviour change. The study findings, however, show once again that increased knowledge, even attitude change, in isolation does not necessarily directly impact on behaviour. Rather, much of the behaviour change reported here appeared to be underscored by high levels of perceived behaviour control, a central tenet of the theory of planned behaviour (Ajzen 1985). Though not a specific component of this theory, it is clear that sexual behaviours in the study population remains deeply embedded in their social and material circumstances and in their cultural and gendered contexts. Also, theories of behaviour change cannot be easily applied to circumstances of conflicting goals, such as fertility desires and protected sex.

Desires for fertility, expressed by men and women, often translated into unprotected sex. Findings among people receiving ART in Togo (Moore and Oppong 2007) and India (SriKrishnan et al. 2007) were similar, with men and women desiring children; whereas Kerrigan et al. (2006) report differently from Brazil, where males were often the predominant agent pushing their partners to have children. Fertility desires must be respected and steps taken to promote safe conception and an HIV uninfected child, if desired (UNFPA and WHO 2006). Couples require information on the risk of transmission from mother to child, the importance of ART adherence during pregnancy and childbirth and assisted reproduction techniques, where available.

Although most often beneficial for participants and their relationships, disclosure by itself appears insufficient to guarantee protected sex. The process of disclosure and of identifying one's infector has been shown elsewhere to lessen emotional reactions such as vengeance and increase ease in practising safer sex (Moskowitz and Roloff 2008). Mention of purposefully infecting others with HIV did occur here, echoing previous evidence of vengeance described in South Africa (Leclerc-Madlala 1997) and also in gay populations (Moskowitz and Roloff 2008).

In terms of the two major elements of sexual risk behaviour – multiple partners and low condom use – it is important to note that the main behaviour change that occurred was a reduction in concurrent partners. Both HIV testing and receipt of ART appear to be key life stages or transition points in the respondent's lives, when they review and change their

behaviour. Contact with health services at this time provides an important opportunity for intervention.

Short-term information, education and communication interventions could address misconceptions about condoms, but are unlikely to alleviate the more deep rooted psycho-social barriers reported. Longer term client- or couple-focused counselling could be used to identify, explore and address these barriers, most especially among discordant couples or where one has an unknown status. Programmes might consider using the experiences of individuals who overcame barriers to condom use to design behaviour change interventions and employ such persons as peer educators or expert patient trainers within ART programmes. The low condom use prior to their HIV diagnosis shows again the need to intensify programmes that promote condom use at community level.

Self-reported condom use in this study incurred both recall and social desirability biases (Allen et al. 2006), perhaps heightened among those receiving repeated counselling on condom use. Selection of participants based on self-reported condom use, with inclusion of both consistent and inconsistent users, may limit such bias.

In conclusion, the study suggests that there is a reduction in the number of sexual partners and, to a lesser extent, an increase in condom use around the time of HIV diagnosis and that these behaviour changes are facilitated by partner disclosure and further supported by ART programmes and related interaction with health providers. Despite this, however, some patients continue to have unprotected sex and require additional support. Individualized risk-reduction interventions could possibly address the particular barriers that some individuals still face in effecting safe sex and improved sexual health.

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Résumé

Á Mombasa, au Kenya, des entretiens en profondeur ont été menés avec vingt-trois adultes sexuellement actifs recevant une thérapie antirétrovirale (TAR) afin de comprendre les changements des comportements sexuels après le début du traitement, et les facteurs influençant l'usage du préservatif. Vécue par ces personnes auparavant, l'infection à VIH à son stade avancé avait entraîné une baisse significative du désir sexuel et de la fonction sexuelle parmi elles. Suite au diagnostic de VIH, le nombre de partenaires sexuel(le)s s'est restreint et les relations monogames sont devenues prédominantes. La prise d'une thérapie antirétrovirale a renforcé ces changements, tout en améliorant la santé sexuelle. Cependant, les partenariats sexuels concomitants se poursuivent dans le cadre du mariage polygame, et des rapports sexuels non protégés ont lieu avec les partenaires régulières, même celles qui sont séronégatives. Les personnes ayant utilisé des préservatifs de manière irrégulière avant de commencer leur traitement antirétroviral restent souvent des usager(e)s irrégulier(e)s par la suite. Alors que le dévoilement du statut sérologique semble avoir un impact favorable à l'usage du préservatif, il ne constitue pas toujours un facteur prédictif des rapports sexuels protégés. En plus des perceptions classiques de l'impact du préservatif sur l'intimité et la confiance, les rôles de genre traditionnels, les conceptions erronées sur la nocivité potentielle du préservatif et les désirs de fertilité entravent l'usage du préservatif.

Resumen

Para este estudio se llevaron a cabo entrevistas exhaustivas con 23 adultos sexualmente activos que reciben un tratamiento con antirretrovirales en Mombasa, Kenia, con el objetivo de entender qué cambios ocurren en la conducta sexual después de empezar el tratamiento y qué factores influyen a usar preservativos. La enfermedad del sida en estado avanzado había conducido previamente a una destacada disminución del deseo y la función sexuales. Tras la prueba del sida, disminuyó el número de parejas sexuales y empezaron a predominar las relaciones monógamas. Con los antirretrovirales se reforzaron estos cambios a la vez que mejoró la salud sexual. Sin embargo, siguen ocurriendo relaciones sexuales simultáneas en matrimonios polígamos así como sexo sin protección con parejas regulares, incluso con personas seronegativas. Las que sólo usaban preservativos en determinadas ocasiones antes de empezar a tomar antirretrovirales, con frecuencia tampoco los usaban después regularmente. Aunque la revelación del estado seropositivo del VIH parece reforzar el uso del condón, esto no siempre augura que luego las relaciones sexuales sean con protección. Además de las percepciones clásicas sobre el efecto de los preservativos en la intimidad y la confianza, los roles tradicionales sexuales, las ideas erróneas sobre el posible daño a causa de los preservativos y los deseos de fertilidad obstaculizan el uso de preservativos.

Article 4

Sexual behaviors of HIV-positive persons not accessing HIV treatment in Mombasa, Kenya: Prevention with healthy positives in the community

Submitted to AIDS and Behaviour

Title: Sexual behaviors of HIV-positive persons not accessing HIV treatment in Mombasa, Kenya: Prevention with healthy positives in the community

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Running Head: Sexual behavior of PLHIV in Mombasa, Kenya

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Abstract:

People living with HIV (PLHIV) not receiving ART often fall outside the ambit of prevention programs. Using modified snowball sampling to recruit PLHIV, 698 survey participants were recruited through community health workers and HIV-positive peers in Mombasa, Kenya. Of the 59.2% (413/698) sexually active PLHIV, 25% reported multiple sexual partners. Overall, unprotected sex occurred in 52% of sexual partnerships; notably with 32% of HIV-negative partners and 54% partners of unknown HIV status. Multivariate analysis, controlling for intra-client clustering, showed non-disclosure of HIV-status (AOR: 2.47, 95%CI: 1.53-3.99, $p<0.001$); experiencing moderate levels of perceived stigma (OR 3.00, 95%CI: 1.55-5.80; $p<0.001$); believing condoms reduce sexual pleasure (OR 2.99, 95%CI: 1.71-5.23; $p<0.001$) were independently associated with unsafe sex. Unsafe sex was also higher in those using non-condom contraception (OR 5.48, 95%CI: 2.56-11.73; $p<0.001$); or no method (OR 4.17, 95%CI: 2.13-8.17; $p<0.001$), compared to consistent condom users. High-risk sexual behaviors are common among PLHIV not accessing HIV treatment services.

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Key words: PLHIV, prevention of sexual transmission of HIV, sexual behavior, unsafe sex, Africa

Introduction

HIV transmission remains a significant global concern; in 2009 there were an estimated 2.6 million new infections globally.[1] Sub-Saharan Africa remains the region most heavily affected by HIV, and accounts for 69% of HIV infections worldwide and a similar proportion of new HIV infections among adults.[1]

People living with HIV (PLHIV) who receive antiretroviral therapy (ART) are in regular contact with health workers and thus exposed to prevention messages and commodities. Indeed several studies have documented a reduction in sexual risk behaviors among PLHIV initiating ART.[2-5] At the same time, studies have shown that PLHIV accessing HIV care services, but not receiving ART, have higher sexual risk behaviors and unprotected sex than those taking ART, even though both groups have contact with health workers and exposure to prevention messages.[6-9] A major gap, however, is evidence about the patterns of sexual behavior among PLHIV in the community who are not receiving ART and are either accessing HIV care services infrequently or not at all and whose only contact with health services might well have been post-test counselling at the time of testing HIV-positive.

Studies of the determinants of unprotected sex in HIV-infected people suggest that multiple factors operate individually or in an overlapping manner to influence sexual behavior .[10] Intention and self-efficacy regarding safe sex;[11, 12] dilemmas around disclosure of HIV status to partner(s) and fears of subsequent rejection;[11, 13-16] and motivation to protect partners as well as themselves against re-infection with a new HIV strain or another sexually transmitted infection play an important role in effecting safe sex.[10] Partner attitudes and willingness to use condoms, complicated by partner status and willingness to be tested for HIV, add further dimensions to safe sex practices.[4, 15, 16] Traditional gender attitudes and sexual power differentials continue to influence condom use and risk behaviors.[16-19] Furthermore, fertility desires may lead to PLHIV ignoring the risks of unprotected sex.[16, 20, 21] Most of the evidence about these determinants comes from studies with PLHIV accessing HIV treatment or care services (ART or regular routine follow-up of HIV disease including co-trimoxazole

prophylaxis). Little is known about whether these factors also influence sexual behavior of PLHIV in the community, the 'healthy positives', who do not yet require ART and who do not visit health facilities or other care services. Although newly diagnosed HIV-positive persons are advised to visit treatment centres for routine follow-up and co-trimoxazole prophylaxis, many PLHIV choose not to. Moreover, it is possible that HIV-related stigma or denial constitute barriers for PLHIV to attending these services and similarly foster high-risk behaviors.

In Kenya, in 2009, an estimated 1.3 to 1.6 million persons were living with HIV and an estimated 70% (308,610 - 438,000) of PLHIV with advanced disease were receiving ART.[22] Clearly a large number of PLHIV are not receiving treatment mostly because they do not yet require ART. Many of these PLHIV are likely outside the ambit of regular health care and prevention services. An estimated 100,000 new HIV infections occurred in 2009 in Kenya, highlighting the need for prevention efforts to focus on sexual risk behaviors of PLHIV, including on those not accessing HIV care services. In this paper we examine the sexual risk behaviors of PLHIV in the community who were not receiving ART or co-trimoxazole prophylaxis.

Methods

Study participants were recruited for a cross-sectional survey, using modified snowball sampling, through Community Health Workers (CHW) and HIV-positive Peers from Post Test Clubs (PTC). Four CHWs from all four Mombasa districts (n=16) were each asked to recruit 20 PLHIV. Five Peers from eight PTCs (n=40) across the city were each tasked with recruiting 12 PLHIV. HIV-positive adults who were 18 years or older, not currently taking ART or co-trimoxazole prophylaxis were eligible to participate.

Recruitment followed a detailed protocol on approaching PLHIV, maintaining confidentiality and verifying HIV-positive status. Each participant received Ksh 200 (+/- USD 2.60) as compensation for their time and transport. CHWs and peer recruiters received Ksh 100 (+/-USD 1.30) per participant recruited to cover their transport costs. Ethical approval was obtained from the Kenyatta National Hospital's Ethics Committee and Institutional Review Board of the Population Council. Written informed consent was obtained from all participants.

Data were collected using structured questionnaires administered in Swahili by trained research assistants. Demographic variables were categorized and time since diagnosis of HIV classified as less than 12 months, 12-24 months and ≥24 months. Contraception was categorized as: male/female condoms for contraception, other FP methods (IUD, hormonal methods, permanent methods, diaphragm, foam/jelly, or rhythm) and no contraception. Perceived stigma was assessed using an adapted Berger's Stigma Scale (Cronbach's alpha of adapted scale: 0.81) and was categorized as minimal or low (16-40), moderate (41-52) or high stigma (53-64).[23, 24] The recall reference period for sexual behavior was the previous six months. Data were collected on sexual activity, lifetime number of sexual partners, number of sexual partners in the past six months, type of partners, partner's HIV status and disclosure of own status to partners. A regular partner was defined as a spouse or cohabiting partner, or a long-term friend with whom the respondent has sex frequently. A casual partner was defined as a partner with whom the respondent was not living and had sex once or rarely. Commercial or transactional partners were those where money or gifts were exchanged for sex.

To assess transmission concerns, participants were asked a binary question: "Are you worried about transmitting HIV to this partner?" Attitudes to condom use were assessed with two statements: "I am tired of always having to make sure that I use a condom every time I have sex" and "Using a condom takes away the romance from sex" – responses were scored as agree, disagree or don't know. STI events were self-reported episodes of genital discharge or genital ulcer in the past six months (laboratory confirmation was unavailable). Unprotected sex (UPS-6 months) was defined as inconsistent condom use with partners in the past 6 months. Unsafe sex (US), the primary outcome, was defined as inconsistent condom use with partners of HIV-negative or unknown status in the past six months (US-6 months). Participants were asked to report UPS for up to six partners in the past six months. UPS at last sex and US at last sex were also reported.

Data Management and Statistical Analysis

Data were entered into handheld computers (Dell Axim X 51) and then uploaded into Microsoft Access 2003 using Perseus 7.0.044 software. The data were analyzed on two levels (respondent-level and partner-level) using Intercooled Stata 8.0 (Stata Corporation, College Station, Texas, USA).

Respondent-level analysis compared demographic and behavioral characteristics of male and female participants. Unpaired Student's *t* test and the Mann-Whitney *U* test compared continuous variables with normal or non-normal distributions respectively, and a chi-square test identified differences between categorical variables. Unadjusted Mantel Hanzel odds ratios were reported.

Analysis at the level of sexual partner included data for up to six partners for each respondent in the last six months. Univariate logistic regression, controlling for clustering by participant identity number, was performed on each variable to identify associations between the variable and unsafe sex at 6 months and last sex. Variables significant, at alpha level of 0.05, on univariate regression were included in the multivariate model.[25] Also, *a priori*, disclosure of HIV status and type of partner were included in initial models, based on previous evidence.[6, 26-29] For In multivariate analysis, logistic regression models controlled for clustering as there were multiple measures on the same participant, and each participant's sexual behavior with one partner may not be independent from her or his behavior with other partners. A main effects model was used. [30] Although sex of the respondent was not associated with unsafe sex in univariate analysis, it was forced into the model as socio-demographic characteristics varied markedly between women and men (Table 1). Separate multivariate models were developed for US-6 months and US-last sex.

Results

Between May and August 2007, 720 PLHIV were interviewed out of 748 identified by CHWs and Peers; 28 persons were found ineligible as they were receiving ART or cotrimoxazole prophylaxis. Data from 22 participants were lost due to technical failures

with the hand-held computers, leaving data on 698 participants. CHWs recruited 345 PLWA (mean 21.5 PLWA/CHW) and Peers from PTCs recruited 342 participants (mean 8.5 PLWA/Peer). For 11 participants data on source of recruitment was unavailable.

Median age of participants was 33.5 years (IQR=28-33). Twenty-three percent (n=163) of participants reported visiting HIV clinics (34.4% visited monthly, 16.6% every two to six months, 20.2% when sick and 28.8% off and on); none were receiving ART or co-trimoxazole prophylaxis. Differences were detected in socio-demographic characteristics between female and male respondents [Table 1]. Women were more likely than men to be widowed (OR 3.40; 95%CI: 1.98-5.88; p<0.001); to attend HIV clinic (OR 1.73; 95%CI: 1.10-2.74; p=0.017) and be unemployed (OR 1.73; 95%CI: 1.10-2.71; p=0.018). They were also less likely to drink alcohol each week (24.7% vs. 34.2%; OR: 0.63; 95%CI: 0.43 -0.93; p=0.017) or to report ever using drugs (21.7% vs. 63.4%; OR: 0.16; 95%CI: 0.11-0.24; p<0.001). Women knew their HIV-status for longer periods than men. Participants recruited by CHWs and by Peers had a similar age, sex, education and employment status (data not shown).

TABLE 1

Sexual Behavior

Male participants reported significantly higher median life time partners than females (14, IQR=6-25 vs. 4, IQR 3, 8; p<0.001). In the six-months preceding the survey, 59.2 percent of participants were sexually active; similar in females and males [Table 2]. Males were more likely to report multiple partners (≥2 partners) than female participants (OR: 3.67; 95%CI 2.18-6.18; p<0.001). Overall 16 sexually-active participants (5 males and 11 females) reported more than 6 partners. Twenty percent of male participants reported a mix of sexual partners (regular/casual/ transactional) as against 9.7% female participants (OR: 2.33; 95%CI: 1.23-4.43; p<0.01). [Table 2] While the majority of male (84.4%) and female participants (98.8%) reported heterosexual partners, 15.5% of males (n=14) and 1.2% of females (n=4) reported same sex partners in the past six months [Table 2]. Over a quarter (26.8%) of sexual partners mentioned by sexually-active men were males (n=48 male partners).

Partner characteristics

Sexually-active respondents reported a total of 616 sex-partners over the reference period [Table 2]; a mean of 1.98 partners per sexually-active man and 1.36 per sexually active woman. Female participants reported more regular partners compared to male participants (72.1% vs. 50.8%; OR: 2.50; 95%CI: 1.73-3.61; p<0.001) while male participants had more casual (23.5% vs. 19.7%; OR: 1.25; CI: 0.82-1.90; p=0.29) and transactional partners (25.7% vs. 8.2%; OR: 3.85; 95%CI: 2.35-6.30; p=<0.001) than women (p<0.001) [Table 2]. Three quarters of all partners were of unknown HIV-status, similar for men and women. Disclosure of HIV-status was made to a third of all partners (males 30.2% vs. females 39.8%; OR: 1.53; 95%CI: 1.09-2.47; p=0.02).

TABLE 2

Fertility intentions and family planning

Overall, 82% (572/698) of respondents had children from past or current relationships, and 74.8% (522/698) did not want any more children. However, 67.3% (470/698) of respondents were not using any contraception. Among those respondents who did not want children, fewer, but still half, were not using contraception (54.8%; 286/522).

Other sexual practices

Twenty nine percent (24 males and 94 females,) of sexually-active respondents reported sexual intercourse with a partner during menstruation. Of those, 78 percent (18 males and 74 females) inconsistently or never used condoms during menstrual periods. Eighteen percent of sexually active respondents (23 males and 50 females) reported ever having anal sex. Of those, 80.8% (14 males and 45 females) inconsistently or never used condoms during anal sex. Twenty-eight percent of those sexually-active (33 males and 83 females) reported ever having oral sex. Of those 87 percent (27 males and 74 females) inconsistently or never used condoms during oral sex. (Data not shown)

TABLE 3

Sexually transmitted infections

Overall, 44 percent of participants reported ever having a STI other than HIV. Males were significantly more likely to ever report a STI compared to females (55.9% vs. 41.0%; OR: 1.82, 95%CI: 1.27-2.61; p<0.001). Of those who ever had a STI, half (49.5 percent) had a STI in the last six months. A higher proportion of female participants reported genital discharge (42.9% vs. 19.7%, OR: 3.06; 95%CI: 1.68-5.55; p<0.001) and genital ulcers (38.2% vs. 25.5%; OR: 1.80; 95%CI: 1.04-3.11; p=0.046) in the last six months compared to men. Of note, 46.5% informed their regular partners of their infection, but only 13.9% of those with multiple partners informed other partners.

Prevalence of unprotected sex

UPS-6 months was reported in over half (52%) the sexual partnerships, more by women than men (55.2% vs. 44.1%; OR: 1.56; 95%CI: 1.09-2.21; p=0.01) [Table 3]. Males were more likely to report UPS-6 months with female partners compared to male partners (52% vs. 22.9%; OR: 3.63; 95%CI: 1.66-7.95; p 0.001). Both sexes were more likely to have UPS-6 months with regular partners compared to casual or transactional partners (p<0.001). UPS-6 months was reported with almost a third of HIV-negative partners (males 35.3% vs. females 30.4%; OR: 0.80; 95%CI: 0.25-2.63; p=0.72) and with half of the partners of unknown HIV status (males 45.0% vs. females 57.3%; OR: 1.64; 95%CI: 1.07-2.47; p=0.02) by both male and female respondents. There was no difference noted in reporting UPS-6 months with respect to disclosure [Table 3]. Patterns of UPS-last sex were similar to those of UPS-6 months [Table 3].

TABLE 4

Unsafe sex with HIV negative or unknown status person

Risk factors associated with US-6 months were explored (Table 4). In univariate analysis, university level education, more than 12 months since HIV diagnosis, non-disclosure of HIV-status, moderate and high levels of internalized stigma, condom use fatigue, believing that condoms reduce pleasure and using non-condom contraceptive methods were associated with higher risk of US-6 months and were included in the model.

On multivariate analysis, controlling for intra-client clustering, non-disclosure of HIV-status to a partner (AOR 2.47, 95%CI: 1.53-3.99; p<0.001), experiencing moderate levels of perceived stigma (OR 3.00, 95%CI: 1.55-5.80; p<0.001), believing condoms reduce sexual pleasure (OR 2.99, 95%CI: 1.71-5.23; p<0.001) or being unsure about condoms reducing pleasure (OR 9.19, 95%CI: 2.70-31.19; p<0.001), using a non-condom contraceptive method (OR 5.48, 95%CI: 2.56-11.73; p<0.001) or not using any contraception (OR 4.17, 95%CI: 2.13-8.17; p<0.001) were independently associated with US-6 months. Sex of the respondent, though not significantly associated on univariate analysis, was associated with US-6 months on multivariate analysis: female respondents were nearly two times more likely to report US-6 months (OR 1.96, 95%CI: (1.07-3.57); p<0.03) compared to male respondents. University education and time since HIV diagnosis were not associated with US-6 months. Predictors for US-last sex were similar to those for US-6 months.

Discussion

Despite an overall reduction in the rate of new HIV infections in sub-Saharan Africa widespread concern remains about the continuing transmission of HIV in the population.[1, 31] This study, conducted among PLHIV in the coastal community of Mombasa, show high rates of unsafe sex in this population. Almost sixty percent of the participants recruited were sexually-active in the past six months; significantly higher than what we reported in an earlier study conducted in Mombasa among PLHIV receiving ART (44%) and PLHIV receiving co-trimoxazole prophylaxis, but not ART (47%)[6]; and also higher than that documented by other studies among PLHIV accessing care services in Uganda (48%),[9] Cameroon (47%),[32] and Cote d'Ivoire (47%).[7] Unprotected sex occurred with over half the sexual partners; this was significantly higher with regular partners than with non-regular partners. This is much higher than that found in ART-naïve PLHIV in Uganda and South Africa.[8, 29, 33] Of concern is the fact that unprotected sex was reported with a third of HIV-negative partners and half the untested partners (unknown HIV status); similar concerns have

been raised previously.[14] Three quarter of all sexual partners were of unknown HIV-status amplifying the risk of HIV transmission.

Disclosure of HIV-status to partners and perceived stigma emerged as independent determinants of safe sex behaviors. It is important to note the intersection of the two determinants where PLHIV are reluctant to disclose for fear of rejection (perceived stigma) which may or may not happen.[15, 16] This study also highlights the role that beliefs about condoms reducing pleasure and condom use fatigue play in influencing safe sex.[34, 35] The Social Cognitive Theory on behavior change states that information (HIV awareness) is necessary but not sufficient for preventive behavior to occur. To engage in HIV prevention one needs both self-regulation and risk reduction skills in addition to information.[36] A necessary first step would be to change attitudes, a challenge in this population where a perception of relative good health may remove the urgency to effect behavior change. Prevention programs need to develop strategies to shift attitudes and beliefs about condom use followed by building risk reduction skills in this high risk group. High levels of unmet family planning needs were observed in this population: more than half of the participants who did not want to have children were not using contraception. Using a non-condom family planning method or not using any family planning was also associated with higher risk of unsafe sex. Although widely discussed, effective integration of family planning counseling and services into HIV prevention programs is not taking place and merits urgent action.[37, 38]

We documented risky sexual practices such as unprotected sex during menstruation, unprotected MSM and heterosexual anal sex and unprotected oral sex. Sexual exposure to genital blood during menstruation is prevalent but not documented frequently; the practice is believed to facilitate transmission of HIV and other STIs.[39, 40] This study also found substantial same sex behaviors among male participants in the community (16%) and almost a quarter of all sexual partners reported by male participants were male. Mombasa is known for the presence of male sex workers and unprotected anal sex is frequently reported in this population.[41] Anal intercourse is reported relatively less frequently than unprotected vaginal intercourse among heterosexual individuals. The low prevalence of anal intercourse among heterosexual individuals may be offset by its

greater efficiency for transmitting HIV.[42] Health workers need to specifically discuss these forms of risky sexual behaviors during prevention counselling.

The study provides evidence that prevention programs can reach PLHIV in the community, who are not accessing routine HIV care services, through community health workers or peer workers. About three quarters of participants were not accessing any HIV care and support services they could benefit from. This occurred despite increased availability of HIV care services and ART in the community in recent years. Further research, to explore why this population is not accessing HIV care services and regular follow-up, is warranted. The study was also able to reach PLHIV who had been tested positive more than 12 months previously (57 percent) and therefore, presumably, more likely to have forgotten any prevention messaging at the time of post-test counselling.

The study is not without limitations. We recruited participants using modified snowball sampling. Although our sample is not a random representative sample, this technique did however allow us to reach PLHIV within the community who are otherwise not accessible and limit the level to which CHWs and PTC Peers could recruit from within their networks. We believe we were able to recruit a sufficiently diverse and representative sample of participants for this study. For the partner level analysis we limited the number of partners each participant could describe to a maximum of six in the reference period; this afforded us the ability to obtain more reliable recall and limit the influence of the outliers in the sample. We did not control for network size as is done with RDS samples for the following reasons: the health workers did not belong to the same risk group and therefore did not share the network of the study participants they recruited; PLHIV tend to be relatively isolated keeping their HIV positive status restricted to themselves or within the immediate family resulting in small poorly developed social networks; [43-46] and recruitment was based on non-probability sampling. We did not control for clustering at the recruiter level, which could lead to increased variance in reported behaviours, so results must be interpreted carefully and in context. The study relies on self-reported sexual risk and condom use behaviors which may be subject to social desirability and recall bias. Reviews of validity and reliability of HIV research have found that sexual behavior data are fairly consistent and

self-reported data on sexual acts reasonably congruent especially for infrequent acts and short recall periods.[47, 48] However, recent studies using biomarkers to validate self-reported condom use suggest the over reporting of condom use and recommend interpreting self-reported behaviors with caution.[49] Over reporting would further raise the level of risk found in this study.

In conclusion, a significantly large number of PLHIV in the community are not accessing ART or HIV care services in Mombasa and high risk sexual behaviors are widely prevalent in this population. HIV programs need to bring this population into the ambit of prevention and care services.

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Table 1: Participant characteristics: HIV positive adults not receiving ART, Mombasa, 2007

Variable	Total (n=698)	Males (n=164)	Females (n=534)	P [a]
Age: median (IQR)	33.5 (28-39)	34.5 (29-42)	33 (28-38)	0.02[b]
Highest education Level: % (n)				
No education	7.3 (51)	3.7 (6)	8.4 (45)	
Primary	59.2 (413)	54.9 (90)	60.5 (323)	
Secondary	31.1 (217)	38.4 (63)	28.8 (154)	
University	2.4 (17)	3.1 (5)	2.3 (12)	0.04
Marital status: % (n)				
Married or cohabiting	34.4 (240)	40.9 (67)	32.4 (173)	
Never married	21.1 (147)	32.9 (54)	17.4 (93)	
Divorced, Separated,	20.4 (143)	15.8 (26)	21.9 (117)	
Widowed	24.1 (168)	10.3 (17)	28.2 (151)	<0.001
Employment status: % (n)				
Employed	75.9 (530)	82.9 (136)	73.8 (394)	0.02
Type of HIV testing facility used: % (n)				
Government health facility	80.7 (563)	77.4 (127)	81.7 (436)	
Private medical centre	15.3 (107)	12.2 (20)	16.3 (87)	
Other	4.0 (28)	10.4 (17)	2.1 (11)	<0.001
Time since diagnosis: % (n)[c]				
0-11 months	43.1 (301)	50.0 (82)	41.0 (219)	
12-23 months	19.5 (136)	22.6 (37)	18.5 (99)	
24+ months	33.4 (233)	23.2 (38)	36.5 (195)	<0.001
Attends HIV clinic: % (n)				
Yes	23.4 (163)	16.5 (27)	25.5 (136)	
No	76.7 (535)	83.5 (137)	74.5 (398)	0.02
Perceived level of stigma: % (n)				
Low	16.2 (113)	18.9 (31)	15.4 (82)	
Moderate	68.8 (480)	67.7 (111)	69.1 (369)	
High	15.0 (105)	13.4 (22)	15.5 (83)	0.5
Drink alcohol weekly: % (n)				
Yes	26.9 (188)	34.2 (56)	24.7 (132)	0.02
Has ever used drugs: % (n)				
Yes	31.5 (220)	68.5 (104)	21.7 (116)	<0.001

[a] X^2 test unless indicated.
[b] Mann-Whitney *U* test.
[c] n=671; 28 respondents did not know their time since diagnosis.
ART: antiretroviral therapy; IQR: interquartile range

Table 2: Sexual behavior among HIV+ adults not receiving ART in Mombasa, Kenya 2007

All Respondents				
	Total (n=698)	**Males** (n=164)	**Females** (n=534)	**P Value**[a]
Lifetime no. of partners: median (IQR)[b]	5 (3,10)	14 (6,25)	4 (3,8)	<0.001
Sexually active in past 6 months: % (n)	59.2 (413)	55.5 (91)	60.3 (322)	0.27
Sexually Active Respondents				
	Total (n=410[c])	**Male** (n=90)	**Females** (n=320)	**P Value**[a]
No. of partners in past 6 months: % (n)[d]				
One partner	75.5 (308)	54.4 (49)	81.5 (259)	
More than one partner	24.5 (100)	45.6 (41)	18.6 (59)	<0.001
Sex of partner: % (n)				
Only male	79.8 (327)	12.2 (11)	98.8 (316)	
Only female	18.8 (77)	84.4 (76)	0.3 (1)	
Both male & female	1.5 (6)	3.3 (3)	0.9 (3)	<0.001[e]
Type of partner: % (n)				
Only regular	76.3 (313)	62.2 (56)	80.3 (257)	
Only casual	8.5 (35)	11.1 (10)	7.8 (25)	
Only sex workers	3.2 (13)	6.7 (6)	2.2 (7)	
Multiple types	12.0 (49)	20.0 (18)	9.7 (31)	0.002
Sexually Active Respondents (partner level analysis: n=616)				
	All respondents (n=410)	**Males respondents (n=90)**	**Female respondents (n=320)**	**P Value**[a]
Partners of respondents	n=616	n=179	n=437	
Sex of partner: % (n)				
Male	78.1 (481)	26.8 (48)	99.1 (433)	
Female	21.9 (135)	73.2 (131)	0.9 (4)	<0.001[e]
Type of partner: % (n)				
Regular	65.9 (406)	50.8 (91)	72.1 (315)	
Casual	20.8 (128)	23.5 (42)	19.7 (86)	
Sex worker	13.3 (82)	25.7 (46)	8.2 (36)	<0.001
Partner HIV status: % (n)				
Positive	15.3 (94)	17.3 (31)	14.4 (63)	
Negative	10.2 (63)	9.5 (17)	10.5 (46)	
Unknown	74.5 (459)	73.2 (131)	75.1 (328)	0.64
Disclosure: % (n)				
Partner knows	37.0 (228)	30.2 (54)	39.8 (174)	
Partner does not know	63.0 (388)	69.8 (125)	60.2 (263)	0.02

[a] X^2 test unless indicated
[b] n=684; 14 respondents were excluded if they did not know, did not respond, or reported ≥ 800 partners
[c] n=410; 3 sexually active respondents did not answer further questions about their sexual partners
[d] n=408; 2 respondents did not respond
[e] Fisher's exact test
ART, antiretroviral therapy; IQR, interquartile range

Table 3: Prevalence of Unprotected Sex (UPS) in the Past 6 months and at Last Sex among HIV+ Sexually Active Participants not Receiving ART in Mombasa, Kenya, 2007 (partner level analysis n=616)

	Past 6 months		At last sex	
	Male Respondents (n=90)	**Female Respondents (n=320)**	**Male Respondents (n=90)**	**Female Respondents (n=320)**
Total Unprotected Sex: % (n)	44.1 (79/179)	55.2 (241/437)	40.2 (72/179)	46.5 (203/437)
By sex of partner: % (n)				
Male	22.9 (11/48)	55.7 (241/433)	20.8 (10/48)	46.9 (203/433)
Female	52.0 (68/131)	0 (0/4)	47.3 (62/131)	0 (0/4)
	p= 0.001	p=0.04[b]	p=0.001	p=0.13[b]
By type of partner: % (n)				
Regular	59.3 (54/91)	61.6 (194/315)	52.8 (48/91)	50.5 (159/315)
Casual	26.2 (11/42)	38.4 (33/86)	26.2 (11/42)	37.2 (32/86)
Sex worker	30.4 (14/46)	38.9 (14/36)	28.3 (13/46)	33.3 (12/36)
	p<0.001	p<0.001	p=0.002	p=0.02
By partner status: % (n)				
Positive	45.2 (14/31)	61.9 (39/63)	38.7 (12/31)	38.1 (24/63)
Negative	35.3 (6/17)	30.4 (14/46)	23.5 (4/17)	26.1 (12/46)
Unknown	45.0 (59/131)	57.3 (188/328)	42.8 (56/131)	50.9 (167/328)
	p=0.74	p<0.001	p=0.32[b]	p=0.002
By disclosure: % (n)				
Partner knows	38.9 (21/54)	57.5 (100/174)	31.5 (17/54)	44.8 (78/174)
Partner does not know	46.4 (58/125)	53.6 (141/263)	44.0 (55/125)	47.5 (125/263)
	p=0.35	p=0.43	p=0.12	p=0.58

[a] X^2 test unless indicated
[b] Fisher's exact test
ART, antiretroviral therapy

Table 4: Factors associated with Unsafe Sex in the past 6 months (US-6 months) and at last sex (US-last sex) among HIV+ sexually-active participants not receiving ART, Mombasa, Kenya, 2007, Adjusted for intra-client clustering (partner level analysis n=616)

	US-6 months					US-Last Sex				
Variable	**Prevalence % (n)**	**Crude Odds (95% CI)**	**P value**	**Adjusted Odds (95% CI)**	**P value**	**Prevalence % (n)**	**Crude Odds (95% CI)**	**P value**	**Adjusted Odds (95% CI)**	**P value**
Sex of respondent										
Male (n=179)	36.3 (65)	1.0	---	---	---	33.5 (60)	1.0	---	1.0	---
Female (n=437)	46.2 (202)	1.51 (0.88-2.59)	0.14	1.96 (1.07-3.57)	0.03	41.0 (179)	1.38 (0.80-2.36)	0.25	1.72 (0.98-3.04)	0.06
Age*										
18-24 years (n=106)	42.5 (45)	0.85 (0.44-1.65)	0.64			38.7 (41)	0.84 (0.44-1.59)	0.59		
25-34 years (n=291)	46.4 (135)	1.0	---			43.0 (125)	1.0	---		
35-44 years (184)	39.7 (73)	0.76 (0.46-1.26)	0.29			33.2 (61)	0.66 (0.40-1.08)	0.10		
45+ (n=35)	40.0 (14)	0.77 (0.31-1.94)	0.58			34.3 (12)	0.69 (0.28-1.69)	0.42		
Marital status*										
Married or cohabiting (n=232)	44.8 (104)	1.0	---			41.0 (95)	1.0	---		
Never married (n=184)	41.3 (76)	0.87 (0.49-1.51)	0.61			35.9 (66)	0.81 (0.47-1.40)	0.44		
Divorced, separated, or widowed (n=200)	43.5 (87)	0.95 (0.59-1.53)	0.83			39.0 (78)	0.92 (0.58-1.47)	0.73		
Highest education level completed										
No education (n=42)	52.4 (22)	1.32 (0.53-3.26)	0.55	0.53 (0.21-1.38)	0.20	42.9 (18)	1.01 (0.41-2.48)	0.98	0.41 (0.15-1.10)	0.08
Primary (n=378)	45.5 (172)	1.0	---	---	---	42.6 (161)	1.0	---	---	---
Secondary (n=179)	39.1 (70)	0.77 (0.47-1.26)	0.30	1.24 (0.65-2.35)	0.51	31.8 (57)	0.63 (0.39-1.01)	0.05	0.92 (0.51-1.67)	0.78
University (n=17)	17.7 (3)	0.26 (0.07-0.98)	0.05	0.74 (0.19-2.84)	0.66	17.65 (3)	0.29 (0.08-1.10)	0.07	0.89 (0.24-3.28)	0.89
Sex of partner*										
Male (n=481)	44.3 (213)	1.0	---			39.3 (189)	1.0	---		
Female (n=135)	40.0 (54)	0.84 (0.49-1.42)	0.52			37.0 (50)	0.91 (0.53-1.55)	0.72		
Type of partner*										
Regular (n=406)	48.3 (196)	1.80 (0.88-3.68)	0.11			42.4 (172)	1.68 (0.83-3.37)	0.15		
Casual (n=128)	33.6 (43)	0.98 (0.41-2.32)	0.96			32.8 (42)	1.11 (0.47-2.62)	0.81		
Sex worker (n=82)	34.2 (28)	1.0	---			30.5 (25)	1.0	---		
Time since diagnosis										
< 12 months (n=265)	52.8 (140)	1.0	---	---	---	46.8 (124)	1.0	---	---	---
12-24 months (n=131)	37.4 (49)	0.53 (0.30-0.94)	0.03	0.59 (0.31-1.12)	0.11	34.4 (45)	0.59 (0.34-1.03)	0.06	0.68 (0.37-1.25)	0.21
≥24 months (n=197)	35.0 (69)	0.48 (0.28-0.82)	0.01	0.70 (0.39-1.24)	0.23	31.0 (61)	0.51 (0.30-0.86)	0.01	0.74 (0.42-1.31)	0.30

Disclosure to partner										
Yes (n=228)	31.1 (71)	1.0	---	---	---	26.8 (61)	1.0	---	---	---
No (n=388)	50.5 (196)	2.26 (1.52-3.35)	< 0.001	2.47 (1.53-3.99)	< 0.001	45.9 (178)	2.32 (1.56-3.45)	< 0.001	2.58 (1.62-4.12)	< 0.001
Transmission concerns*										
Yes (n=394)	43.7 (172)	1.0	---			38.3 (151)	1.0	---		
No (n=222)	42.8 (95)	0.97 (0.63-1.49)	0.87			39.6 (88)	1.06 (0.69-1.62)	0.80		
Had STI in past 6 months*										
Yes (n=145)	42.8 (62)	0.97 (0.58-1.63)	0.91			60.0 (87)	1.06 (0.65-1.76)	0.80		
No (n=471)	43.5 (205)	1.0	----			61.6 (290)	1.0	----		
Perceived internalized stigma										
Minimal/Low (n=98)	17.4 (17)	1.0	---	---	---	17.4 (17)	1.0	---	---	---
Moderate (n=431)	46.9 (202)	4.20 (2.22-7.95)	< 0.001	3.00 (1.55-5.80)	0.001	41.5 (179)	3.38 (1.84-6.22)	< 0.001	2.22 (1.15-4.28)	0.02
High (n=87)	55.2 (48)	5.86 (2.60-13.21)	< 0.001	2.04 (0.80-5.23)	0.14	49.4 (43)	4.66 (2.20-9.86)	< 0.001	1.61 (0.66-3.97)	0.30
Tired of using condoms										
Agree (n=253)	49.8 (126)	1.99 (1.26-3.14)	0.003	1.41 (0.84-2.37)	0.19	45.5 (115)	2.12 (1.36-3.30)	0.001	1.58 (0.96-2.60)	0.07
Disagree (n=319)	33.2 (106)	1.0	---	---	---	28.2 (90)	1.0	---	---	---
Do not know(n=44)	79.6 (35)	7.81 (3.31-18.43)	< 0.001	4.88 (1.82-13.09)	0.002	77.3 (34)	8.65 (3.74-20.02)	< 0.001	5.64 (2.22-14.34)	< 0.001
Believe condom reduces pleasure										
Agree (n=369)	51.0 (188)	2.87 (1.81-4.54)	< 0.001	2.99 (1.71-5.23)	< 0.001	24.8 (55)	2.46 (1.57-3.83)	< 0.001	2.41 (1.40-4.14)	0.001
Disagree (n=222)	26.6 (59)	1.0	---	---	---	44.7 (165)	1.0	---	---	---
Ambivalent (n=25)	80.0 (20)	11.1 (4.03-30.28)	<0.001	9.19 (2.70-31.19)	< 0.001	76.0 (19)	9.62 (3.72-24.84)	< 0.001	7.51 (2.27-24.79)	0.001
Family planning										
Using condom (n=124)	16.1 (20)	1.0	---	---	---	12.9 (16)	1.0	---	---	---
Using other method (n=117)	53.0 (62)	5.9 (2.87-11.96)	< 0.001	5.48 (2.56-11.73)	< 0.001	47.0 (55)	5.99 (2.92-12.26)	< 0.001	5.15 (2.46-10.80)	< 0.001
No family planning (n=375	49.3 (185)	5.06 (2.72-9.42)	< 0.001	4.17 (2.13-8.17)	< 0.001	44.8 (168)	5.48 (2.91-10.30)	< 0.001	4.21 (2.16-8.19)	< 0.001
Drink Alcohol Weekly*										
Yes (n=251)	46.6 (117)	1.25 (0.79-1.97)	0.34			41.4 (104)	1.21 (0.78-1.87)	0.40		
No (n=365)	41.1 (150)	1.0	---			37.0 (135)	1.0	---		

ART, antiretroviral therapy; CI, confidence interval; STI, sexually transmitted infection

Photo credit: Manoocher Deghati/IRIN

Chapter 5: Discussion and Conclusions

An HIV-positive IDP mother and child participate in a gathering organized by the Society for Women Against AIDS in Kenya (SWAK), at Nakuru IDP camp April 2008. Thousands of Kenyans who dropped out of HIV treatment programmes as a result of the country's post-election violence are gradually returning to clinics and the antiretroviral (ARV) drugs that help prolong their lives. © Manoocher Deghati/IRIN

Chapter 5: Discussion and Conclusions

5.1 Discussion of research findings

The studies presented in this thesis provide an overview of sexual behaviours of PLHIV to help programmes design evidence-based targeted interventions to reduce HIV transmission. This body of work explores sexual behaviours of HIV-positive individuals from various subgroups: (1) PLHIV receiving ART and therefore in regular contact with the health system, (2) PLHIV not eligible for ART but receiving co-trimoxazole prophylaxis and therefore also in contact with health services, and (3) PLHIV in the community who are not receiving any treatment and therefore have minimal or no health worker contact or influence. Studies 1-3 were among the first to explore the topic of sexual behaviours in Kenya when ART first became available in Mombasa through USAID support in 2004. To the best of my knowledge there are no studies exploring sexual behaviours of PLHIV in the community who are not accessing any HIV care services; almost all studies have been done with PLHIV in clinics waiting to initiate ART. I present findings from my work and place them in the context of results from other research to provide recommendations for prevention programmes. Comparisons drawn between the different studies have been done to illustrate behaviours from the point of view of policy impact; these comparisons do not assume a statistical basis as the population samples and time periods of conducting the studies are different.

PLHIV continue to be sexually active to a variable extent in different subgroups in Mombasa. Among participants receiving ART and co-trimoxazole preventive therapy (PT) less than half reported being sexually active (44% and 47% respectively) [Article 1]. Studies from Uganda and Cote d'Ivoire conducted around the same time, and a more recent study from South Africa show similar rates of sexual activity among PLHIV accessing HIV care services. [44-46] Among PLHIV in the community, who were not receiving ART, 59 percent of the participants reported that they were sexually active [article 4]. There is no evidence available regarding PLHIV not accessing services. There appears to be a change, mostly a decrease, in sexual desire and activity in relation to disease stage. Advanced HIV disease affects sexual function ranging from a marked reduction in desire and activity with prolonged periods of abstinence to a gradual return of interest but not full restoration of activity with ART; or in some cases a marked increase in sexual activity with ART. [Article 3] However, in our prospective

cohort study we did not find a significant increase in sexual activity after 12 months of ART in Mombasa. Similar findings have been reported from Uganda after 6 months on ART and South Africa after 12 months on ART. [45, 46] Interestingly, a higher proportion of male PLHIV on ART in India were sexually active (61%); however, there too there was no evidence of an increase in sexual activity over time on ART. [Annexure 1]

Sexual risk behaviours, described as multiple sexual partners and unprotected sex, continue to be reported across the different subgroups. Information on the lifetime number of sexual partners was only elicited in the study with PLHIV in the community not receiving any treatment.[Article 4] HIV-positive men had a higher median number of lifetime sexual partners than HIV-positive women (14 vs. 4). It is noteworthy that the majority of PLHIV, across all sub-groups reported one sexual partner over the reference in the different studies. Findings from the qualitative study show that PLHIV make a concerted effort to change sexual behaviour and reduce the number of partners, moving towards monogamous relationships after testing HIV positive; however, not all are able to do so. A small but significant proportion of PLHIV continue to have multiple partners. Among PLHIV in the cohort study 10 percent of participants reported two or more partners at baseline prior to ART initiation [article 2] and among PLHIV in the community not accessing care services 25 percent reported two or more partners [article 4]. Accessing treatment helps clients reduce the number of partners; the proportion of participants reporting two or more partners dropped to six percent after 12 months on ART in the cohort study [article 2] While Peltzer et al. (2010) did not observe a reduction in the number of partners among PLHIV after 12 months on ART in South Africa, a more recent study from Uganda by Wandera et al (2011) reports a reduction in number of partners in the first six months after ART that was sustained thereafter over two and a half years of follow-up. [46, 47] Qualitative evidence from article 3 suggests that multiple overlapping sexual relationships exist and are socially accepted for men, for example, men with two or more wives. Other studies, including a recent study from Zimbabwe find that participants, especially women, tend to under report sexual concurrency (having more than one sexual relationship at the same time) on surveys, while qualitative research can elicit these behaviours more effectively. [48, 49] There is evidence that sexual concurrency is a more important predictor of STI transmission than the number of partners. [50, 51] Prevention programmes need to

target this sub-population. Health workers and counsellors should be trained to identify these individuals during the course of HIV counseling, and trained to provide focused counseling related to the risks associated with multiple overlapping partnerships. A meta analytic review of the effect of HIV counseling on sexual risk behaviours found that HIV-positive participants and HIV sero-discordant couples reduced unprotected intercourse and increased condom use more than HIV-negative and untested participants. [25, 28]

Unprotected sex with partners is prevalent across all groups. Although PLHIV on ART reported consistent condom use with regular partners (past 6 months) more frequently than PLHIV on PT (53% vs. 22%), it is a concern that a significantly large proportion of PLHIV on ART and PLHIV on PT in this study did not use condoms consistently with their regular partners. [Article 1] Among PLHIV not receiving any treatment unprotected sex occurred with 60 percent of regular partners in the past 6 months. Further, unprotected sex with HIV-negative or unknown status regular partners, carrying a higher risk of HIV transmission, occurs frequently. Low levels of consistent condom use with HIV negative and unknown status regular partners were reported by PLHIV on ART (30% and 56%) and PLHIV on PT (42% and 16%) in article 1. Among PLHIV receiving no treatment unsafe sex occurred with 33 percent of HIV-negative and 54 percent of unknown status partners. [Article 4] In annexure 2, we report similar evidence from our work in Thailand and Zambia. Others recent studies from Cameroon, South Africa, and India provide supporting evidence on the continuing high prevalence of unprotected sex among PLHIV waiting to initiate ART and among those on ART. [42, 46, 52-57] Although unprotected sex with casual /non-regular and commercial sex partners was reported across all groups, unprotected sex with regular or cohabiting partners is more frequent and of concern. Bunnell et al. (2006) suggest that almost 85 percent of risky sexual acts occur within married couples. [45] It is noteworthy that a significant proportion of PLHIV had partners of unknown status or partners who had not been tested for HIV (PLHIV on ART: 55% and PLHIV on PT: 41% in article 1 and PLHIV with no treatment: 74% in article 4). We did not, however, find any evidence for an increase in sexual risk behaviours as a result of ART. Among PLHIV receiving ART unprotected sex with a HIV-negative or unknown status partner decreased significantly after 12 months on ART (50% at start of ART and 28% after 12 months). Other studies also report a decline in unprotected sex among PLHIV on ART

[45, 46, 57-60]; although one study from Cote d'Ivoire has documented a short term increase in unprotected sex after ART. [61]

Non-disclosure of HIV status and perceived or internalized stigma emerged as strong predictors of unprotected sex and multiple partners among PLHIV on ART as well as among those not receiving any treatment; also reported in other studies. [45, 46, 62-65] Qualitative evidence from PLHIV on ART suggests that the two determinants intersect where PLHIV are reluctant to disclose for fear of rejection (perceived stigma) by a partner which may or may not happen; in fact several participants reported support and acceptance from their partners on disclosing their positive status. [Article 3] Similar outcomes have been reported from Uganda and Brazil. [65, 66] Stigma in these cases referred to interpersonal relationships between partners or spouses and not at a community level. Depression was also found to increase the likelihood of unsafe sex in our study [Article 2]; however, a later study from South Africa did not support our findings. [46]

Negative attitudes and misconceptions towards condom use are widespread in the community, even among many of the PLHIV who use condoms. Views that condoms reduce pleasure and cause discomfort, mistrust of condoms and misconceptions regarding negative consequences of condom use e.g. cancer, and religious beliefs discouraging condom use still persist in the community. [67] The belief that condom use is associated with partner infidelity, especially when condoms are introduced into existing long term relationships without disclosure of HIV status, poses a major barrier. Sexual practices such as unprotected sexual intercourse during menstrual periods, unprotected heterosexual anal intercourse and oral sex without condoms were documented among PLHIV in article 4. These practices are not routinely explored during research but are high risk behaviours associated with risk of HIV transmission that need to be addressed by HIV prevention programmes. [68-70]

A desire for children was found to increase the likelihood of unprotected sex among HIV-positive women in our qualitative study. Similar supporting evidence is available from other studies from Brazil, India, Togo and Uganda. [71-75] At the same time many PLHIV do not desire more children but are also not using contraception necessitating further inquiry into whether this is intentional or a result of non-availability of

contraceptive methods. [76] High levels of unmet family planning needs were observed in our study.[Article 4] Using a non-condom based contraceptive method or not using any contraception was associated with unsafe sex among PLHIV. [Article 4] Although the integration of HIV prevention and treatment programmes with family planning programmes has been discussed widely at country level and at international meetings, effective integration of the two programmes is not taking place. [76-78] National HIV programmes need to review the integration of HIV and family planning programmes to identify weak links that require strengthening and gap areas that should be included in the programme.

Sexually transmitted infections (STI) are often regarded as surrogate markers for unprotected sex. PLHIV across all subgroups reported STI related symptoms in the reference period. In the comparative study presented in article 1, PLHIV on PT were more likely to report symptoms related to STIs than those on ART (22% vs. 13%). Forty-nine percent of the PLHIV who reported ever having a STI (44%) reported symptoms in the past 6 months in article 4. Across all subgroups male PLHIV were more likely to report STI related symptoms compared to female PLHIV. In the absence of laboratory testing we cannot be certain about these STI symptoms, for example, whether the genital discharge among women was physiological rather than pathological. Genital ulcers are more likely to be indicative of a pathological condition. In many countries, such as India, syndromic management of STIs, based on similar self-reported symptoms and signs, is the accepted form of care in primary health care clinics acknowledging that symptoms indicate an infection. [79] Self-reported STI symptoms suggest that some level of unprotected sex is occurring in the community. At the same time there is sufficient evidence that the presence of genital ulcers or discharge does increase the risk of HIV transmission. [23, 54]. Ulcers associated with Treponema pallidum, Haemophilus ducreyi and Herpes simplex infections and non-ulcerative inflammatory discharge associated with Chlamydia trachomatis, Neisseria gonnorhea, Trichomonas vaginalis and bacterial vaginosis are associated with an increased risk of HIV transmission. [8] This is particularly concerning when partners are discordant or of unknown HIV status.

From a programmatic point of view, the evidence from these studies should be shared with policy makers, program managers and health workers. New evidence coming from the HIV Prevention Trials Network study (HPTN 052 Press release 11 May 2011) demonstrating that early treatment with antiretroviral medications resulting in undetectable viral load confers protection against transmission of HIV among sero-discordant couples, in combination with previous evidence from the Swiss cohort study, will impact HIV prevention policies and strategies in the coming months. Debates on the feasibility of early initiation of ART for PLHIV are expected. However, achieving full coverage where all HIV-positive persons are treated as soon as they are detected positive appears unrealistic at this time. Ambrosioni et al (2011) discuss that not all HIV-infected persons know their status as people resist HIV testing fearing stigma. [80, 81] And of those who know their status not all have access to treatment, agree to be treated or take the therapy effectively.[10, 82] Developing countries, especially in sub-Saharan Africa with the highest burden of HIV, are resource strapped and dependent on donor supported treatment programs. Treatment programmes in these countries are unable to reach all those with advanced HIV disease who are eligible to receive ART. Globally, 36 percent (about 5.2 million) of the 15 million people in need in low- and middle-income countries were receiving antiretroviral therapy at the end of 2009; and in sub-Saharan Africa only 37 percent of those in need of ART were receiving therapy.[1]. In Kenya 30 percent of the adults with advanced HIV disease were still not receiving ART in 2009. [7] Diverting scarce resources from PLHIV with advanced HIV disease and in urgent need of ART for HIV prevention among asymptomatic individuals will be difficult to implement. Treatment failure and resultant viral resistance as a result of poor adherence or discontinuation of therapy still remain major concerns with ART. Counseling on consistent and correct condom use with all partners must continue to remain the mainstay of HIV prevention and condom use should only be discontinued on an individual basis for PLHIV on ART who attend clinic visits regularly, do not have other concurrent STIs and demonstrate effective therapy through repeated undetectable viral load measures that are sustained over a period of time. Wilson et al (2008) caution that the risk of HIV transmission in heterosexual partnerships in the presence of effective treatment is low but not non-zero, and that the transmission risk in male homosexual partnerships is high over repeated exposures. If the claim of non-infectiousness in effectively treated patients was widely accepted, and condom use subsequently declined, then there is the potential for

substantial increases in HIV incidence. [19] Caution must be exercised when disseminating this information

- Active follow up of HIV positive persons in the community

While PLHIV receiving ART or those on regular follow up at HIV clinics are easily reached, the challenge lies in reaching PLHIV in the community who, as our research shows, exhibit high levels of sexual risk behaviours and have a very high proportion of partners of unknown HIV status. Our study has demonstrated that PLHIV can be reached in the community through Community Health Workers (CHW) and peers counsellors at Post-test clubs in Mombasa. This strategy needs to be scaled up in Mombasa and other parts of Kenya to bring PLHIV into the ambit of the treatment programme and prevention interventions. This approach could be adapted in other countries. As a direct result of sharing our findings with NASCOP in Kenya, the Population Council was asked to translate a national training guide developed by the Centers for Disease Control (CDC) for Community Health Workers in Uganda. The Population Council and ICRH are presently evaluating the effectiveness of a community based HIV prevention intervention in Mombasa, delivered by CHWs.

A shift in the approach to dealing with newly diagnosed HIV-positive persons is warranted. Counsellors from VCT centres should be required to follow people who test HIV positive at their centres and encourage them to register at a HIV clinic or ART centre. Presently newly diagnosed HIV-positive persons receive post-test counseling and a referral slip for an ART centre following which they are left on their own; health workers do not follow PLHIV in the community due to confidentiality concerns. The programme would benefit from linking VCT referral slips and ART registration through VCT registration numbers. This would provide them with an accurate tally of the number of persons testing positive, number of HIV-positive persons registered at ART centres and number of HIV-positive persons in the community who have not registered. We have recommended the same in India based on results from a study examining enrolment of PLHIV into ART programs where we were able to follow newly diagnosed PLHIV in the community with the help of VCT centre counsellors.[9]

- Strengthen HIV prevention counselling

In view of the findings pertaining to multiple partners and unprotected sex within married couples, especially with untested or HIV-negative partners, health workers and counsellors need to focus on cohabiting or married clients emphasizing the risks associated with multiple/ concurrent partner relationships, the need for partner testing, and consistent condom use with all types of partners irrespective of HIV status. In light of new evidence from the HPTN study, where feasible, ART for prevention of HIV transmission could be considered for some high risk discordant couples. Counselors need to be informed of new developments and associated counseling needs. Stigma and disclosure are major barriers requiring an individualized and need based approach to prevention efforts sustained over several visits.

Counsellors and health workers also need to actively dispel myths and misconceptions related to condoms using scientific information. Counselling should include clear and specific information related to the risks associated with unprotected sexual intercourse during menstrual periods, heterosexual anal sex and oral sex as well as the increased risk for HIV transmission in the presence of other STIs. These issues do not routinely feature in prevention materials or counsellor training programmes. The CHW training manual does include information on STIs but nothing specifically on sex during menses, heterosexual anal sex or oral sex.

- Strengthen linkage between Reproductive Health and HIV services

Our study revealed a high unmet need for family planning among PLHIV in the community. HIV prevention services should routinely include family planning advice and referrals for PLHIV accessing services. For women living with HIV consultations with gynaecologists should be routinely programmed for annual pap smears to rule out cervical malignancy and evaluation and management of STI symptoms. Counseling on reproductive health and family planning should also be offered routinely to men living with HIV. As evidenced in our studies PLHIV continue to experience and report STI symptoms. An evaluation of other STIs should form a part of care at HIV clinics.

- Scaling up of HIV testing and counseling

KAIS 2007 estimates that more than 80 percent of HIV-infected persons do not know their HIV status. This gap needs to be addressed urgently. Further efforts are needed to expand HIV testing in the general population. Provider initiated testing has contributed to increasing the number of people getting tested. Universal testing and counseling for all ambulatory care at health clinics, hospital admissions, surgical procedures, dental care clinics, health camps and maternal child health and family planning services may be considered. Confidential HIV testing should be strongly recommended for health workers and staff at health centres and community health workers. Partner testing is vital, our study reveals PLHIV living with untested partners – all efforts should be made to bring partners in for testing and counseling.

5.2 Limitations

The research presented in this thesis was all conducted in Mombasa which may limit the ability to generalize findings to other settings. Mombasa is a large port town with a large number of migrant workers, at the same time it is also semi-rural with a population spread out over a wide geographic area. However, sexual behaviours appear to be similar across PLHIV populations and results are comparable across studies conducted in different locations across East and South Africa, e.g. no evidence of an increase in risk behaviours over 12 months on ART or evidence of unprotected sex among married couples.

All four studies presented here are either cross sectional or an observational cohort study in the context of ART and prevention counseling offered therein. Thus the evidence presented is limited to documenting behaviours or change in behaviours without attributing them to specific HIV risk reduction interventions. The four studies have been conducted in a phased manner, one leading to the next one. Evidence from studies presented in articles 1 and 2 led to the design of the study in article 4, and evidence from that one led to the study presently underway in Mombasa that evaluates a community based HIV prevention intervention.

The studies presented in the thesis have used different study designs and different sampling methods to recruit participants. Due to the limited number of HIV positive persons who could receive treatment under the pilot ART program, all PLHIV eligible

for treatment were recruited into the randomized controlled m-DOT adherence study as soon as they registered for ART. In articles 1-3 HIV positive participants receiving ART were drawn from the adherence study. Study participants provided information on sexual risk behaviours at baseline, 6 months and 12 months after ART (quantitative data). Although PLHIV participants receiving ART in the first three articles overlap, the studies explore sexual risk behaviour from different perspectives using different study designs: longitudinally over 12 months of ART (used baseline and 12 month data), cross-sectionally to compare sexual behaviours among PLHIV receiving ART (used 6 month data) with those receiving co-trimoxazole prophylaxis at the same clinics, and qualitatively to provide an in-depth understanding of sexual behaviours emerging from the two quantitative studies.

(i) In article 1 we compare sexual behaviours cross-sectionally across two independent convenience samples of PLHIV (ART for 6 months and co-trimoxazole prophylaxis for 6 months) accessing services at the same centres to draw conclusions on the influence of ART on sexual behaviours. Participants on ART were drawn from the adherence study and those on co-trimoxazole prevention therapy from those accessing HIV services. Clients in both groups received services from the same centres, were counselled similarly on HIV prevention and had monthly follow-up visits at centres. Although, the sampling process has methodological limitations and findings may not be generalizable to other settings; the study does provide evidence on differences in sexual behaviours between the two groups. Bateganya et al (2005) in Uganda and Moatti et al (2006) in Cote d'Ivoire used similar study designs to report on the influence of ART on sexual risk behaviours.[44, 60] The non-availability of CD4 cell counts and viral load measures for participants on co-trimoxazole prophylaxis limited our ability to compare participants with regard to their health and immune status.

(ii) In article 2 participants on ART were drawn from the adherence study and followed for 12 months after initiating ART and the analysis used baseline and 12 month data for comparison. Although participants in the cohort study were randomized to the m-DOT arm and control arm as a part of the adherence study (see annexure 3) they received similar counseling with regard to HIV prevention and we found no difference in the change in sexual behaviour between the two groups.

(iii) In article 3 we purposively selected 23 PLHIV from the cohort sample based on key characteristics of interest (from the baseline interview) for in-depth interviews to better understand the reasons, motivations and factors that influence sexual behaviours. This method of selecting cases nested within specific stratum has been used in other studies [34, 66, 83]

(iv) In article 4 we used a non-probability modified snow ball sampling to select PLHIV who were not accessing HIV care services. Studies have shown that PLHIV tend to remain isolated, poorly networked and reluctant to access services due to stigma concerns.[80, 81, 84, 85] Mshana et al (2006) found that both experienced and anticipated stigma prevents PLHIV from accessing treatment and care services and makes them hesitant to be followed in the community, while Roura et al (2009) conclude that stigma concerns continue to prevent uptake of services including VCT years after the roll out of free ART services in rural Tanzania.[10, 11] Therefore, reaching HIV positive persons in the community poses a major challenge. Most sampling strategies to reach hidden populations such as men who have sex with men, injecting drug users and sex workers rely on the social and peer networks of these populations. Snow ball sampling is chain referral sampling method where participants recruit peers who bring in their peers and so on. [86] A drawback of this method is the heavy reliance on the initial sample, bias towards more cooperative subjects and respondents with larger networks. Respondent Driven Sampling (RDS) is a form of chain referral sampling that combines 'snowball sampling' with a mathematical model that weights the sample by accounting for the size of the participant's social network. [87-90]. Another strategy, Targeted Sampling, is an approach that relies on several mechanisms: epidemiologic approaches to describe geographic areas, ethnographic methods to describe the population with regard to approximate size, location and characteristics. Participants are then recruited through the help of outreach workers using chain referral sampling.[91] In Mombasa the Coast Province Network of Positive People is small and poorly organized. Our study on stigma found that PLHIV are reluctant to share their status, are poorly networked with high levels of internalized stigma (see annexure 5). To address these barriers we used a modified snowball sampling method and used health workers to recruit participants. Community health workers and counsellors from Post Test Clubs were asked to recruit PLHIV, who were not accessing ART services, from the geographic areas where they worked. To reduce

the biases related to the recruiter and the initial sample, bias towards more cooperative subjects and respondents with larger networks, the number of clients each health worker could bring into the study was restricted. In the data analysis we did not control for the network size as is done routinely in RDS, for the following reasons: a) the health workers did not belong to the same risk group and therefore did not share the network of the study participants they recruited; and b) PLHIV tend to be relatively isolated keeping their HIV positive status restricted to themselves or within the immediate family resulting in small poorly developed social networks and c) recruitment was based on non-probability sampling. We did not control for clustering at the recruiter level, which could lead to increased variance in reported behaviours, for several reasons: a) we found no significant socio-demographic differences between PLHIV recruited by community health workers and those recruited by counsellors from Post Test Clubs; b) health workers recruited participants from within a fixed geographical area reaching PLHIV from different risk groups (PLHIV from different risk groups live together in Mombasa, there are no districts specific to certain risk groups) and c) health workers were allowed to recruit a limited number of participants into the study. Peltzer et al (2008) describe symptom experiences of PLHIV recruited by key informants, through support groups and by other PLHIV. They use hierarchical regression analysis without controlling for clustering by recruiter. [92] Although we were able to recruit a sufficiently diverse sample of PLHIV, it is not a random representative sample. Therefore, in view of the limitations posed by sampling method used to reach PLHIV in the community the findings from our study should be interpreted with caution and in context. More studies assessing sexual risk behaviours among PLHIV not accessing services are needed.

We have relied on self-reported behaviours in all four studies which may be subject to social desirability and recall biases. Reviews of validity and reliability of HIV research have, however, found that sexual behaviour data are fairly consistent and self-reported data on sexual acts reasonably congruent especially for infrequent acts and short recall periods. [93-95] There are also concerns that repeated data collection in cohort studies can affect data reliability and validity. Nevertheless several studies collect sexual behaviour data over long periods, for example, the Swiss Cohort study where data was collected over several years and Uganda study reporting self reported behaviours over a three year period. [47, 96] To reduce biases related to repeated data collection and

improve recall we designed the questionnaire to refer to the period since the initiation of ART for data collection at 6 months and 12 months. Participants were encouraged to respond truthfully by assuring them that their responses would not affect the services they received and that there were no 'right or wrong' responses. The fact that studies conducted in other locations exploring the same behaviours have also relied on self-reported behaviours with comparable findings, may contribute to minimize the effect of the bias when making recommendations for programmes. New technologies for data collection such as Audio Computer Assisted Self Interviewing (ACASI) and Interactive Voice Response System (IVRS) have been evaluated to reduce social desirability biases when collecting data on sexual behaviours.[97, 98] ACASI has been found to be superior to face-to-face interviews with regard to self-reported condom and microbicide gel use. The program works well with low literacy clients. IVRS, on the other hand, has not performed as well. It has several limitations: it can support only short questionnaires, is dependent on local phone network coverage and phone charging, and relies on the client to pick up the call. In our recent study with sex workers in South India we found an overall compliance rate of 15.7 percent with 81 percent logical responses to IVRS based responses on condom use and microbicide applicator use. (Unpublished data) Recent studies that have used biomarkers such as Prostate Specific Antigen and Rapid Stain Identification to validate self-reported condom use behaviours suggest that self-reported behaviours should be interpreted with caution when evaluating HIV prevention interventions. [99-101] We are using ACASI to collect sexual behaviour data in the Population Council and ICRH study evaluating a community based HIV prevention intervention currently underway in Mombasa. New studies would benefit from using new technologies for data collection and biomarkers to validate sexual behaviour data.

5.3 Directions for future research

Although several studies have shown no significant increase in high-risk sexual behaviours among individuals receiving antiretroviral therapy, most have followed study participants for a maximum of 12 months. One study from Cote d'Ivoire did document a short term increase in sexual risk behaviours with ART. Thus, while existing research does not support the notion of 'disinhibition', the limited evidence suggests that measuring behaviour change and HIV prevention efforts among those

receiving ART remains a high priority. Research is needed to document changes in sexual risk behaviours over long term antiretroviral therapy, for example 3 to 5 years of treatment especially in light of new findings about non-infectiousness with effective ART (HPTN 052) to detect possible sexual 'behavioural disinhibition' among PLHIV. We found only one study with a three year follow-up.[47] Longer term follow-up becomes even more important in the context of poor adherence leading to treatment failure and higher viral loads, and the possibility of sexual transmission of resistant and more pathogenic viral strains to both HIV-negative and HIV-positive partners. Higher viral loads are associated with greater risk of HIV transmission. [23, 102] Research on sexual risk behaviour should include biomedical markers and measures of viral load. Self-reported condom use has always been a contentious issue with regard to its validity. It is time for biomarkers to be used in sexual behaviour studies e.g. Prostate Specific Antigen (PSA) or Rapid Stain Identification (RSID) for semen to validate reports of condom use and STI testing. [103-105]

Given the evidence that early ART can reduce HIV transmission and that ART may not be available for every asymptomatic PLHIV, modelling studies are needed to determine the feasibility and cost impact to HIV programmes for providing ART for discordant couples. As ART services are scaled up and information about ART reducing infectiousness spreads in the community, research exploring 'treatment optimism' and sexual 'behavioural disinhition' in high risk groups and youth is needed.

There has been much discussion about concurrent sexual relationships in Africa. While there is evidence that concurrent sexual relationships are associated with a higher risk for HIV transmission through sexual networks there is a lack of consensus on how concurrency is defined, how it should be measured and to what extent it influences the HIV epidemic in Africa. [106, 107] Further research is warranted to assess the actual risk of transmission and its impact on the epidemic.

The association between depression and unprotected sex among HIV-positive persons has not been clearly established and merits further research. Depression, non-disclosure, internalized stigma and lower self-efficacy influence condom use. Teasing out these relationships through qualitative research and establishing the association using quantitative research methodology is required. Home based testing is being

promoted as a strategy to encourage disclosure and partner testing; further research is needed to examine the acceptability and effectiveness of this approach. Preliminary findings from our current study in Mombasa exploring a community based prevention intervention suggest low uptake of home based HIV testing (unpublished data). We did not explore the role circumcision plays in influencing sexual risk behaviours in our studies and would recommend that circumcision be included in future sexual behaviour studies.

5.5 Conclusions

In conclusion HIV positive persons are a key target group for HIV prevention programmes. High risk behaviours described as multiple and/or concurrent partners and unprotected sex with partners are prevalent among both PLHIV accessing HIV care services, those who are in regular contact with health workers and exposed to prevention messages, as well as among PLHIV in the community who are not accessing HIV treatment or care services. There is no evidence to suggest that ART leads to an increase in unsafe sex. PLHIV in the community exhibit higher levels of risky behaviours than those in care services. Prevention programmes need to urgently reach this population in the community and bring them into the ambit of treatment and HIV prevention services. In light of new evidence on the effectiveness of early treatment with antiretroviral medications in reducing HIV transmission among discordant couples, HIV programmes need to be careful about disseminating this information in the community as widespread decline in condom use may lead to resurgence of new infections. Counseling on consistent condom use with all partners and partner reduction should remain the main focus of prevention programmes. Prevention efforts targeting PLHIV may have marginal benefits as the number of undiagnosed HIV infected people vastly outnumber those who know their status and may be accessing prevention programs. However, efforts must continue to focus on PLHIV because this has the potential to reach the untested partners of PLHIV, high risk groups and others in their limited networks. There is sufficient evidence documenting risk behaviours, prevention programmes now need to implement strategies to promote safe sex behaviours and research is needed to evaluate these strategies for effectiveness. Successful models have been demonstrated in western countries; some of these should be adapted and evaluated in Kenya.

Summary

In 2009, Kenya had an estimated 1.5 million people living with HIV and in the same year an estimated 110,000 people were newly infected with HIV. HIV continues to spread in the population despite the existence of prevention programmes. HIV can only be spread from a HIV-positive person to HIV-negative person or in some cases even to HIV-positive person with a different viral strain. Thus PLHIV are a key target group for prevention programmes.

This thesis is based on four research studies conducted with PLHIV in Mombasa, Kenya between 2004 and 2008. The first of these studies (articles 1-3) were conducted with PLHIV when ART was first rolled out in Kenya with USAID support. These studies were among the first to examine sexual risk behaviours in the context of ART. Findings from these studies documenting higher risk behaviours among PLHIV co-trimoxazole prophylaxis for opportunistic infections led to the fourth study exploring sexual risk behaviours among PLHIV in the community who were not receiving any treatment. Evidence from that study has led to a fifth study presently underway in Mombasa that evaluates a community based HIV prevention intervention delivered by CHWs for PLHIV in the community not receiving treatment.

The studies presented in this thesis provide an overview of sexual behaviours of three different subgroups of PLHIV: (1) PLHIV who a receiving ART and therefore are in regular contact with health workers and prevention services; (2) PLHIV who are not eligible for ART but are visiting health services for follow up services and receiving co-trimoxazole prophylaxis for opportunistic infections and therefore continue to have contact with health workers, and (3) PLHIV in the community who are not accessing HIV care services and therefore do not have contact with health workers or prevention services.

Key findings: Sexual risk behaviours defined as multiple sexual partnerships and unprotected sex with partners are prevalent to variable degree among the various PLHIV subgroups; PLHIV not receiving any treatment exhibit the highest level of risky behaviours. A major concern to prevention programmes is the reporting of unprotected sex with sero-discordant or unknown status sexual partners. A large section of PLHIV have partners of unknown HIV status or untested partners; 75 percent of the partners of PLHIV not accessing HIV care services were of unknown HIV status. Non-disclosure of HIV status to partners, perceived or internalized stigma and depression were significantly associated with unprotected sex. We did not find any evidence of an

increase in sexual risk behaviours after 12 months of ART; in fact we noted a significant decrease in the proportion of participants reporting unprotected sex with HIV-negative or untested partners after 12 months on ART. Qualitative data revealed that PLHIV attempt to control risky behaviours after testing positive or starting ART, but struggle with disclosure, fear of abandonment, partner reaction or refusal to test, and misconceptions and religious beliefs pertaining to safe sex, condom use and gender norms.

Further research is needed to better understand the factors that influence sexual risk behaviours. There is urgent need for intervention research to identify effective HIV prevention strategies or interventions that are acceptable in this community.

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Annexure 1

Sexual behaviour of HIV-positive men currently on Antiretroviral Therapy

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Sexual Behaviour of HIV Positive Men Currently on Antiretroviral therapy

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ABSTRACT

With increased availability of highly active antiretroviral therapy (HAART), preventive and protective sexual behaviour of people living with HIV/AIDS (PLHA) is an area of special concern. A cross-sectional study exploring the sexual risk behaviour among PLHA receiving HAART was conducted at one private and three public sector health facilities in Pune and Delhi. Results from 260 male patients are presented. Median age was 37 years (range 23 to 70 years). Eighty eight per cent respondents were currently married; 70 per cent reported knowing their partner's status and about half reported having a HIV-negative partner.

Sixty one per cent respondents reported sex in the last 6 months of which 96 per cent did so with a regular partner. With regard to regular partners, 82 per cent of the respondents reported knowing their partner's HIV status and of these 45 per cent respondents reported having a sero-discordant partner. Disclosure to a partner was strongly associated with partner status and was made most often HIV-positive partners (82%) followed by HIV-negative partners (73%) and least often to partners of unknown status (48%; $p < .01$). Ninety per cent of the respondents reported using a condom at last sex; most often with HIV-negative partners (95%) followed by HIV-positive partners (86%) and partners of unknown status (85%); 82 per cent respondents reported using condoms consistently. Of those reporting sex in the reference period, very few respondents mentioned sex with a casual partner or a sex worker and none reported sex with a male partner. With regard to casual partners and sex workers, none of the men disclosed their HIV status to them, none knew their partner's HIV status, but all reported using a condom at last sex. Although, overall risk behaviour was low and most reported sexual activity was with regular partners and reported condom use at last sex with HIV-negative regular partners was high, lower levels of disclosure of serostatus and condom use were reported with partners of unknown status and sero-concordant

partners. Prevention related interventions focusing on regular partner relationships that encourage disclosure and consistent condom use need to be integrated into AIDS care services.

INTRODUCTION

Highly active anti-retroviral therapy (HAART) typically results in improved immune status by lowering viral loads and increasing CD4 counts, thus slowing disease progression, and fostering better health outcomes (1-4). With increased availability of HAART more people are living longer and healthier lives. This includes continuing or resuming sexual activity, thereby increasing the chance of transmission of infection. There is some evidence, mostly from populations of men who have sex with men (MSM) in western countries, that unprotected sex (5-10) and the incidence of sexually transmitted infections including HIV (11-12) have increased since HAART became more widely available. There is similar evidence of increased risk behaviour among HIV-positive men and women (13-14). Dukers et. Al. found that risk behaviour with casual partners was associated with immunological and virological improvements among homosexual men (15). This may in part be related to a perception among infected persons of lower infectivity due to low viral loads as a result of being on HAART. Crepaz et al conducted three meta analyses exploring (a) prevalence of unprotected sex in HIV positive patients on HAART vs. those not receiving HAART (b) prevalence of unprotected sex in patients on HAART with undetectable viral loads vs. patients with detectable viral loads and (c) prevalence of unprotected sex related to beliefs about reduced transmission with HAART or less concern about engaging in unprotected sex among people with HIV positive, HIV negative and unknown serostatus. Findings of this analyses revealed that people's beliefs about HAART and viral load may promote unprotected sex, even though HIV-positive patients receiving HAART, including those with undetectable viral loads, did not exhibit increased sexual risk behaviour (16). While preventive and protective sexual behavior of HIV-positive persons on antiretroviral therapy (ART) has become an area of special interest and concern; there is very little information on this in India.

Although, the prevalence of HIV infection in India is less than one per cent, it is estimated that 5.1 million people are infected with HIV, making India the country with the second highest number of infections in the world. Despite various prevention

efforts, the number of persons living with HIV/AIDS is increasing with heterosexual intercourse the principal mode of transmission. In India, around 85 per cent of new infections are due to heterosexual transmission. HIV is spreading beyond risk groups into the general population and the number of women infected is rising, with one in four HIV cases now a woman (17). In April 2004 the Government of India announced anti-retroviral therapy provision through selected public sector health facilities in the six highest prevalence states; this program is now being scaled up to additional sites in high prevalence states as well as other states. One of the major concerns with scaling up of ART in resource-limited settings is the emergence of drug resistant viral strains as a result of sub-optimal adherence and the subsequent transmission of resistant viral strains in the population through unprotected sex.

This paper is based on a study that was designed to assess adherence to treatment and sexual risk behaviour among 310 HIV-positive persons currently on HAART at private and public health facilities in Pune and Delhi. The study also investigated how clients of private sector facilities pay for ART.

STUDY DESIGN

The study used a cross sectional design. HIV-infected persons receiving ART at selected facilities were interviewed once as they came in for routine follow-up visits at outpatient clinics at one private and three public sector health facilities; patients admitted in the ward were not interviewed. All patients who had been on ART for at least one month and were willing to be interviewed were recruited into the study. Interviews were conducted at Ruby Hall Clinic (private sector) in Pune, Employees State Insurance Corporation (ESIC) Hospitals (public sector) in Delhi and Pune and at Northern Railway Hospital (NRH) in Delhi (public sector) between May and August 2004. Public health facilities included in this study (ESIC, NRH) provide government-supported health insurance schemes in the organized sector whereby employers provide health care coverage for employees. ESIC provides health coverage to employees of small-scale industries and offices (factories, restaurants, news paper offices, security services). NRH provides health coverage to employees of the Indian Railways. Both programs extend health coverage to the families of employees as well. In the private sector health facility patients pay fee-for-service and the amount is usually entirely paid out-of-pocket. Men are generally the income-earning members of

the family with control of financial resources and thereby greater access to care services. Even when services are open to family members, they are routed through the employee, usually men, giving them greater access to services.

Using a semi-structured questionnaire, trained external interviewers conducted interviews in Hindi, Marathi and English. Ethical approval was obtained from the Ethical Review Board of the Population Council and the ethics committees of participating health facilities. Written informed consent was obtained from all participants.

The analysis is limited to sexual risk behaviour of 260 male respondents. The recall reference period for the study was the past six months. Chi Square test was used to assess significance between variables of interest. Mann Whitney test was used to assess significance where Chi Square test was not available due to skewed data distribution Relevant chi-square and z statistics have been reported.

RESULTS

Background Characteristics

The median age was 37 years (range 23 to 70 years). Ninety one per cent of the respondents were employed and of these, 92 per cent reported working full time. Eighty eight per cent of the respondents were currently married, 8 per cent single (never married) and 4 per cent divorced or widowed. Seventy per cent of married respondents reported knowing their spouse/partner's HIV status; of these 48 per cent reported having a HIV negative spouse/partner (Table 1).

Table 1: Background information of study participants (n =260)

	Per cent
Age	
≤25 years of age	1.9
26-45 years of age	78.5
≥46 years of age	19.6
Education	
< 5 years of school	6.9
6-12 years of school	54.2
University	38.8
Employment	
Employed	91.2
Unemployed	8.8
Marital status	
Currently married	87.7
Single (never married)	8.1
Separated/divorced/widowed	4.2
Knowledge of partner's HIV status	
HIV positive	32.0
HIV negative	47.8
Unknown status	20.2
Time since HIV diagnosis	
Less than 12 months	18.8
13 to 24 months	23.5
More than 24 months	57.7
Time since starting ART	
Less than 12 months	40.8
13 to 24 months	27.3
More than 24 months	31.9
CD4 counts at start of art	
Less than 100 cells/ mm^3	45.1
101 to 200 cells/mm^3	38.5
More than 200 cells/mm^3	16.3
Current level of depression	
Minimal	50.4
Mild	15.4
Moderate	16.5
Severe	17.7

Reported Sexual Activity in the Past Six Months

As per national guidelines, ART is initiated in HIV-positive patients with CD4 cell counts of less than 200 cells/mm^3 indicating late HIV disease. At this stage, patients are usually fairly sick and may have experienced an episode or two of opportunistic infections. Once on HAART, patients' immune and health status generally improve. Sixty one per cent reported having had sex during the past six months.

Sexual activity in the past six months was reported by 65 per cent of married respondents followed by single (33%) and separated respondents (18%) (Table 2). Time since diagnosis of HIV disease, defined as time since HIV testing, was explored. There was no significant association between respondents' sexual activity in the past six months and the time since diagnosis of HIV infection. Similarly, there was no significant association between respondents' sexual activity in the past 6 months and the time on treatment. However, disease stage based on CD4 counts at the start of taking ART was found to be associated with reported sexual activity during the reference period. Patients who had initiated ART with very advanced HIV disease (CD4 cells <100/mm^3) were significantly less likely to report sexual activity in the past six months compared to respondents who had initiated ART with higher CD4 cell counts. Current depression was assessed using Beck Depression Inventory (BDI II). Study participants with moderate to severe depression were less likely to report sexual activity in the past 6 months when compared to those with minimal to mild depression.

Table 2: Percent distribution of reported sexual activity in past six months

Characteristic	Sexual activity in past 6 months Yes (n-158)	No (n-102)	Significance*
Age			
<45 years	62.2	37.8	χ^2 = .916; df=1; p .338
> 46 years	54.9	45.1	
Marital status			
Currently married	65.4	34.6	χ^2 =17.007; df=2; p .000
Single (never married)	33.3	66.7	
Separated/divorced/widowed		18.2	81.8
Time since HIV diagnosis			
Less than 12 months	57.1	42.9	χ^2 = 1.462; df=2; p .481
13 to 24 months	67.2	32.8	
More than 24 months	59.3	40.7	
Time since starting ART			
Less than 12 months	62.3	37.7	χ^2 = .387; df=2; p .824
13 to 24 months	57.7	42.3	
More than 24 months	61.4	38.6	
CD4 count at start of ART			
Less than 100 cells/ mm^3	51.7	48.3	χ^2 = 6.526; df=2; p .038
101 to 200 cells/mm^3	67.7	32.3	
More than 200 cells/mm^3	66.7	33.3	
Depression			
Minimal	70.2	29.8	χ^2 = 11.826; df=3; p .008
Mild	60.0	40.0	
Moderate	46.5	53.5	
Severe	47.8	52.2	

* Chi square test

Type of Partners

Respondents were asked about different type of partners. A regular partner was defined as a spouse or someone with whom the respondent lived or had a stable relationship. A casual partner was defined as a partner the respondent had sex with only once or rarely and was not living with or married to. A sex worker was defined as a partner the respondent paid money to in exchange for sex. Ninety six per cent of the 158 respondents who reported sexual activity in past six months reported having sex with a regular partner, very few reported sex with a casual partner or a sex worker (Figure 1). Three per cent of male respondents reported ever having had sex with a male partner; none reported sex with a male partner in the past six months

Regular Partner Relationships

Regular partner relationships were explored further with respect to knowledge of partner's HIV status, disclosure of own status to partners and condom use at last sex by partner type. Overall 82 per cent of the 152 respondents who reported sex with a regular partner reported knowing their partner's HIV status, 73 per cent had disclosed their own HIV status to their regular partner, 90 per cent reported using a condom the last time they had sexual intercourse with their regular partner and 82 per cent reported always using a condom with their regular partner during the reference period.

Among respondents with regular partners (n=152) partner's HIV status was strongly associated with whether the respondent disclosed to that partner (Table 3). Disclosure was highest among respondents with HIV-positive partners (84%); seventy three per cent of the respondents with an HIV-negative partner and only 48 per cent of the respondents with a partner of unknown status reported disclosing their status ($p = .002$). Age, education, time since HIV diagnosis, time on ART and depression were not found to be associated with disclosure of one's status to a regular partner. In contrast condom use at last sexual intercourse with a regular partner was reportedly highest with an HIV-negative partner (Table 3).

Ninety six per cent of the respondents with a HIV-negative partner, 86 per cent of those with an HIV-positive partner and 85 per cent of those with a partner of unknown HIV status reported using a condom at last sex but the differences were not statistically significant. Condom use at last sex with a regular partner was significantly lower among respondents with less than five years of schooling when compared to those with higher education levels and respondents over 45 years of age. Time since HIV diagnosis and time on ART were not found to be associated with condom use with regular partners. (Table 3)

Table 3: Disclosure and condom use with regular partner (n-152)

Variable	Disclosure		Condom use at last sex	
	% Yes	% No	% Yes	% No
Age Group				
< 45 years	70.2	29.8	92.8	7.2
> 46 years	85.2	14.8	77.8	22.2
Significance	χ^2 = 2.530; df=1; p .112[1]		χ^2 = 5.633; df=1; p .029[2]	
Education				
< 5 years of school	8.8	31.3	68.8	31.3
6-12 years of school	73.6	26.4	91.8	8.2
University education	73.0	27.0	93.7	6.3
Significance	χ^2 = .158; df=2; p .924[1]		χ^2 = .9.324; df=2; p .009[1]	
Marital status*				
Currently married	73.5	26.5	90.5	9.5
Single (never married)	50.0	50.0	100.0	0.0
Separated/divorced/ widowed	50.0	50.0	50.0	50.0
Time since HIV diagnosis				
Less than 12 months	66.7	33.3	82.1	17.9
13 to 24 months	65.0	35.0	90.0	10.0
More than 24 months	78.6	21.4	92.9	7.1
Significance	χ^2 = 3.158; df=2; p .206[1]		z = -1.429 ; p .134[3]	
Time since starting ART				
Less than 12 months	70.3	29.7	89.2	10.8
13 to 24 months	71.1	28.9	94.7	5.3
More than 24 months	77.6	22.4	87.8	12.2
Significance	χ^2 = .818; df=2; p .664[1]		z= -.136 ; p .892[3]	
CD4 count at start of ART				
Less than 100 cells/ mm^3	63.3	36.7	90.0	10.0
101 to 200 cells/mm^3	81.5	18.5	90.8	9.2
More than 200 cells/mm^3	69.6	30.4	87.5	12.5
Significance	χ^2 = 5.264; df=2; p .072[1]		χ^2 = .207; df=2; p .901[1]	
Depression				
Minimal to mild	69.6	30.4	92.9	7.1
Moderate to severe	82.1	17.9	82.5	17.5
Significance χ^2=3.555;df=1;p=.062***[2]	χ^2 = 2.252; df=1; p .133[1]			
Partner's HIV status				
HIV positive	84.2	15.8	86.0	14.0
HIV negative	73.1	26.9	95.6	4.4
Unknown status	48.1	51.9	85.2	14.8
Significance	χ^2 = 12.051; df=2; p .002[1]		χ^2=4.132; df=2; p .127 [1]	

*Significance not reported as very few respondents fell into single and divorced category

[1]Chi Square, [2] Fishers exact test, [3] Mann Whitney U

Eighty two per cent of the respondents reported always using a condom with their regular partner in the last 6 months; 2 per cent reported using condoms frequently and 16 per cent sometimes.

Sex with Casual Partners and Sex Workers

Five per cent of the respondents reporting sexual intercourse in the last six months reported sex with a casual partner during the reference period. Of those who reported sex with a casual partner (n = 8) three respondents reported they thought their partner was HIV negative but had not asked the partner. Five respondents reported not knowing their partner's status. None of the respondents disclosed their own HIV status to these partners. All respondents reported using a condom the last time they had sex with their most recent casual partner during the reference period.

Three respondents (2%) reported having sex with a sex worker. All reported not knowing the partner's HIV status, not having disclosed their own HIV status to these partners but used a condom the last time they had sexual intercourse.

DISCUSSION

The vast majority of respondents in this study were currently married and it is interesting to note that almost half (48%) were in a discordant relationship with an HIV negative partner. This sets the stage for risk of transmission of infection to the negative partner and highlights the importance of emphasizing preventive and protective behaviour within the health care setting.

In the study sample, most reported sexual activity was with a regular partner. While overall rates for disclosure of the study participant's HIV status to their regular partner were relatively high, disclosure was more frequent to an HIV-positive partner than an HIV-negative partner. More than a quarter of the respondents who reported sex in the reference period did not disclose their HIV status to a negative partner and more than half did not disclose to a partner of unknown HIV status. This places HIV-negative partners or partners of unknown status at risk of contracting HIV infection. We are unable to comment on a temporal relationship between disclosure and knowledge of partner status.

Overall reported condom use with a regular partner was high. The study found that more than 95 per cent of respondents with a HIV-negative regular partner reported

using condoms at last sex. A study of sero-discordant couples in California found sero-positive respondents taking ART (protease inhibitors) were less likely to report unprotected sex with their negative partners compared to those not taking ART (18). While it is encouraging to note the high percentage of condom use with HIV negative partners, reported condom use was lower among respondents with partners of unknown status. This combined with low rates of disclosure to partners of unknown HIV status places these partners at considerable risk of HIV infection. Respondents with HIV positive regular partners also reported lower condom use. This places them and their partners at risk of re-infection with new viral strains. A literature review by Crepaz et al found that in nine out of eleven studies persons living with HIV were significantly more likely to engage in unprotected sex with sero-concordant partners when compared to uninfected partners (19). Condom use with a regular partner was lower among older respondents (>46 years of age) when compared to younger respondents in our study. Higher condom use by younger men attending sexually transmitted disease clinics in Pune has been recently reported **(20).** This study and ours may suggest that older males are more likely to perceive condoms as a family planning method than as a method for disease prevention, although further research is needed to better understand the social and cultural factors influence condom use for STI/HIV prevention among older males.

Consistent condom use with regular partners was lower than that reported at last sexual intercourse, and almost a fifth did not use condoms consistently. Although some respondents neither enquired about their casual partner's or sex worker's HIV status nor disclosed their own positive status, it was encouraging to note that all reported using condoms at last sex with these partners. Unfortunately we are unable to rule out the extent to which social desirability may have influenced these responses.

While our study found some evidence of risk behaviours among respondents on HAART (eg. unprotected sex, multiple partners and sex with sex workers), overall there were relatively low levels of risky behaviour. Low risk behaviour may be explained when taking into account many study participants' history – getting tested and diagnosed, having HIV disease advanced enough to warrant treatment and having had several contacts with health workers in the course of their treatment (treating physicians, nurses, counselors etc) who convey prevention and protection messages.

Although there is concern that sexual risk behaviour may dramatically increase once HIV positive persons feel better on treatment **(21),** our study did not support this view. There were no significant differences sexual behaviour, in disclosure rates and condom use by respondents on ART for different periods of time (less than 12 months, between 13 and 24 months and more than 24 months). A cross sectional study design has its limitations and more prospective studies with patients on ART are needed to validate these findings in India. In a recent meta-analysis Crepaz et al reported no significant relationship between being on HAART and engaging in unprotected sex among HIV positive persons and stratified analysis has in fact shown patients on HAART were significantly less likely to have engaged in unprotected sexual intercourse **(16, 18).** However, all studies included in the meta-analysis were from the industrialized world, therefore more studies in developing countries are needed.

CONCLUSIONS

Traditionally the focus of prevention programs has been on high-risk groups such as sex workers, men who have sex with men, truckers, etc. The evidence from our study highlights the need for expanding the scope of prevention programs to include HIV positive populations with a special focus on regular partner relationships that facilitate disclosure and emphasize consistent condom use. While sero discordant couples retain the focus of prevention efforts, sero concordant couples also need a special focus, as the risk of re-infection with a different HIV strain remains. Prevention related interventions that integrate HIV prevention activities with HIV AIDS care services are required.

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Annexure 2

Access to Antiretroviral Therapy for Adults and Children with HIV Infection in Developing Countries: Horizons Studies, 2002–2008

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Access to Antiretroviral Therapy for Adults and Children with HIV Infection in Developing Countries: Horizons Studies, 2002–2008

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SYNOPSIS

The Access-to-Treatment research initiative of the Population Council's Horizons program undertook 11 projects across Asia and sub-Saharan Africa from 2002 to 2008. The projects included a variety of cross-sectional exploratory studies, situation analyses, and longitudinal randomized, controlled intervention studies that examined service delivery, community awareness, health-seeking behaviors, adherence, cost, and other factors affecting treatment for adults and children infected with human immunodeficiency virus (HIV). This article summarizes the key findings and lessons learned from these projects, and examines cross-cutting issues such as stigma, quality of life, and sexual-risk behaviors among people living with HIV and acquired immunodeficiency syndrome on antiretroviral therapy. The article concludes with recommendations for evidence-based programming and future research around treatment for both children and adults.

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More than 60 million people have been infected with human immunodeficiency virus (HIV), and 20 million have died since acquired immunodeficiency syndrome (AIDS) was first described in 1981.[1,2] Treatment with antiretroviral therapy (ART) became widely available in developed countries in 1996, but access in developing countries lagged until advocacy and generic competition drove down prices in 2002.[2] Although a handful of countries such as Brazil, Thailand, Senegal, and Botswana were providing ART for adults through public-sector health facilities as early as 2000, treatment programs in most other developing countries were not established until 2002 or later. ART services for children were initiated much later and continue to be limited. The introduction of treatment programs in low-resource settings raised questions about readiness of health systems, quality of service delivery, capacity of human resources, and ability of individuals to adhere to the programs, for which relevant evidence from developing country contexts did not yet exist.

In light of these issues, the Horizons program convened a meeting of international experts in 2001 to prioritize research questions around access to ART and the operational challenges related to the introduction of therapy in developing-country settings.[3] The resulting Access-to-Treatment research initiative was launched in 2002 and has spawned 11 projects (Figure) across Asia and sub-Saharan Africa examining service delivery, health-seeking behaviors, adherence, cost, and other factors affecting treatment for adults and children infected with HIV. This article summarizes the key findings and lessons learned from these projects, and examines issues such as stigma, quality of life, and sexual-risk behaviors among people living with HIV and AIDS (PLHA) on ART. The article concludes with recommendations for evidence-based programming and future research around treatment for both children and adults.

IDENTIFYING PROBLEMS AND GAPS

Patient retention and adherence

Horizons initially undertook exploratory studies to investigate gaps in programs that were planning to or had already initiated ART services. These studies identified patient retention and adherence to treatment as major challenges for scale-up. A 2002 situation analysis of the newly implemented national ART program in 15 hospitals in five northern provinces of Thailand documented a dropout rate of 30% in the first six months of the program,[4] primarily because of side effects and lack of ongoing support. Types of nonadherence included missing doses, not taking medications on time, and not following treatment instructions.

A 2004 study of PLHA in India found adherence to be significantly lower among patients with severe depression and among those receiving free ART compared with patients in the private sector who paid out-of-pocket for treatment. The study also revealed that patient knowledge about their medications was low, highlighting the need for better patient education prior to initiating ART and ongoing adherence support thereafter.[5,6]

Gaps in provider training

Gaps in provider training, confidence, and competency also emerged as important barriers to service delivery. In Thailand, a majority of ART providers (i.e., doctors, nurses, and counselors) reported difficulties in counseling on medication side effects, and nearly half of the doctors reported difficulties in diagnosing and managing side effects and medication interactions, despite receiving intensive training.[4] A health-care worker survey in three Kenyan provinces revealed knowledge gaps and low confidence regarding pediatric HIV diagnosis protocols, medication management, management of comorbidities, vaccination in symptomatic children, prevention of mother-to-child transmission (PMTCT), and counseling.[7] Horizons researchers also identified a lack of standardized or coordinated training for health-care workers on the management of pediatric HIV in South Africa, where most doctors and nurses reported receiving no formal training in ART and relied upon self-directed study from books and online courses.[8]

Integration with other health services

Horizons researchers documented minimal integration of HIV prevention, care, and treatment services, and weak links between services. In South Africa, a 2002 situation analysis of direct and ancillary HIV/AIDS services in 98 health facilities in KwaZulu-Natal, a province where adult HIV prevalence was 30%, revealed that less than one-third of the women receiving antenatal care were counseled on HIV, sexually transmitted infections, and PMTCT; only 42% of community health centers and 17% of clinics provided PMTCT services; and only one-half of the facilities offered voluntary counseling and testing for HIV.[9] Lack of integration also was reported between ART and tuberculosis (TB) services.[10] A study exploring current practices in pediatric ART rollout at 16 sites in five South African provinces found that the majority of children receiving ART were referred from community clinics when sick or from inpatient wards; less than 2% of children

Figure. Sample characteristics and study designs of Horizons' Access-to-Treatment study projects, 2002–2008

Study title and country	*Year(s) of study*	*Target population*	*Sample size (n)*	*Type of study*	*Sampling methodology*	*Key findings*
Reproductive health services in KwaZulu-Natal, South Africa: a situation analysis study focusing on HIV/AIDS services[a]	2002–2003	Adults infected with HIV	98 health facilities 418 clients 299 health-care providers	RSA descriptive	Simple random sampling of health facilities Convenience sampling of respondents	Integration of reproductive health into ANC services was limited. Availability of PMTCT services to ANC clients was limited to a few centers. Facilities had basic services to treat STIs but lacked laboratory facilities to test for STIs, including HIV. Critical weaknesses in training, supervision, client education, and key program elements remained for many FP services. Comprehensive counseling addressing HIV, STIs, and FP was not provided.
Exploring current practices in pediatric ARV rollout and integration with early childhood programs in South Africa: an RSA[b]	2005	Children infected with HIV	16 ARV programs 126 caregivers 74 health-care workers	RSA descriptive	Convenience sampling	Lack of standardized/coordinated training for health-care workers on management of pediatric HIV. Referral links between pediatric HIV and PMTCT services were weak. Space constraints, human resource shortage, lack of clinical capacity, and "fear of treating HIV-infected children" were key barriers for health-care workers.
Exploring models of delivering ART and integration of ART with TB services in South Africa[c]	2006	Adults infected with HIV	14 health facilities 262 PLHA 43 health-care providers	RSA descriptive	Convenience sampling	Lack of integration among HIV care, ART, and TB services was documented. Referrals were made to other centers for accessing TB or ART services, which posed a problem for clients. Health-care providers received training relevant to services provided—without overlap between HIV and TB. Distance from ART/TB services was a key barrier to accessing services for clients. Women were more likely to access both ART and TB services compared with men.
Formative assessment of the acceptability of an m-DOT strategy to promote adherence to ART among PLHA in Mombasa, Kenya[d]	2002	Adults infected with HIV	38 PLHA	Qualitative descriptive	Purposive sampling	Acceptability of an m-DOT strategy was high. PLHA preferred a clinic-based, m-DOT approach due to confidentiality concerns, risk of stigma associated with home visits, and beliefs that clinic visits afforded access to better quality care.

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Figure (continued). Sample characteristics and study designs of Horizons' Access-to-Treatment study projects, 2002–2008

Study title and country	*Year(s) of study*	*Target population*	*Sample size (n)*	*Type of study*	*Sampling methodology*	*Key findings*
Operations research around the introduction of ARVs in the management of HIV-infected individuals in Mombasa, Kenya[e–k]	2003–2006	Adults infected with HIV	234 PLHA	Prospective randomized, controlled study (two arms)	Quota sampling with randomized assignment	DAART was effective in increasing adherence during the intervention period compared with standard care. The beneficial effect was not sustained in the post-intervention phase. DAART strategy was feasible and acceptable. Significant improvements in BMI, immunologic and virologic functions, and depression scores were observed. Stigma declined significantly over time. Self-reported sexual-risk behaviors (multiple partners and unprotected sex) declined significantly over 12 months of follow-up. Unprotected sex continued to be reported with regular partners.
Healthy start pediatric HIV study: a diagnostic study investigating barriers to HIV treatment and care among children in Kenya[l]	2007	Children infected with HIV	1,180 caregivers of children aged <15 years 103 health-care workers	Descriptive	Cluster sampling of households Convenience sampling of health-care workers	Caregivers demonstrated low knowledge of pediatric HIV and treatment options. Attitudinal barriers to pediatric treatment were widespread, and stigma prevented caregivers from accessing care. Cost was an additional barrier to seeking pediatric treatment. Health-care workers cited service-side barriers: gaps in HIV knowledge, insufficient training, lack of confidence in pediatric HIV diagnosis protocols and ARV drug management, space constraints, and staff shortage.
Community education and referral: supporting adherence to ART and prevention for PLHA in Zambia[m]	2004–2006	Adults infected with HIV	1,200 community members 500 PLHA on treatment	Prospective pre- and post-intervention control evaluation	Cluster sampling of community members from households Quota sampling of PLHA	HIV knowledge increased similarly over time in intervention and comparison sites. Between 25% and 37% of study participants had undergone HIV testing; the increase was significant only at the Ndola intervention site. Women received testing significantly more than men. Partner disclosure increased significantly at both the intervention and comparison sites in Lusaka but remained unchanged in Ndola. High levels of adherence to ART were reported from all sites. There were significant reductions in internalized stigma among people on ART in Lusaka. Although community stigma decreased over time at both intervention and comparison sites, it remained an important barrier to accessing care.
Assessment of adherence to treatment and sexual-risk behavior among HIV-positive patients receiving ART: a diagnostic study in India[n,o]	2004	Adults infected with HIV	310 PLHA on treatment	Descriptive	Quota sampling	High levels of adherence were reported by study participants overall. Adherence was significantly lower among patients with severe depression and those receiving free ART compared with patients paying out-of-pocket for treatment.

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Figure (continued). Sample characteristics and study designs of Horizons' Access-to-Treatment study projects, 2002–2008

Study title and country	*Year(s) of study*	*Target population*	*Sample size (n)*	*Type of study*	*Sampling methodology*	*Key findings*
A diagnostic operations research to inform the national initiative on improving access to treatment, care, and support for HIV-positive women and their families in India[p]	2005–2006	Pregnant or postpartum (<24 months) women infected with HIV	315 females infected with HIV	Descriptive	Convenience	Integration of HIV services into reproductive health and ANC was limited, and service provision focused on single issues without addressing HIV risk. Less than one-third of the HIV-positive women were informed about testing for CD4 cell counts and ART. Less than one-half of the children born to HIV-positive women were tested for HIV. Future fertility intentions were not explored, and high levels of unmet FP needs were documented. Linkages among ANC, PMTCT, and ART care and support programs were weak.
An RSA of the provision of highly active ART to people living with HIV/AIDS by the Ministry of Public Health's Access to Care Project in northern Thailand[q]	2002	Adults infected with HIV	15 ART clinics 120 PLHA	RSA descriptive	Purposive sampling	Gaps in health-care worker knowledge and ability to manage HIV disease and ART were documented. Nearly one-third of the patients dropped out of the ART program after six months, mostly due to side effects. Lack of follow-up support for patients to manage their treatment was reported.
Reducing dropouts and increasing adherence rates among PLHA on ART in northern Thailand[r]	2004–2007	Adults infected with HIV	45 hospitals 753 PLHA	Randomized, controlled study (three arms)	Convenience sampling of facilities with random assignment to groups Quota sampling of PLHA	Patient dropout rates were lower in the peer-support and enhanced adherence-counseling intervention groups compared with standard care. Self-reported adherence was high in all three groups. Patients in the intervention arms demonstrated higher self-efficacy, greater improvements in quality-of-life scores, and greater decreases in internalized stigma scores.

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Figure (continued). Sample characteristics and study designs of Horizons' Access-to-Treatment study projects, 2002–2008

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HIV = human immunodeficiency virus

AIDS = acquired immunodeficiency syndrome

RSA = rapid situation analysis

ANC = antenatal care

PMTCT = prevention of mother-to-child transmission

STI = sexually transmitted infection

FP = family planning

ARV = antiretroviral

ART = antiretroviral therapy

TB = tuberculosis

PLHA = people living with HIV/AIDS

m-DOT = modified directly observed therapy

DAART = directly administered ART

BMI = body mass index

were referred from PMTCT programs.[8] A study of HIV-positive pregnant and postpartum women in three high-prevalence Indian states found that less than one-third of the women had been informed about testing for CD4 cell counts, and only 18% were informed about the availability of ART during antenatal care. Of the women with living children, 44% reported that none of their children had been tested for HIV.[11]

Community awareness

Uptake of ART services depends on community awareness about HIV and availability and accessibility of services. Horizons researchers conducted a community survey of primary caregivers of children in three Kenyan provinces selected because of high HIV prevalence and the availability of pediatric HIV care services.[7] The study found that while caregivers understood the basics of HIV in adults, knowledge about HIV infection and symptoms in children was low: only half of the caregivers could name three symptoms indicative of pediatric HIV infection. Although the majority of caregivers were aware of treatment options for children infected with HIV and believed that these children could live into adulthood, less than two-thirds of the caregivers knew where to access HIV testing and treatment services for children.[7] Health-care costs (e.g., transport, consultation fees, and medications) and HIV-related stigma were additional barriers to seeking care. A community intervention is being developed by study partners to raise awareness, encourage people to get tested and have their children tested, and link people to care as necessary.

Confidentiality and stigma concerns

Horizons researchers found that concerns about confidentiality and fear of stigma influence the design of services to promote adherence to treatment. Acceptability of a modified directly observed therapy (m-DOT) to promote adherence to ART was assessed among people infected with HIV accessing services in coastal Kenya.[12] Researchers explored the acceptability of home visits by health-care workers vs. clinic visits among PLHA and the preferred frequency of clinic visits per week, as well as the preferred cadre of health-care workers for home visits. The majority of PLHA interviewed expressed a preference for clinic-based m-DOT, citing confidentiality concerns and risk of stigma within the community associated with home-health visits, and the belief that clinic visits afforded access to qualified health-care workers and the sense of personal control offered by visiting the clinic instead of being visited at home. Clients felt that community health-care workers (not dressed in uniforms) were the preferred cadre for home visits. As a result of these findings, researchers designed and implemented an intervention study to evaluate the effectiveness of clinic-based, directly administered ART (DAART) in Kenya.

FIRST EFFORTS TO IMPROVE THERAPY ADMINISTRATION

M-DOT for ART

In Kenya, Horizons researchers conducted one of the first randomized, controlled studies of a clinic-based DAART intervention as a strategy to increase adherence to ART. The intervention consisted of clinic visits twice a week for the first 24 weeks, during which patients met with DAART nurses who observed medication ingestion, dispensed medications for the time between visits, performed pill counts, and provided individualized adherence support. Non-DAART patients received standard, monthly in-clinic follow-up, including adherence counseling and routine health care.[13] The study found that DAART was feasible and effective in promoting adherence during the intervention period (proportion with >95% adherence: DAART, 92% vs. non-DAART, 80%), but these effects were not sustained after the intervention.[14,15] Horizons researchers found DAART to be particularly beneficial in the first 24 weeks in patients with moderate or severe depression. Study findings raised further questions about the best way to optimize DAART and whether it is most effective among a subgroup of adults at risk for nonadherence.[15]

Adherence counseling and peer education

In Thailand, Horizons researchers, in partnership with Chiang Mai University, conducted a randomized, controlled study to evaluate interventions to promote ART adherence and reduce dropouts at 45 hospitals across four northern provinces.[16] Hospitals were assigned to three groups: (*1*) enhanced adherence counseling, including patient education, side-effect management, and integration of medication into daily life; (*2*) enhanced adherence counseling plus peer education at clinic and home visits; or (*3*) standard care consisting of routine counseling and clinical follow-up. The study found that enhanced counseling with and without peer involvement was effective in reducing dropouts compared with standard care after 12 months of treatment, and that the peer intervention served to significantly increase patients' self-efficacy in adhering to ART after 12 months of treatment.[16]

AIDS Community Education and Referral Strategy

While interventions designed to increase adherence and decrease risk behaviors are important, effective

community-level interventions may also influence positive outcomes for individuals. The AIDS Community Education and Referral Strategy in the Zambian cities of Lusaka and Ndola represents one such effort. The intervention aimed to raise community awareness of HIV; strengthen community-based PLHA support groups by incorporating traditional healers, church groups, and home-based care services; establish referral mechanisms between health facilities and the community; and utilize volunteer peer-support workers at clinics.[17]

While few significant differences were found, it is likely that an unrelated clinic-based adherence program introduced in the comparison sites by another organization diluted the effects. However, the study raises questions about the intensity of interventions required to bring about community-level change. Despite these limitations, the study has contributed to the understanding of the positive roles different groups (e.g., traditional healers, home-based care workers, and positive networks) can play in addressing HIV and how to link clinic services and community activities.[17] These findings were used to inform a similar intervention in Uganda in 2007.

RELATED ISSUES

Stigma and ART

Horizons researchers nested observational studies within intervention studies to examine change in HIV-related stigma among PLHA receiving ART. These studies used an adapted HIV-stigma scale covering four domains: personalized stigma, disclosure concerns, negative self-image, and concern with public attitudes.[18] Common themes from Horizons studies in Thailand,[16] Zambia,[17] and Kenya[19] showed that stigma decreased over time on ART. For example, in Kenya, the proportion of patients receiving ART and reporting moderate to high stigma declined from 73% prior to initiating ART to 56% after 12 months of treatment. In addition, internalized stigma appeared to be higher among female patients compared with male patients prior to initiating ART in Kenya[19] and Zambia.[17]

Quality of life and ART

Perceived quality of life is a proxy for effectiveness of medication regimens; if HIV is effectively controlled, individuals have an increased sense of well-being and are able to re-engage in routine activities. Horizons researchers documented significant increases in quality-of-life measures over time. In Thailand, significant improvements were observed in mental and physical health scores during the 12 months following counseling for adherence and peer support.[16] In Kenya, significant improvements occurred across general health perception; physical, social, and cognitive functioning; pain; mental health; energy; and fatigue.

Gender and ART

Horizons researchers did note gender differentials in patient populations: more than 60% of Kenyan and Zambian patients and more than half of the Thai patients were female.[15–17] Interestingly, about one-third of the female participants in Kenya and Zambia were widows, suggesting that some women might access treatment after the death of their spouses. It also is possible that women, who often contract HIV infection from their male partners/spouses, access treatment much later and only when symptomatic. No gender differentials in adherence were documented.

Sexual-risk behavior and ART

Researchers have expressed concern that effective treatment and concomitant increases in well-being and sexual activity could lead to an increase in unprotected sex among PLHA. Horizons researchers found no evidence of increased sexual-risk behavior (i.e., multiple partners or unprotected sex) in Kenya,[20–23] Thailand,[24] Zambia,[17] and India.[5] For example, in Kenya, the proportion of sexually active participants who reported unprotected sex with an unknown or HIV-negative partner declined from 50% at baseline to 28% after 12 months on treatment. However, unprotected sex is still prevalent, underscoring that the risk of HIV transmission remains, particularly with regular partners.

FOLLOW-ON NEEDS

Methods and measures

Horizons researchers used a diverse range of research methodologies and study designs in their Access-to-Treatment portfolio (Figure). They used validated measures and scales frequently, particularly pertaining to adherence,[25] depression,[26] and quality of life.[27,28] A team of expert psychologists and social scientists adapted some scales to more accurately reflect the local cultural context, and translations and back translations were pretested before application. In the absence of a gold standard, measuring adherence accurately is a challenge, especially in settings with limited resources. It is recognized that patients often overstate self-reported adherence and underreport missed doses.[29,30] Adherence studies often require that clinic staff take over measures such as pill counts and self-reports as a part of clinical management. Specialized training for interviewers to ensure consistent and accurate data

collection with regard to these techniques is essential. Newer methods to improve data-collection methods and tools need to be explored.

Horizons partners at Chiang Mai University have developed a computer-based program to increase the accuracy of pill counts as a result of the study; such methods need to be evaluated. The use of audio computer-assisted self-interviewing has been used in other Population Council studies addressing sensitive topics and could be applied to treatment research to improve accuracy of self-report of adherence. Sample selection of HIV-infected patients is often challenging, as PLHA cannot be identified or reached in communities for reasons of confidentiality. Horizons researchers often have had to use convenience or quota sampling to overcome this problem.[31]

Provider training

The Horizons program was among the first to implement intervention studies on adherence in developing countries. The evidence base provided by Horizons' early exploratory studies has greatly contributed to the design, strengthening, and scale-up of ART services. Horizons researchers identified training gaps and lack of provider confidence across several studies. Most treatment programs provide one-time, intensive provider training at their start. The importance of ongoing, need-based, and interactive training for providers cannot be overemphasized, particularly for trained pediatric infectious disease providers. Training materials developed by Horizons, such as the adherence counseling manual used in Kenya,[13] are important in this endeavor and have since been adapted by programs in Zambia, Tanzania, South Africa, and Russia.

Human resource shortages in Africa are well documented,[2] and some treatment programs are run by clinical officers and nurses instead of medical doctors. Expert consultation is needed as treatment regimens become more complicated. Future research will be needed to evaluate models of training programs with ongoing mentoring and access to specialist services. As in other sectors, sustainability of interventions after initial funding ends is a challenge for both programs and researchers. For example, peer volunteers or community health workers often play a key role in enhancing service delivery, but may require some form of compensation to continue delivering interventions.

Defining best practices

Horizons' research has highlighted the lack of integration of HIV testing and TB, PMTCT, maternal health, and ART services. Program managers and departments of health have used this information, for example, in South African program planning efforts. In Kenya, the Kenya Network of Women with AIDS is developing interventions to increase community awareness of pediatric HIV and treatment. Efforts to integrate HIV prevention, care, and treatment services require evaluation to identify best practices and successful models for scale-up. As programs race toward universal access to ART, it is imperative to explore new approaches to service delivery while simultaneously strengthening health systems and monitoring quality of services.

DAART as a strategy to promote adherence was first documented after a successful community-based m-DOT intervention in Haiti using *accompagnateurs* or community health workers.[32,33] DAART has been evaluated largely among PLHA at risk of nonadherence, such as injection drug users,[34–36] incarcerated patients,[37,38] and, to a limited extent, the general population.[39,40] Horizons has added to the scientific evidence by rigorously evaluating clinic-based DAART in a resource-limited setting. Given that improvements in adherence were not sustained beyond the DAART intervention, further research is needed to determine the optimum duration of the intervention and ways to sustain its effects. Population Council researchers are developing a study to evaluate DAART among nonadherent clients—a population for whom this resource-intensive intervention might prove most beneficial.

HIV programs have long used HIV-positive peers in the developing-country context for prevention, social support, and, to a limited extent, treatment-related activities; however, none has evaluated a peer-based adherence-support intervention. The Thailand Horizons study was one of the first to show that such interventions are effective in increasing adherence, raising self-efficacy, lowering self-stigma, and improving quality of life, compared with standard care. This intervention has been introduced widely across the country with Global Fund assistance. It is recognized that such interventions are costlier than the traditional standard of care, and current scale-up of ART programs may exclude such ancillary services. Still, Horizons' work in Kenya and Thailand shows the value of ancillary services (e.g., DAART and peer education and support).

Targeted population issues

The Horizons studies began as ART programs first rolled out and most patients presented with advanced HIV disease—a factor that undoubtedly stimulated adherence. As the epidemic matures, programs are increasingly managing patients on long-term treatment with emerging evidence of poor adherence.[41] It is inevitable that patients in resource-poor settings

will experience side effects and conditions associated with long-term ART (e.g., lipodystrophy and diabetes), as has been documented in western countries.[5,42–44] Second-generation adherence studies in developing countries will need to examine these factors, as well as viral resistance, and their intersection with quality of life and stigma. For example, lipodystrophy might serve as an identifier for HIV-positive individuals in the community, resulting in stigma and discrimination.

Although the Horizons studies provide no evidence of an increase in sexual-risk behavior among PLHA on treatment, unprotected sex in regular-partner relationships is prevalent, and the risk of HIV transmission is still a concern. Treatment programs need to emphasize risk reduction, condom use, and partner testing. Council researchers are developing a prevention-with-positives intervention to integrate prevention and treatment services in Kenya to address these issues.

Despite intense recent attention to pediatric treatment, access to treatment for children infected with HIV is still lagging behind that for adults.[1,45] Priority areas for research include evaluation of interventions to increase diagnosis of HIV among children and to facilitate early treatment for children infected with HIV. Horizons is supporting community interventions to increase uptake of pediatric HIV testing and treatment services in Kenya, and the Population Council is working in South Africa on a family-centered approach to expand HIV testing of children at risk and provide pediatric care and treatment. Adherence interventions for pediatric populations need to be developed and evaluated in the African context as more children infected with HIV receive treatment. Age also is an important consideration, as adherence issues will differ among young children, adolescents, and emancipated minors. While work on this topic has occurred in the West, it may not be immediately translatable to sub-Saharan Africa.

Despite global efforts to provide access to HIV treatment in low- and middle-income countries, only 28% of the estimated 7.1 million adults in need of treatment were receiving ART in 2006;[1] this figure is even lower among infected children. With expanding ART provision in developing countries, research on health service delivery and social behaviors is required. Horizons has made a major contribution to the body of scientific evidence on access-to-treatment issues, answered key research questions, and provided directions for next steps.

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Annexure 3

Short- and long term efficacy of modified Directly Observed Antiretroviral Treatment in Mombasa, Kenya: A randomized trial

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Short- and Long-Term Efficacy of Modified Directly Observed Antiretroviral Treatment in Mombasa, Kenya: A Randomized Trial

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Objectives: To determine short- and long-term efficacy of modified directly observed therapy (m-DOT) on antiretroviral adherence.

Design: Randomized controlled trial.

Setting and Analytic Approach: From September 2003 to November 2004, 234 HIV-infected adults were assigned m-DOT (24 weeks of twice weekly health center visits for nurse-observed pill ingestion, adherence support, and medication collection) or standard care. Follow-up continued until week 72. Self-reported and pill-count adherence and, secondarily, viral suppression and body mass index measures are reported. Generalized estimating equations adjusted for intraclient clustering and covariates were used.

Results: During weeks 1–24, 9.1% (9/99) of m-DOT participants reported missing doses compared with 19.1% (20/105) of controls ($P = 0.04$) and 96.5% (517/571) of m-DOT pill-count measures were ≥95% compared with 86.1% (445/517) in controls [adjusted odds ratio = 4.4; 95% confidence interval (CI) = 2.6 to 7.5; $P < 0.001$. Adherence with m-DOT was 4.8 times greater (95% CI = 2.7 to 8.6; $P < 0.001$) with adjustment for depression and HIV-related hospitalization. In weeks 25–48, adherence with m-DOT (488/589) was similar to controls (507/630). Viral suppression at 48 weeks was 2.0 times (95% CI = 0.8 to 5.2; $P = 0.13$) as likely in m-DOT participants as controls. M-DOT patients had larger body mass index increases at 24 weeks (2.2 vs 1.4 kg/m^3; $P = 0.014$). Viral suppression was more likely at week 48 (21/25 vs 13/22; $P = 0.057$) and week 72 (27/30 vs 15/23; $P = 0.027$) among depressed participants receiving m-DOT.

Conclusions: M-DOT increased adherence, most notably among depressed participants.

Keywords: antiretroviral therapy, HIV, adherence, modified directly observed therapy, pill counts

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INTRODUCTION

Access to antiretroviral treatment (ART) is increasing in resource-constrained settings.[1] Such therapy can successfully reduce HIV-related morbidity and mortality,[2] but only if high levels of adherence are maintained.[3] Although recent evidence suggests that lower adherence levels may be acceptable, particularly for nonnucleoside reverse transcriptase regimens,[4,5] suboptimal adherence is associated with viral resistance, virological and immunological failure, and disease progression.[3,6,7]

Levels of adherence to ART in sub-Saharan Africa are generally greater than in high-income countries.[8–12] However, some studies in Africa have shown variable ART adherence and patient retention,[13–16] as evidenced by a recent meta-analysis in which more than a third of patients reported suboptimal adherence in 8 of the 27 studies included.[8]

Strategies such as patient education, practical medication management skills, building self-efficacy, and support from treatment buddies have been used to optimize ART adherence.[17–27] Mostly, evaluation of these strategies has occurred in high-income countries. Adherence studies that have taken place in Africa have focused on providing home-based support,[28,29] assessing the role costs of ART plays in adherence[29,30] and on building self-efficacy.[9,31] Modified directly observed therapy (m-DOT), adapted from Tuberculosis Directly Observed Treatment Short-course (TB-DOTS),[32,33] is one approach to promote adherence in which a proportion of drug taking is observed, whereas the remainder are self-administered. M-DOT has been evaluated among specific target groups in the United States, largely in patients with poor adherence, active drug use, or incarceration.[34–39] Overall, these studies, including a randomized trial,[36] reported promising findings. However, a randomized trial among patients attending

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public clinics in the United States found no effects on adherence or virological outcomes with a 6-month community-based m-DOT intervention.[40] In resource-constrained settings, a study in Haiti was the first to document that a home-based m-DOT strategy using community health workers (CHW) could effectively support adherence[29,41] and a randomized trial of a 6-week community-based m-DOT intervention delivered by peer educators in Mozambique showed promising results as well.[42]

The primary objective of our study was to determine whether an m-DOT intervention would increase adherence to ART in adults in the first 24 weeks after initiating therapy. The study also aimed to ascertain whether the intervention would be effective in sustaining higher adherence in a 48-week postintervention period.

METHODS

Participants were recruited at 3 outpatient HIV treatment clinics in Mombasa, Kenya, from September 2003 to November 2004: a provincial referral hospital (n = 167); a private, not-for-profit clinic (n = 59); and a district hospital (n = 8). The study cohort was followed for 72 weeks. Study activities and the m-DOT intervention took place within routine clinical services. HIV prevalence among pregnant women who access antenatal services and HIV testing at the provincial referral hospital was 11.4% (211/1858) in 2004 and 11.1% (177/1594) in 2005 similar to levels at the district hospital (9.3%, 46/497 in 2004 and 10.8%, 51/472 in 2005). Access to ART at these sites began around the time of the study.

Eligibility Criteria

ART naive adults (>18 years) residing in Mombasa who were eligible for ART (CD4 cell count < 200 cells/mm^3 or WHO clinical stage 3 or 4) were invited to participate. Clinic nurses informed potential participants of the study who were then contacted by research staff. Written informed consent was provided by all participants. Ethical approval was obtained from the Kenyatta National Hospital Ethics and Research Committee and Institutional Review Board of the Population Council.

Study Design and Sampling Techniques

Computer-generated random number assignment was used, allocating an equal number of participants to treatment and control groups. Allocation concealment was maintained with sequentially numbered, opaque sealed envelopes. Before ART initiation, participants were randomly assigned to study groups, in blocks of 40. Only laboratory personnel were blinded to study group allocation. Standardized data collection tools, staff training, and regular supervision by the study coordinator aimed to ensure that study activities were uniform across sites.

A sample size of 230 was chosen to detect a 20% difference in adherence between study groups (80% adherence with m-DOT vs 60% in controls) assuming 40% death or loss to follow-up, an alpha of 0.05 and power of 0.80.

Standard Care

All patients received first-line treatment regimens consisting of single-formulation stavudine, lamivudine, and either nevirapine or efavirenz. As standard care, all participants attended 3 one-on-one adherence counseling sessions before initiating ART. In these, trained nurse counselors emphasized the importance of adherence; educated patients on the treatment regimen, dosing instructions, side effects, and dietary considerations; tailored the regimen to daily activities; and identified social issues like living conditions and family support.[43] After ART initiation, patients visited treatment centers every 4 weeks for follow-up. At the first 2 follow-up visits, general adherence counseling was provided (review of the topics discussed during preparatory counseling), as was discussion of specific emerging problems with side effects or medication intake[43]; thereafter, counseling was tailored to individual needs. All patients were encouraged to bring a family member or friend to clinic visits and counseling sessions.

M-DOT Intervention

In addition to standard care, patients in the intervention arm received m-DOT services for the first 24 weeks of ART. Although consideration was given to provision of home-based m-DOT, formative research revealed that patients were concerned this would undermine their privacy and confidentiality. They also believed that clinic visits would provide beneficial access to health care workers, so m-DOT services were provided during twice weekly clinic visits.[44] To enhance convenience, participants could select 1 of 6 health centers for their m-DOT visits (the 3 recruitment sites and 3 primary health clinics). At each visit, participants met with m-DOT observers (nurses) who observed ingestion of the patient's ART dose, inquired about difficulties encountered, and provided individualized adherence support. Used medication containers were also collected, pill counts recorded, and medication dispensed for the subsequent 3 or 4 days.

During the monthly clinic visits, efforts were made to ensure that participants in the m-DOT and control group received equal contact time with study staff to minimize the likelihood that any differences observed would be due to nonspecific effects of increased attention given to the intervention group. CHW traced m-DOT participants who missed visits and brought medications to participants who were unable to visit the facility. After cessation of m-DOT at week 24, patients had no further contact with m-DOT observation centers. Like the control group, they collected monthly medication refills at recruitment clinics and received standard adherence support during weeks 25–72. No compensation was given for study participation, though travel costs were reimbursed for 21 m-DOT participants with financial constraints (US$0.65 per visit).

Data Collection and Study Variables

Data were collected using structured questionnaires administered in Swahili by research assistants. Age was grouped by tertiles (<33, 33–40, and >40 years). Variables were categorized as follows: education as never attended school, received primary education, and attended secondary or tertiary education; marital status as never married, married or cohabiting, divorced or separated, and widowed; living

arrangements as lives alone and lives with others; and employment into currently employed and unemployed. HIV-related hospitalization, a binary variable, was based on participant's self-report of HIV-related hospitalization in the preceding year. Four socioeconomic categories were derived by totaling scores from questions on dwelling characteristics, access to water and electricity services, and ownership of assets like television, radio, and bicycle. Each question had equal weighting and was scored from 1 to 4. Perceived internalized stigma was assessed at baseline and 12 weeks using a 16-item scale (Cronbach's alpha of adapted scale: 0.81) derived from Berger's HIV stigma scale (Cronbach's alpha: 0.96)[45] and field tested before use. This covered 3 domains: disclosure concerns (6 items), negative self-image (5 items), and concerns with public attitudes (5 items). Patients responded on a 4-item Likert scale from *strongly agree* to *strongly disagree*. Total scores (possible range 16–64) were categorized as minimal or low (16–40), moderate (41–52), or high stigma (53–64). Depression was assessed at baseline and weeks 24, 48, and 72 (4 data points) using a culturally adapted 21-item Beck's Depression Inventory (BDI) version I (Cronbach's alpha: 0.86) translated into Swahili (Cronbach's alpha for the Swahili BDI: 0.84). Depression was categorized as none (0–9), mild (10–18), moderate (19–29), and severe (30–63) as per BDI guidelines.[46] Body weight was collected monthly and body mass index (BMI) is presented (weight in kilogram per height in square meters). CD4 cell counts were determined at baseline and weeks 24, 48, and 72 using PARTEC (Partec-GmBH, Münster, Germany) and FACS counters (Becton & Dickinson Immunocytometry Systems, San Jose, CA). CD4 measures were extracted from medical records by nurses and the study coordinator. For analysis, cell counts at baseline and week 24 were dichotomized above and below the median. Plasma viral load (Roche Amplicor HIV-1 Monitor test version 1.5; Roche Molecular systems, Branchburg, NJ) was measured at 48 and 72 weeks. Viral load was dichotomized to those with, and those without, viral suppression (ie, $<$400 copies/mL^3).

Adherence measures consisted of self-reported adherence[47] and clinic-based pill counts.[48] Self-reported adherence (4-day recall) was assessed 7.0 times (8 weekly from 1 to 48 weeks plus at week 72) and was dichotomized into those having missed or not having missed doses in the past 4 days.[47] Pill counts were made at each m-DOT visit between weeks 4 and 24 when used medication containers were returned (twice weekly). These counts were aggregated to produce a 4-week measure. From weeks 25–48 and for participants in the control arm (weeks 4–48), pill counts were measured every 4 weeks and at week 72 (a total of 13 data points for both groups). Pill counts, measured as a percentage and dichotomized to $>$95% and $<$95% adherence, were calculated as:

$$\frac{\text{Number of pills taken}}{\text{Number of pills expected to have taken}} \times 100$$

Participants who died or dropped out of the study were, for the purposes of analysis, considered nonadherent for that reporting period and were counted as missing thereafter. Those who attended clinic visits but failed to bring back bottles were counted as missing for that reporting period. Some came back with fewer pills than expected due to misplaced pills, repeated ingestion if pills had been vomited, or "pill dumping" (as occasionally admitted to counselors and CHW). This produces values of adherence $>$100% and these patients were given an adherence value equal to 100 minus the excess percent adherence (eg, a 102% pill count was given the value 98%).

Annual incremental costs for the health system for each m-DOT patient was calculated from the additional resources required: staff time (patient-flow analysis) at health facilities to observe the clients, staff time of CHW who tracked patients through home visits, and additional transportation and communication expenses for CHW trackers.

Statistical Analysis

Data were double entered by separate clerks in a Microsoft Access 2003 database and analyzed using Intercooled Stata 8.0 (Stata Corporation, College Station, TX). Patients were analyzed within the group to which they were originally assigned, regardless of whether they received the study intervention.

Levels of adherence in the 2 groups was compared in the first 24 weeks to assess effectiveness of the intervention and then compared during weeks 25–48 and week 72 to detect any sustained effects on adherence. In these 2 periods, self-reported adherence with m-DOT and the proportion of 4 weekly periods in which patients in the m-DOT group were $>$95% adherent was compared with controls.

Generalized estimating equations were constructed to evaluate repeated pill-count adherence measures in the 2 study groups, controlled for intraclient clustering and baseline variables, which may have differed between the intervention and the control group. An exchangeable correlation structure was chosen, which assumes that the correlation between each pair of observations for an individual is the same. Variables associated with the repeated pill-count measures (each capturing a 4-week period) in bivariate analysis or in previous studies were entered in the multivariate model in a forward stepwise manner. Variables with $P < 0.10$ or those whose removal markedly altered the model fit were retained in the final model. Interaction between study group and other explanatory variables was assessed.

Secondary outcomes were evaluated as follows: virological suppression, increases in CD4 cell counts, and changes in weight and BMI. For these analyses, the Mann–Whitney U test was used to assess differences between groups as continuous variables had a nonnormal distribution and χ^2 test were used to detect differences in categorical variables.

RESULTS

Subject Characteristics and Retention

One hundred sixteen participants were assigned to the intervention arm, 118 to the control arm, and 15 declined participation (Fig. 1). Seven participants were enrolled but did not receive the intervention (3 due to death before initiating ART, 1 due to severe illness, and 3 due to withdrawal). The m-DOT and control groups had similar baseline characteristics (Table 1). About two thirds were female. At baseline, a substantial proportion of participants reported mild (34.8%,

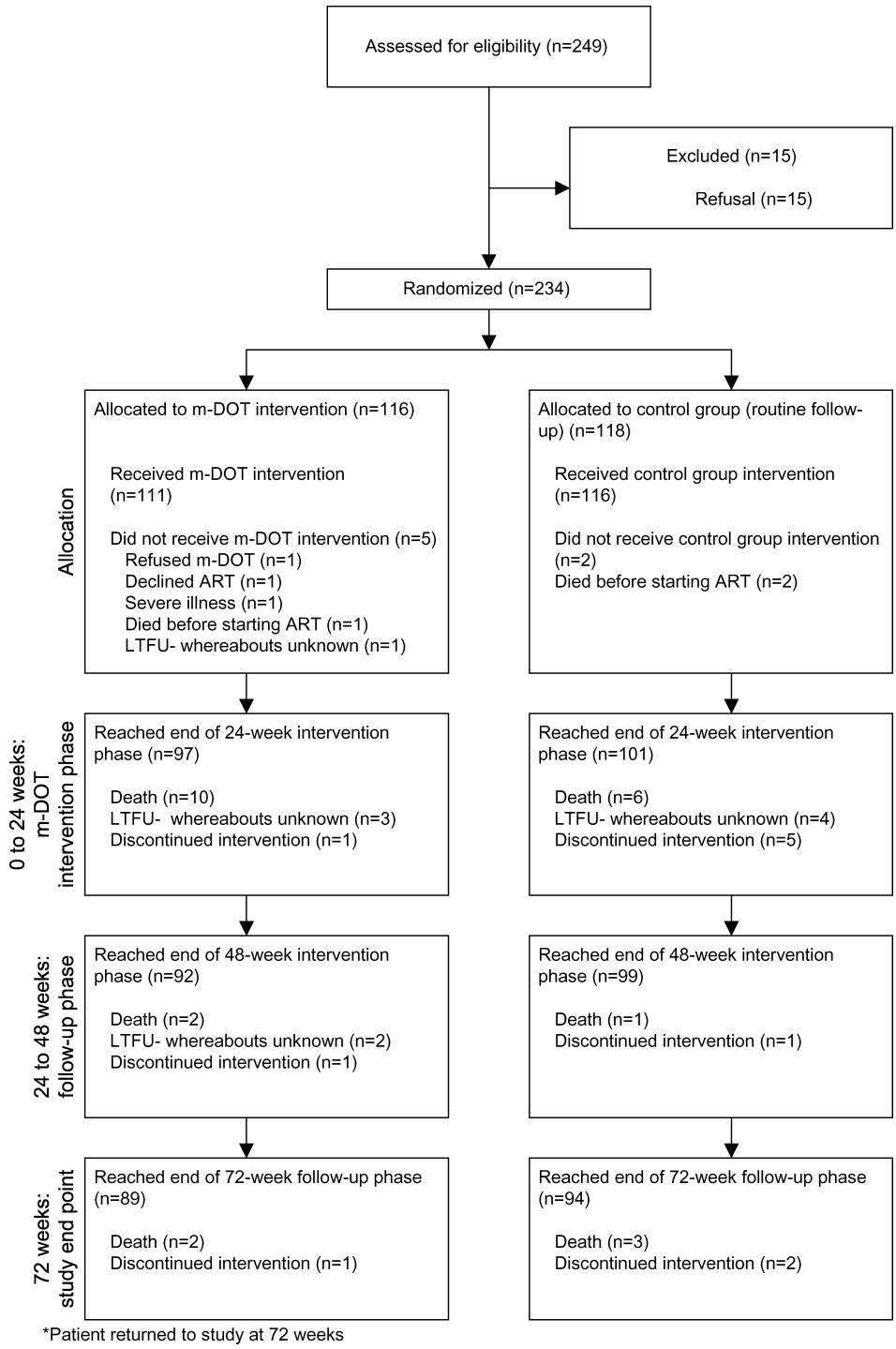

FIGURE 1. Participant flow.

78/224) or moderate to severe depression (31.7%, 71/224). Median CD4 cell count was 99 cells/mm^3, with 25.4% (59/232) having <50 cells/mm^3.

The majority (78.6%, 181/230) initiated an efavirenz-based regimen with the remainder receiving nevirapine-based treatment. During the study, 1 patient changed to a protease inhibitor–containing regimen (lopinavir/ritonavir, zidovudine, and didanosine). Participants in the intervention arm attended a median of 42 of 48 scheduled m-DOT visits (interquartile range = 28–45). The annual incremental cost per client of the m-DOT intervention was approximately US$31 (1US$ = 70 KSh). Additional staff time accounted for 80% of costs.

Of 234 people enrolled, 217 (92.7%) had a study endpoint at 24 weeks and 210 (89.7%) at 72 weeks (183 completed the study protocol and 27 died). More than two thirds of deaths occurred within 24 weeks of enrollment (19/27, 70%).

TABLE 1. Baseline Characteristics of the Study Population

	Control	M-DOT
Gender, % (n)		
Female	63.6 (75)	63.8 (74)
Male	36.4 (43)	36.2 (42)
Age (n = 234), mean years (SD)	37 (7.8)	37.3 (8.0)
Highest education level, % (n)		
Never attended school	6.0 (7)	5.4 (6)
Primary education	47.9 (56)	51.4 (57)
Secondary or tertiary education	46.2 (54)	43.2 (48)
Marital status, % (n)		
Never married	14.5 (17)	13.4 (15)
Married or cohabiting	49.6 (58)	47.3 (53)
Divorced or separated	16.2 (19)	12.5 (14)
Widowed	19.7 (23)	26.8 (30)
Living arrangement, % (n)		
Lives alone	14.5 (17)	9.8 (11)
Lives with others	85.5 (100)	90.2 (101)
Socioeconomic status, % (n)		
Group 1	21.4 (25)	17.0 (19)
Group 2	53.9 (63)	51.8 (58)
Group 3 or 4	24.8 (29)	31.3 (35)
Employment, % (n)		
Employed	19.7 (23)	18.8 (21)
Unemployed	80.3 (94)	81.3 (91)
Alcohol use in last month, % (n)		
Yes	6.0 (7/117)	2.7 (3/112)
Used recreational drugs in last 6 months, % (n/N)		
Yes	1.9 (2/105)	1.8 (2/110)
Perceived stigma, % (n)		
Minimal or low	27.8 (32)	33.6 (37)
Moderate	56.5 (65)	58.2 (64)
High	15.7 (18)	8.2 (9)
Depression, % (n)		
No depression	35.3 (41)	31.5 (34)
Mild depression	36.2 (42)	33.3 (36)
Moderate or severe depression	28.5 (33)	35.2 (38)
BMI (n = 215), mean in kg/m^2 (SD)	20.6 (4.3)	20.8 (4.5)
HIV-related hospitalization in year before ART initiation, % (n/N)		
Yes	17.1 (20/117)	18.0 (20/111)
CD4 cell count (n = 232), median in cells/mm^3 (IQR)	96 (48–130)	106 (49–152)

IQR, interquartile range.

Effects of M-DOT on Adherence and Viral Load Measures

Within the 24-week intervention period, 9.1% (9/99) of participants in the m-DOT arm self-reported missed doses compared with 19.1% (20/105) in the control arm ($P = 0.04$). During the same period, 96.5% (551/571) of the monthly pill-count measures (6 data assessment points) in the m-DOT arm showed adherence levels >95% compared with 86.1% (445/517) of controls [adjusted odds ratio (AOR) = 4.4; 95% CI = 2.6 to 7.5; $P < 0.001$] (Table 2). Similar results were seen using a pill-count threshold of ≥90% to define adherence: 97.7% (558/571) of adherence measures were ≥90% in the m-DOT group compared with 93.4% (483/517) in controls (AOR = 2.9; 95% CI = 1.4 to 6.0; $P = 0.004$). Viral load was not available for the period 1–24 weeks.

Analysis of other covariates in weeks 1–24 showed adherence was higher among participants aged 33–40 years compared with those <33 years, among people who lived with others, and among those with a pre-ART CD4 cell count above the median. Gender, employment, and site of recruitment were not associated with adherence during the intervention or subsequent period. With multivariate analysis, those in the m-DOT group were 4.8 times (95% CI = 2.7 to 8.6; $P < 0.001$) as likely to be adherent as controls in weeks 1–24. Depression (results shown below) and having an HIV-related hospitalization in the year preceding ART (AOR = 1.7; 95% CI = 0.9 to 3.1; $P = 0.08$) were retained in the final generalized estimating equations model, though a significant association between these factors and adherence was not noted.

From weeks 25 to 48, after m-DOT discontinuation, no differences were noted in self-reported adherence: 12.9% (12/93) of those receiving m-DOT reported missed doses compared with 13.4% (13/97) in the control arm ($P = 0.92$). During this period, 80.7% (415/514) of pill-count measures (6 data assessment points) in the m-DOT arm were >95% compared with 457/545 (83.9%) in controls (AOR = 0.8; 95% CI = 0.6 to 1.2; $P = 0.36$). Undetectable viral load (Table 3) was observed in a larger proportion of patients in the m-DOT arm compared with the control arm at 48 weeks, but this difference was not statistically significant (OR = 2.0; 95% CI = 0.80 to 5.2; $P = 0.13$).

At 72 weeks, there was no difference in self-reported adherence between groups: 2.6% (2/77) of patients in the m-DOT arm reported missed doses compared with 4.7% (4/89) of controls ($P = 0.49$). Although a higher proportion of participants in the m-DOT group had >95% adherence on pill counts compared with controls, the difference was not statistically significant (70.7% vs 58.8%; OR = 1.7; 95% CI = 0.9 to 3.3; $P = 0.12$). A similar proportion in both study groups had undetectable viral load.

Effects of M-DOT on Immunological and Clinical Measures

After 6 months of ART, the median increase in CD4 cell counts for all participants was 173 cells/mm^3 (interquartile range = 95–261 cells/mm^3) similar in both groups (169 cells/mm^3 with m-DOT vs 175 cells/mm^3 in controls). Similarly, immunological changes after 18 months of ART did not differ between groups (median CD4 cell increase in m-DOT = 220 vs 234 cells/mm^3 in controls; $P = 0.65$). However, compared with controls, patients in the m-DOT group had a larger mean increase in BMI during weeks 1–24 (2.2 kg/m^2, SD = 2.2 vs 1.4 kg/m^2, SD = 2.1; $P = 0.014$) and weeks 1–48 (2.4 kg/m^2, SD = 3.2 vs 1.5 kg/m^2, SD = 2.6; $P = 0.047$). No increase in BMI was detected at 72 weeks (2.4 kg/m^2, SD = 3.7 vs 1.6 kg/m2, SD = 3.2; $P = 0.13$). No difference in survival at week 72 was noted: 87.1% (101/116) and 89.8% (106/118; $P = 0.51$) in the m-DOT and control arm, respectively.

TABLE 2. Proportion of Months With ≥95% Adherence and Repeated Measures Odds Ratios Using Generalized Estimating Equations During the Study Intervention and Between Weeks 25 and 72

	Weeks 1–24		Weeks 25–72	
	Proportion of Months With ≥95% Adherence, n/N (%)	Odds Ratio (95% CI)	Proportion of Months With ≥95% Adherence, n/N (%)	Odds Ratio (95% CI)
Study group				
Control	86.1 (445/517)	1.0	80.5 (507/630)	1.0
M-DOT intervention	96.5 (551/571)	4.4 (2.6–7.5)	79.5 (468/589)	0.96 (0.7–1.4)
Gender				
Female	91.2 (644/706)	1.0	80.7 (632/783)	1.0
Male	92.2 (352/382)	1.1 (0.7–1.9)	78.7 (343/436)	0.9 (0.6–1.2)
Age (completed years)				
<33	88.5 (301/340)	1.0	79.2 (305/385)	1.0
33–40	94.1 (319/339)	2.1 (1.1–3.8)	83.0 (321/387)	1.3 (0.8–2.0)
>40	91.9 (376/409)	1.5 (0.8–2.6)	78.1 (349/447)	0.9 (0.6–1.4)
Highest education level				
Never attended school	93.0 (66/71)	1.0	83.0 (73/88)	1.0
Primary	90.8 (472/520)	0.7 (0.2–2.5)	80.5 (469/583)	0.8 (0.5–1.5)
Secondary or tertiary	92.0 (446/485)	0.9 (0.3–3.0)	79.4 (427/538)	0.8 (0.4–1.4)
Marital status				
Never married	85.4 (111/130)	0.5 (0.3–0.9)	77.6 (114/147)	0.8 (0.5–1.3)
Married or cohabiting	91.9 (501/545)	1.0	81.9 (489/597)	1.0
Divorced or separated	89.9 (142/158)	0.8 (0.4–1.5)	74.5 (137/184)	0.7 (0.4–1.1)
Widowed	94.8 (236/249)	1.5 (0.7–3.2)	80.7 (230/285)	0.9 (0.6–1.4)
Living arrangement				
Lives alone	87.1 (108/124)	1.0	81.1 (107/132)	1.0
Lives with others	92.1 (882/958)	1.8 (1.0–3.2)	79.8 (863/1081)	0.9 (0.5–1.6)
Socioeconomic status				
Group 1	88.6 (186/210)	1.0	82.7 (182/220)	1.0
Group 2	92.0 (537/584)	1.5 (0.8–2.8)	80.1 (558/697)	0.8 (0.5–1.3)
Group 3 or 4	92.7 (267/288)	1.7 (0.8–3.4)	77.7 (230/296)	1.7 (0.4–1.2)
Employment status				
Employed	93.3 (194/208)	1.0	83.4 (191/229)	1.0
Unemployed	91.1 (796/874)	0.7 (0.4–1.3)	79.2 (779/984)	0.8 (0.5–1.2)
Perceived stigma				
Minimal or low	90.7 (274/302)	1.0	78.7 (258/328)	1.0
Moderate	92.6 (590/637)	1.3 (0.8–2.3)	80.1 (573/715)	1.1 (0.7–1.7)
High	89.3 (125/140)	0.9 (0.4–2.1)	83.0 (142/171)	1.3 (0.8–2.4)
Depression*				
No depression	93.7 (326/348)	1.0	80.3 (578/720)	1.0
Mild depression	90.0 (341/379)	0.6 (0.3–1.2)	80.9 (182/225)	1.0 (0.7–1.6)
Moderate/severe depression	91.1 (300/329)	0.7 (0.4–1.5)	74.3 (124/167)	0.7 (0.4–1.1)
BMI*				
<18.5 kg/m^2	90.7 (244/269)	1.0	79.9 (111/139)	1.0
≥18.5 kg/m^2	91.9 (711/774)	1.1 (0.6–2.0)	81.5 (752/923)	1.1 (0.6–1.9)
HIV-related hospitalization in year before ART				
Yes	88.2 (142/161)	1.0	87.1 (148/170)	1.0
No	92.2 (848/920)	1.7 (0.9–3.1)	78.8 (822/1043)	0.5 (0.3–1.0)
CD4 cell count*				
Less than median, cells/mm^3	89.6 (480/536)	1.0	81.4 (420/516)	1.0
Greater than equal to median, cells/mm^3	93.7 (516/551)	1.8 (1.1–2.9)	79.1 (440/556)	0.9 (0.6–1.3)

*Baseline measures of depression, BMI, and CD4 cell count are used for weeks 1–24 and results of these variables measured at week 24 are used for the 25–48 weeks analysis. Odds ratios are calculated as: (number of months ≥95% adherent/number of months <95% adherent in exposed group)/(number of months ≥95% adherent/number of months <95% adherent in unexposed group), adjusted for intraclient clustering using generalized estimating equations.

TABLE 3. Secondary Outcomes: Effects of m-DOT on Virological, Immunological, and Clinical Outcomes

	Outcomes Plasma Viral Load, % of Patients With Undetectable (<400 copies/mL) (n/N)*	CD4 Cell Count, Median Increase From Baseline in cells/mm^3 (IQR)†	Weight, Median Increase From Baseline in kg (IQR)†
Week 24			
M-DOT	NA	169 (95–253)	4.5 (1.7–9.0)
Control	NA	175 (84–271)	3.5 (0–7.0)
P	NA	0.97	0.04
Week 48			
M-DOT	87.7 (57/65)	204 (126–329)	4.9 (0–10.4)
Control	77.8 (56/72)	207 (117–337)	4.0 (0–9.0)
P	0.13	0.82	0.18
Week 72			
M-DOT	73.6 (64/87)	220 (133–319)	5.5 (1.0–10.0)
Control	77.4 (72/93)	234 (142–354)	3.8 (−1.6 to 8.9)
P	0.55	0.65	0.09

IQR, interquartile range; NA, data not available.
*χ^2 test.
†Mann–Whitney *U* test.

Subgroup Analysis: Effects of M-DOT on Adherence Among Those With Depression

In the multivariate model for the period 1–24 weeks (shown above), after adjusting for study group and HIV-related hospitalization, adjusted odds of adherence in those with mild depression was 0.6 (95% CI = 0.3 to 1.1; $P = 0.08$) and those with moderate/severe depression was 0.6 (95% CI = 0.3 to 1.1; $P = 0.11$), compared with participants without depression.

When comparing m-DOT with controls, no decreases in depression scores were detected at week 24 (median decrease of 6 in m-DOT vs 4 in controls; $P = 0.13$). However, increased reductions in scores were seen at week 48 (median decreases in m-DOT 10.5 vs 6 in controls; $P = 0.04$) and week 72 (median decreases in m-DOT 10 vs 6.5 in controls; $P = 0.03$). To further explore this, we investigated the effects of m-DOT among participants who had moderate or severe depression at study entry. Among these participants, those who received m-DOT were 7.0 times as likely to be adherent than controls in the 1- to 24-week period (95% CI = 2.7 to 18.0; $P < 0.001$). Differences in adherence in this subgroup were not noted after week 24. However, participants in the m-DOT group with baseline moderate or severe depression were more likely to have viral suppression at 48 weeks than similar controls (21/25 vs 13/22; $P = 0.057$) and at 72 weeks (27/30 vs 15/23; $P = 0.027$).

DISCUSSION

The m-DOT intervention was effective in increasing adherence to ART. These effects were, however, not sustained after cessation of the intervention. Although higher rates of viral suppression were observed at 48 weeks among m-DOT participants, these differences were not significant. Other secondary measures such as increasing BMI and decreasing depression scores suggest clinical benefits for those receiving the intervention. Our findings are similar to a randomized controlled study that evaluated a peer-delivered m-DOT intervention in Mozambique,[46] which showed that although self-reported levels of adherence were higher among those receiving the intervention, no differences were noted in immunological outcomes.[46]

Although the study findings suggest that m-DOT increased adherence in these settings, high levels of adherence were also noted among participants in the control group who received only basic support measures. This supports the view that intensive adherence interventions like m-DOT should optimally target subgroups with, or at high risk for, poor adherence.[49] Targeting subgroups of patients at risk for nonadherence has been the dominant strategy in m-DOT research. Our study further suggests that m-DOT may be particularly useful among patients with moderate to severe depression, which is common among HIV-infected persons,[50] and negatively impacts adherence and mortality.[3,51,52] This finding may in part be as a result of regular interaction with an empathetic and supportive counselor. Further research is needed to confirm this finding.

Although there may be a potential role for m-DOT within ART programs in sub-Saharan Africa, it should be considered a component of multifaceted adherence support. A Cochrane review[20] highlights the importance of practical management skills (tailored drug schedules, reminder devices, and medication dossettes) and interventions which help patients identify and address barriers to adherence. These practical strategies, with conceptual similarities to m-DOT, were found to have better success than more complex interventions. The review also found interventions provided for longer periods of time (>12 weeks) were more successful than shorter interventions.

The optimal duration of m-DOT is unknown and warrants further investigation. Adherence declined over time in both the intervention and the control groups. Other studies have also shown dissipation in effectiveness after cessation of the interventions.[53,54] Abrupt/sudden cessation of m-DOT at 24 weeks, with the subsequent introduction of a new follow-up routine, may have contributed to a marked decline in adherence in the m-DOT group. This suggests that a gradual reduction in intensity of m-DOT intervention or booster sessions tailored to the specific need of patients may be required.

Attendance at m-DOT visits was high even without financial incentives suggesting high user acceptability of m-DOT services in this setting. The feasibility of implementing the m-DOT intervention in this study has also been described.[55] A similarly high acceptability and feasibility of m-DOT were reported from Mozambique.[56] In addition to a favorable acceptability profile, m-DOT has a relatively low-cost profile.

We used, a priori, a 95% cut off for adherence in this study. Given that recent evidence suggests that patients receiving nonnucleoside reverse transcriptase–containing regimens may achieve undetectable viral loads with lower levels of adherence,[4,5] we reanalyzed our data using a 90%

adherence cut off and found no difference in study conclusions. Because of the generally high adherence levels, we had insufficient nonadherent subjects for meaningful analysis at lower adherence cut offs. Regardless, we would caution against the promotion of different levels of adherence for different treatment regimens as some patients inevitably move to treatment regimens containing protease inhibitors.

The present m-DOT intervention took place in a clinic setting where participants had greater overall contact time with health providers compared with the control group, thereby increasing the opportunity for the intervention group to access health services. A previous study found that greater utilization of medical services associated with receiving m-DOT resulted in improved virological outcomes.[57] The outcomes reported here could, similarly, be due to nonspecific effects of the increased attention given to the intervention group.

We report adherence levels in a research study setting and it is possible that adherence would be lower in routine care settings. However, as this study took place within the context of routine clinical services, we feel that this increases the ability to generalize findings to similar settings. Further, almost all eligible participants were enrolled, reducing the likelihood of selection bias. As the study began when ART programs were first introduced in Kenya, treatment was available for a limited number of patients. With this constraint, the study lacks power to detect smaller but nevertheless clinically important differences in outcomes. Differences in the way pill counts were measured for the 2 groups during the first 24 weeks could have introduced bias in these measures. However, self-reported adherence, measured identically in both groups, was in the same direction as pill-count measures, supporting study conclusions. The use of additional clinical, virological, and immunological endpoints also strengthens the ability to draw conclusions about the effectiveness of the intervention. Though field tested, the adapted depression and stigma scales have not been validated in this setting, possibly introducing measurement bias. Finally, adherence with single-formulation medications, as used in this study, with a higher pill burden, may differ from fixed-dose combinations.[58]

In conclusion, this randomized controlled trial of a m-DOT strategy showed that this intervention can increase adherence. Although adherence declined to control levels after cessation of the intervention, the results suggest that m-DOT could potentially be a useful strategy to improve adherence in resource-constrained settings, particularly among depressed patients and others at highest risk for nonadherence.

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Annexure 4

Chapter 4: HIV prevention in the context of scaled-up access to HIV treatment

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CHAPTER 4
HIV PREVENTION IN THE CONTEXT OF SCALED-UP ACCESS TO HIV TREATMENT

1. BACKGROUND

1.1 Rationale: why research is needed on HIV prevention among those receiving ART

As HIV treatment programmes scale up across countries, more attention is being directed to the implications of greater access to antiretroviral therapy for HIV prevention, and it is important to assess the potential for both positive and negative consequences. New antiretroviral therapy regimens improve longevity and the quality of life of individuals with HIV, and they have the potential to reduce HIV transmission by suppressing viral loads among people living with HIV (Granich et al. 2008). Greater access to treatment can also lower stigma and raise awareness of HIV, thereby encouraging people to seek testing and adopt preventive behaviours. But greater access to treatment may also increase the number of sexually active individuals infected with HIV, as antiretroviral therapy restores health and extends lifespans, leading to a growing pool of individuals who could potentially transmit HIV. In addition, some evidence suggests that the availability of effective treatment in some settings has reduced concerns about HIV transmission and contributed to an increase in high-risk sexual practices, such as unprotected sex or multiple partners (Cohen 2005; Cassell et al. 2006). Documenting and studying the complex links between treatment and prevention has, therefore, become a priority issue for antiretroviral therapy programmes.

Research on HIV prevention typically relies on behavioural surveillance surveys, Reproductive Health Surveys and Demographic and Health Surveys that focus on the general population or key populations at higher risk of HIV, such as men who have sex with men. A small but growing number of population-based surveys have gathered data to analyse behaviours in relation to respondents' serostatus, such as the 2004–2005 Uganda HIV/AIDS Sero-Behavioral Survey (Bunnell et al. 2008). Such research designs are key to monitoring trends at the population level. By contrast, this chapter focuses on groups whose behaviours may be influenced by the scaling up of HIV treatment. These groups include: patients receiving antiretroviral therapy and HIV-positive individuals who are not receiving treatment (e.g. those who are ineligible to initiate treatment or who are on waiting lists). Other populations of interest to operational research projects may include partners of individuals receiving treatment or users of testing and counselling services who test negative.

The primary objective of research proposed in this chapter is to document sexual risk behaviours among HIV-positive individuals receiving health services in order to: a) learn from comparisons across programmes, countries, regions or time periods about the factors that influence high- or low-risk behaviours; b) gather information to inform behaviour change communication strategies; and c) identify gaps in service delivery. Researchers who want to track changes in sexual behaviours among individuals receiving treatment or to evaluate the effectiveness of prevention interventions may be able to use the tools in this volume for that purpose with some adaptation.

2. FACTORS AND PROGRAMME STRATEGIES

2.1 Factors that influence HIV prevention in the context of scaling up treatment

The implications of treatment for HIV prevention is a complex issue that involves biomedical, demographic and behavioural factors, some of which are summarized below.

Biomedical factors that influence prevention

Antiretroviral therapy may influence sexual transmission of HIV in a number of ways. First, treatment that suppresses viral loads to undetectable levels may reduce but not necessarily eliminate the risk of sexual transmission of HIV infection (Quinn et al. 2000). Shedding of HIV continues in some patients, possibly related to a separate reservoir of infection (Kovacs et al. 2001; Barroso et al. 2003; Fiore et al. 2003; Zuckerman et al. 2004) or to the type of antiretroviral therapy regimen (Neely et al. 2007), and the risk of HIV transmission or re-infection remains.

Moreover, as discussed in the Adherence chapter, inappropriate treatment or poor adherence may result in incomplete viral suppression and the development and transmission of drug resistant viral strains (Paterson et al. 2000; Bangsberg and Deeks 2002). In fact, several studies suggest a relationship between poor adherence and higher risk sexual behaviours (Wilson et al. 2002; Flaks et al. 2003; Kozal et al. 2004), which underscores the need to document sexual risk behaviour among HIV-positive individuals receiving treatment.

Another biomedical factor that may influence HIV transmission is the eligibility criteria used to determine who receives antiretroviral

therapy. In general, while HIV infectivity in a community may decline as antiretroviral therapy programmes scale up (Fang et al. 2004; Porco et al. 2004), some researchers argue that increased access to treatment is unlikely to reduce HIV incidence if eligibility criteria substantially limit the proportion of HIV-positive individuals who can initiate treatment (Auvert et al. 2004; McClelland et al. 2006). Mathematical models suggest that universal testing could drastically cut HIV incidence, but only if treatment were given to all who test positive, not just those who meet strict clinical or immunological eligibility requirements (Granich et al. 2008). These analyses underscore the need to strengthen behaviour change prevention efforts among individuals who are HIV-positive but not receiving antiretroviral therapy.

Sexual risk behaviour among those receiving antiretroviral therapy

Individuals receiving treatment may resume sexual activity as they recover their health and normal functioning. Some researchers and policy makers have raised concerns that wider access to antiretroviral therapy might lead to increased high-risk sexual behaviour — a phenomenon sometimes called "behavioural disinhibition" or "risk compensation" (Cohen 2005; Cassell et al. 2006). Many studies from Europe and the United States have examined whether HIV treatment leads to increased sexual risk behaviours among individuals receiving antiretroviral therapy. A few studies have reported an association between immunological or virological improvements and sexual risk behaviours (or proxy measures such as STI rates) among men who have sex with men and injecting drug users (Martin et al. 2001; Scheer et al. 2001; Tun et al. 2004). However, most research has not found a consistent or significant association with risk behaviour, even when patients achieve an undetectable viral load (Dukers et al. 2001; Bouhnik et al. 2002; Vanable et al. 2003; Wolf et al. 2003; Crepaz et al. 2004; Diamond et al. 2005).

Nevertheless, studies suggest that a substantial minority of patients receiving treatment are sexually active, and some engage in unprotected sex. Even if receiving treatment does not increase levels of unprotected sex, antiretroviral therapy may still increase the risk that those patients who do engage in unprotected sex will transmit a drug resistant strain of the virus. Surveillance data from the United Kingdom suggest that the proportion of new HIV infections that involve a drug resistant strain has increased between 1994 and 2000, accounting for an estimated 27% of new infections in 2000 (Fidler et al. 2001; Cassell et al. 2006).

Only limited evidence is available from low- and middle-income countries, but a number of studies from Côte d'Ivoire, Kenya, South Africa and Uganda have generally failed to find significant increases in high-risk sexual behaviour among individuals receiving antiretroviral therapy (Moatti et al. 2003; Bateganya et al. 2005; Bunnell et al. 2006a; Kennedy et al. 2007; Eisele et al. 2008a; Eisele et al. 2008b; Luchters et al. 2008; Sarna et al. 2008). Thus, while existing research does not support the notion of disinhibition, the limited evidence suggests that measuring behaviour change and HIV prevention efforts among those receiving treatment remains a high priority.

The influence of treatment availability on risk perceptions and sexual behaviour

At the community or population level, there are various hypotheses regarding the effects of treatment availability on risk perceptions, attitudes and behaviours related to HIV transmission. On the one hand, expanding treatment availability may increase knowledge and awareness of HIV and give people a greater sense of control over their lives, resulting in risk avoidance and reduced HIV transmission. On the other hand, increased access to treatment may reduce concerns about unprotected sex, if people believe that treatment lowers the risk of transmission or the negative consequences of HIV infection (Valdiserri 2004).

While research does not support the notion of 'behavioural disinhibition' among individuals receiving treatment, evidence from high-income settings does suggest that expanded access to treatment may be associated with increased sexual risk taking. For example, studies among men who have sex with men in Australia, the Netherlands, the United Kingdom and the United States found that unprotected sex increased in those populations after antiretroviral therapy became widely available (CDC 1999; Dodds et al. 2000; Stolte et al. 2001; Wolitski et al. 2001; Chen et al. 2002; Katz et al. 2002; Van de Ven et al. 2002). High-risk sex may have increased in those settings because treatment availability lowered concerns about the risk of HIV transmission and the negative consequences of contracting the virus. For example, rates of multiple partners, unprotected sex and inconsistent condom use were found to be significantly higher among those who believed that antiretroviral therapy lowers infectivity (Van de Ven et al. 1999; Herlitz and Steel 2001; Suarez et al. 2001; Wilson and Minkoff 2001; Elford et al. 2002; Ostrow et al. 2002; Stolte et al. 2004). Similarly, a meta-analysis by Crepaz et al. (2004) found that rates of unprotected sex were significantly higher among respondents who believed that treatment availability had reduced the risk of HIV transmission or the seriousness of contracting the virus — regardless of their treatment or serostatus.

Research is currently underway to examine whether treatment availability is linked to behavioural disinhibition in low- and middle-income countries. Little has been published at the time this volume is going to press, but one study suggests that this is not the case (Bunnell et al. 2006b).

Other factors that influence sexual behaviour among those living with HIV

Based on the vast literature on sexual behaviour and its determinants, this section summarizes other key factors that should be considered when investigating high-risk sexual behaviour in the context of scaling up treatment for HIV. These include:

- **Number and type of partners.** Some studies suggest that the number of partners, the number of recent sexual encounters and the types of sexual partners are associated with unprotected sex (Wenger et al. 1994; Hays et al. 1997; Grulich et al. 1998; Heckman et al. 1998; Wilson et al. 1999; Semple et al. 2000; Crepaz and Marks 2002). Many prevention programmes

have considered sex worker and casual partnerships to be higher risk than regular partnerships. In the context of HIV prevention among people living with HIV, however, regular partnerships pose a particular risk when the regular partner is HIV-negative and when condom use is low. Evidence from sub-Saharan Africa suggests that many HIV-positive individuals are married to or living with HIV-negative partners (Dunkle et al. 2008). In addition, unprotected sex is common in regular partnerships, even when couples are serodiscordant or the partner's serostatus is unknown (Bunnell et al. 2006a).

- **Concurrent partners.** There is evidence that sexual concurrency (having more than one sexual relationship at the same time) is a more important predictor of STI transmission than the number of partners. This has been shown in theoretical sexual network models (Watts and May 1992; Kretzschmar 2000) and confirmed in epidemiological studies (Morris and Kretzschmar 1997; Potterat et al. 1999; Rosenberg et al. 1999; Koumans et al. 2001).

- **Partner serostatus and viral load.** Partner serostatus also influences sexual risk behaviour. HIV-positive men and women were significantly more likely to engage in unprotected sex with seroconcordant partners in studies from both developed and developing countries (Crepaz and Marks 2002; Hong et al. 2006; Kiene et al. 2006; Kiene et al. 2008). Similarly, research from the United States found that HIV-negative men who have sex with men were more likely to engage in unprotected sex with an HIV-positive partner if that partner had an undetectable viral load (Guzman et al. 2006). It is noteworthy, however, that a number of recent studies from sub-Saharan Africa suggest that a substantial proportion of patients receiving treatment do not know the serostatus of their partner (Bunnell et al. 2006a; Simbayi et al. 2007; Luchters et al. 2008; Sarna et al. 2008).

- **Knowledge and attitudes about HIV and AIDS.** Unprotected sex among HIV-positive individuals has been found to be associated with less knowledge about HIV and transmission (Wenger et al. 1994; Muller et al. 1995; Huszti et al. 1998; Derlega et al. 2006), with beliefs that condoms decrease sexual pleasure (Kline and VanLandingham 1994; Hays et al. 1997), with little commitment to self or others (Godin et al. 1996; Kalichman et al. 1997), and with perceived lack of control and lower confidence in one's ability to negotiate condom use (Crepaz and Marks 2002).

- **Disclosure.** While Crepaz et al. (2002) did not find an association between disclosing HIV status and lower condom use, recent studies have found an association between non-disclosure and rates of multiple partners and unprotected sex in some settings (Olley et al. 2004; Carballo-Dieguez et al. 2006; Derlega et al. 2006; Kiene et al. 2006; Simbayi et al. 2007). More research may be needed to sort out these inconsistent findings.

- **Desire for children.** Living with a sexual partner and a male partner's desire for children were found to be factors that increased the likelihood of unprotected sex among HIV-positive women in studies from Brazil (Kerrigan et al. 2006), India (Sri Krishnan et al. 2007), Togo (Moore and Oppong 2007), Uganda (Nakayiwa et al. 2006) and the United States (Crepaz and Marks 2002).

The evidence for some of these associations is somewhat circular, in that the outcome variable — high-risk behaviour — is not always clearly separate from independent variables, such as number of partners or lack of control. Nevertheless, these factors need to be taken into account in operational research on the links between sexual behaviour and HIV treatment.

2.2 Programme strategies related to HIV prevention in the context of treatment

While most HIV programmes include some information on prevention when counselling clients who are tested for HIV or who receive treatment, prevention is not always systematically integrated into HIV treatment services. Messages about prevention are typically delivered at the initiation of treatment and infrequently thereafter; and follow-up visits typically focus on adherence and management of side-effects with little emphasis on preventing transmission. Some observers have noted that this represents a missed opportunity for providers to encourage safer behaviours and to empower people living with HIV to persuade others to avoid risks.

A number of studies in the United States have found that individual or small group counselling was associated with reports of reduced unprotected sex among those living with HIV (Kalichman et al. 2001; Rotheram-Borus et al. 2001; Patterson et al. 2003; Sorensen et al. 2003; Richardson et al. 2004; Wingood et al. 2004; Kalichman et al. 2005; Wolitski et al. 2005). In most cases, these programmes were designed to provide skills, to raise awareness of the risks of HIV transmission and to address behavioural issues related to treatment and prevention. A meta-analysis of controlled trials in the United States found 14 interventions that significantly reduced unprotected sex (Crepaz et al. 2006). Most were based on behavioural theory and addressed a range of issues (coping, adherence, etc.) but focused extensively on specific skills and behaviours. In addition, most were delivered on a one-to-one basis by health care providers or professional counsellors and involved at least 10 sessions over three months.

A meta-analysis of studies from developing countries between 1990 and 2005 found evidence that client-initiated testing (commonly called VCT) may have a moderate but significant positive effect on prevention (Denison et al. 2008). Specifically, individuals who had received VCT were significantly less likely to engage in unprotected sex after being tested, compared with their behaviour before testing and compared with participants who had not received client-initiated testing; however, the meta-analysis found no significant effect on the number of sex partners (Denison et al. 2008). This review underscores the potential for client-initiated testing as a prevention strategy, but also the need for more evidence. For example, as mentioned in the chapter on

Testing and Counselling in this volume, recent studies from the United States and Zimbabwe (neither of which was included in the meta-analysis mentioned above) reported that high-risk sex increased following rapid HIV testing among men who tested negative (Metcalf et al. 2005; Corbett et al. 2007).

Since 2005, there have been a few additional studies in sub-Saharan Africa that have examined efforts to integrate HIV prevention into services for people living with HIV (Kalichman 2007). For example, prevention efforts by the TASO programme in Uganda significantly reduced levels of unprotected sex among those living with HIV (Bunnell et al. 2006a; Were et al. 2006). Community health workers developed individualized risk reduction plans with goal setting, encouraged and facilitated disclosure and partner testing, and in some places provided HIV tests at home for family members. (These results are similar to an earlier study in Zambia where home-based services, partner HIV testing and couple counselling among patients receiving antiretroviral therapy were found to reduce high-risk sexual behaviours (Allen et al. 2003).) A recent study from South Africa reported that a brief risk reduction intervention delivered by counsellors during routine clinical care visits led to a significant decline in unprotected sex among those receiving the service compared with those in the control group (Cornman et al. 2008). And, a large HIV prevention trial has begun among discordant couples in eastern and southern Africa (Lingappa et al. 2008). More research is needed to examine the extent to which these prevention services can be successfully integrated into treatment services and which strategies are most effective in different settings.

3. RESEARCH OBJECTIVES AND QUESTIONS

As noted earlier, the objective of the research proposed in this chapter is to document sexual risk behaviours among specific HIV-positive populations, with the goal of identifying gaps in service delivery, designing prevention programmes or behaviour change communications strategies and/or comparing programmes. Possible research questions and hypotheses relevant to sexual risk behaviours in the context of scaling up HIV treatment are given in the box below.

The first two research questions require comparisons of HIV-positive individuals who are receiving treatment with those who are not, or before-and-after comparisons of the same individuals over time. (Note, however, that the former design presents a challenge, as researchers must ensure that control and study groups are comparable and that they do not compare healthy controls with symptomatic study group participants.) The third research question applies to a broader study population, including individuals who are HIV-positive but are not yet receiving treatment. The fourth research question can be investigated by asking health workers about their practices and by asking users of health services about their experiences. The fifth research

OPERATIONAL RESEARCH QUESTIONS ABOUT HIV PREVENTION IN THE CONTEXT OF SCALING UP TREATMENT

1. **To what extent is receiving antiretroviral therapy associated with a change in levels of sexual activity (a resumption, an increase, an interruption or a reduction of sexual activity)?**
   Hypotheses:
   - Sexual activity among HIV-positive individuals increases/decreases/stays the same after ***initiating*** antiretroviral therapy.
   - Sexual activity among HIV-positive individuals increases/decreases/stays the same ***with increased duration*** of antiretroviral therapy.

2. **To what extent is receiving antiretroviral therapy associated with high-risk sexual behaviour (such as unprotected sex)?**
   Hypotheses:
   - High-risk sexual behaviour increases/decreases/stays the same after ***initiating*** antiretroviral therapy.
   - High-risk sexual behaviour increases/decreases/stays the same ***with increased duration*** of antiretroviral therapy.

3. **To what extent are knowledge, perceptions or attitudes about HIV and HIV treatment associated with high-risk sexual behaviours?**
   Hypotheses:
   - Individuals who have limited knowledge of HIV transmission are more likely to report high-risk sexual behaviours, such as unprotected sex.
   - Individuals who believe that receiving treatment or achieving undetectable viral loads reduces or eliminates the risk of HIV transmission are more likely to report high-risk sexual behaviours.
   - Individuals who are excessively optimistic about antiretroviral therapy or who express lower concern about HIV in light of treatment availability are more likely to report high-risk sexual behaviours.

4. **To what extent are prevention services integrated into HIV treatment services?**

5. **To what extent do prevention services (delivered in the context of treatment) reduce high-risk sexual behaviours among HIV-positive clients?**
   Hypotheses:
   - Patients receiving prevention services in the context of HIV treatment will report fewer high-risk sexual behaviours than those who do not receive these services.

question would be relevant when seeking to evaluate the effects of prevention strategies integrated into treatment services; however, investigating this question may require more complex study designs than those proposed in this volume.

4. METHODS

4.1 Study populations and study design

The primary population groups to be studied for prevention studies in the context of scaling up HIV treatment may include:

- patients with a diagnosis of HIV who are receiving antiretroviral therapy;
- people living with HIV who are not on treatment but are accessing services or are on waiting lists;
- individuals who have used HIV testing and counselling services may be used as a comparison group, depending on the design of the study; and
- health care providers and administrators working in HIV testing, counselling and treatment programmes.

Ideally, prevention research should integrate both quantitative and qualitative data collection methods in order to monitor changes in behaviour as well as to gather an in-depth understanding of the context in which these behaviours take place. Possible study designs may include repeated cross-sectional surveys among different study populations at different points in time. For example, researchers may conduct cross-sectional surveys among HIV-positive individuals before and after initiating treatment and at different points in time thereafter. They may also compare treated versus untreated HIV-positive individuals. With some adaptation of the instrument, researchers could compare individuals who have been tested with those who have not, or with general population groups according to treatment availability and coverage in different settings.

4.2 Measuring sexual risk behaviour

Sexual risk behaviour has been documented through many behavioural surveys conducted among general populations, as well key populations at higher risk. Reviews of validity and reliability of such research have found that sexual behaviour data are fairly consistent (Aral and Peterman 1996; Crosby 1998; Fenton et al. 2001; Wellings and Cleland 2001), and that self-reported data from partners about sexual acts and condom use are reasonably congruent, especially for infrequent acts and short recall periods (Ellish et al. 1996; Shew et al. 1997; Stone et al. 1999; Weir et al. 1999; Obermeyer 2005). Quantitative indicators of risk behaviours may indicate the magnitude or direction of changes over time, but they provide limited information on the context of or reasons for high-risk behaviours. Qualitative data can improve the quality of self-reports by providing information on the context in which sexual risk behaviour takes place (Amon et al. 2000). The variables in the box below have been used widely to measure sexual risk behaviour in prevention studies because they have a direct influence on sexual HIV transmission.

In addition, researchers may need to gather information about knowledge of HIV infection and its transmission, attitudes about condom use, personal risk perceptions, relationships with partners and respondents' ability to negotiate condom use. For such variables, both quantitative and qualitative data are recommended.

Operationalizing variables, populations of interest and recall periods

Researchers studying HIV prevention in the context of treatment may need to consider the following methodological points:

- **Asking respondents to categorize their sexual partners presents important methodological challenges.** Many studies have used categories such as regular, casual and commercial sexual partners. Regular partners are often defined as spouses or

WIDELY USED VARIABLES FOR MEASURING SEXUAL RISK BEHAVIOUR

- **Multiple partners.** Multiple partners can be measured by asking about the number of sexual partners during a defined reference period.
- **Concurrent partners.** Concurrent partners are overlapping sexual partners. Concurrency can be measured by asking for the dates that partnerships began and ended or, less specifically, by asking about multiple partnerships over a short but defined reference period.
- **Type of sexual partners.** Partners may be categorized in different ways, such as regular, non-regular (casual) and sex workers. Categories of male and female partners can be explored separately or together, depending on the study objectives and the extent to which men have sex with men in the community being studied.
- **Condom use.** Condom use is the key variable when studying sexual risk behaviour. Information on condom use is most often elicited with regard to condom use during the last sexual act (for which recall is expected to be accurate for a realistic time frame) and consistent condom use (use of condoms every time during the reference period). This information can be asked with respect to a particular partner or all partners depending on study objectives and design.
- **Proportion of unprotected sexual acts.** The proportion of penetrative sexual acts (anal and vaginal) in which neither partner used a condom can be sought for different sexual partners and various sexual acts.

co-habiting partners, but in some cultural contexts, researchers may want to use a broader definition that includes long-term partners, even if the couple is not married or cohabiting. Sex worker partners are generally defined as sexual partners who are paid in exchange for sex, but patterns of exchange of sex for money or gifts are complex and the definition is not easy to operationalize. Some researchers classify sex workers as casual partners for convenience, however, this may lead to a loss of information. Non-regular or casual partners are often defined as those who are not regular partners and are not sex workers. The categories of sexual partnerships commonly used by researchers are complex and pose a major measurement challenge, since they may not match local understanding and may not translate well into different languages (UNAIDS 2007). To avoid confusion, researchers may want to explore local categories and terms for different types of partnerships before finalizing the wording of their questionnaires. They will also need to carefully explain these categories to respondents.

- **Researchers can gather information on each sexual partner individually, or by asking about all partners of a specific type during a certain time period.** There are two approaches to collecting data on sexual partners in prevention studies. One approach is to collect information about each individual sexual partner in the order that the sexual encounters occurred during a specified reference period. Researchers can decide how many partners are to be included depending on the study objectives. For example, sexual network studies often focus on the last three sexual partners (Laumann et al. 2004; Morris et al. 2004), while studies examining the risk of HIV transmission may focus on all sexual partners during a fixed reference period (Bunnell et al. 2006a). The other approach is to collect information on each category of sexual partner, for example regular partners, casual partners and sex worker partners, in a given reference period (Amon et al. 2000; Horizons 2006). This method is widely used in behavioural surveillance surveys in most countries and can allow comparisons within and across countries and geographic regions. It is also the method used in the Client Instrument in this volume.

- **Recall periods may be 3, 6 or 12 months long.** Different recall periods have been used to document sexual behaviours. Behavioral Surveillance Surveys conducted by Family Health International (Amon et al. 2000), National Family Health Surveys (IIPS and Macro International 2007) and monitoring and evaluation indicators developed by the UNAIDS Monitoring and Evaluation Reference Group (MERG) use a 12-month reference period, while Centers for Disease Control and Prevention studies, such as Reproductive Health Surveys, have used a 3-month reference period (Morris et al. 2005; Bunnell et al. 2006a). Demographic and Health Surveys have used a 6-month reference period (Bateganya et al. 2005; Sarna et al. 2008). There are advantages and disadvantages to each of these recall periods. Shorter recall periods provide more reliable responses, but if few respondents report sexual activity, researchers may need to lengthen the recall period or increase the sample size. In this volume, the Prevention Module of the Client Instrument uses a recall period of 3 months, but researchers can modify this to 6 or 12 months, depending on the needs of the particular study.

- **Separate research instruments or questionnaire sections may be needed for men and women.** It may sometimes be appropriate to divide the data collection instrument into different sections for men and women respondents to make it easier to seek responses related to same sex sexual partners (men who have sex with men). If the same instrument is used for both men and women, careful skip patterns may be needed.

- **Interviewers need special training to gather data on sexual behaviour.** Training is necessary to ensure that interviewers can build rapport with respondents, conduct interviews in a non-judgemental manner and elicit accurate responses on sensitive subjects. Training on other ways to collect sensitive data such as ACASI (audio computer-assisted self-interviewing) may also be desirable.

- **Studies of sexual behaviour among HIV-positive respondents may need to address slightly different variables than those carried out among the general population.** Although prevention studies among HIV-positive populations may address many of the same questions as those among the general population, researchers may want to gather more detailed information about factors that influence sexual behaviour, depending on the scope of the study. In addition, researchers may need to add questions pertaining to stigma or disclosure, depending on the study population.

5. VARIABLES AND SURVEY QUESTIONS

The following section lists questions that can be used in surveys among HIV-positive respondents or health professionals who provide HIV-related care. Most but not all these variables are included in the Prevention Modules of the Client and Provider Instruments in this volume. As noted earlier, the Prevention Module uses a reference period of 3 months, but researchers can modify this to 6 or 12 months, depending on the study design and the preference of the researcher. “Don’t know”, “Don’t remember” and “No Response” categories can be added as appropriate.

KEY VARIABLES RELATED TO PREVENTION AMONG INDIVIDUALS LIVING WITH HIV

a. Sociodemographic variables (e.g. educational, employment and marital status)
b. Length of time since HIV diagnosis and initiation of antiretroviral therapy
c. Sexual activity
d. Type and number of sexual partners
e. Sexual activity and condom use with regular/casual/sex worker partners
f. Knowledge of partner’s HIV status/disclosure of own status to partner
g. Sexual activity and condom use among men who have sex with men
h. Concurrent sexual partners

i. Knowledge and attitudes related to HIV infection and treatment
j. Attitudes and treatment optimism related to antiretroviral therapy
k. Fertility desires and family planning methods

5.1 Variables and survey questions related to prevention among individuals living with HIV

a. Sociodemographic variables

Sociodemographic variables should include age, sex, education, employment, living conditions and socioeconomic status. Marital status is a particularly important sociodemographic variable to be included in sexual behaviour studies. In countries where polygamy is common, survey instruments should ask married individuals about more than one spouse. Researchers may also need to disaggregate findings by sex and age in order to identify findings that can inform the design of effective programmes for women and men, as well as for young people (e.g. aged 15 to 24 years) versus older adults.

b. Length of time since HIV diagnosis and initiation of antiretroviral therapy

Researchers may want to examine how sexual behaviour changes over time among HIV-positive individuals receiving antiretroviral therapy. Therefore, asking about the length of time that has passed since the respondent received the HIV-positive diagnosis or initiated antiretroviral therapy provides important information about reference periods. Time on antiretroviral therapy is also a key variable for comparing behaviour before and after starting treatment and at different points in time over the course of treatment, as well as for comparing patient groups.

c. Sexual activity and behaviours

Asking respondents whether they have had sexual intercourse in a recent reference period allows researchers to determine the number and proportion of patients on antiretroviral therapy who are sexually active. This in turn provides the denominator for the proportion of sexually active patients who engage in high-risk sexual behaviours.

VARIABLE	SUGGESTED WORDING OF SURVEY QUESTION
Proportion of respondents who are sexually active	**Have you had sexual intercourse (meaning penetrative vaginal or anal sex) during the last 3 months?**
Number of sexual partners in last 3 months	**How many different partners have you had sexual intercourse with during the last 3 months?**
Reasons for sexual inactivity in last 3 months	*If sexually inactive:* **What are the reasons why you have not had sex in the last 3 months?**

d. Type (and number of each type) of sexual partners

The Client Instrument includes numerous variables and survey questions related to the type and number of sexual partners, including the total number of partners and the number of regular partners, casual partners, sex worker partners and — for male respondents — the number of male partners (whether regular, casual or sex workers). Depending on the study objectives, researchers might want to include additional questions about the lifetime number of sexual partners (which has been found to be associated with an increased risk of unprotected sex), the age at first sexual intercourse and whether sexual initiation was forced or voluntary.

e. Sexual activity and condom use with regular partners/casual partners/sex workers

It is expected that the best recall of condom use would be for the most recent period, so it is common to enquire about condom use at the respondent's most recent sexual contact. But since successful prevention strategies require condoms to be used consistently, surveys on prevention should also ask about consistent condom use over a specific reference period. Consistent condom use is typically assessed on a categorical scale for the reference period (e.g. always, almost always, sometimes, rarely and never). If researchers need a quantitative measure to calculate the proportion of unprotected sexual acts, they may want to use a shorter reference period and include more detailed questions. Researchers may also want to ask about reasons for using or not using condoms.

VARIABLE	SUGGESTED WORDING OF SURVEY QUESTION
Penetrative sex with each type of partner (regular, casual, sex worker) in the last 3 months	**During the last 3 months, have you had sexual intercourse (meaning penetrative vaginal or anal sex) with a spouse or a live-in — what we call a regular partner?** *The same question can be posed for casual partners, sex worker partners and male partners (for male respondents).*
Consistent condom use with all partners of each type (e.g. all regular, casual, sexual worker and male partners)	**During the last 3 months, when you had sexual intercourse with your regular partner(s), how often did you and your partner(s) use a condom?** *The same question can be posed for casual partners, sex worker partners and male partners (for male respondents).*
Consistent condom use with all partners	**Thinking about all the times you had sex with any partner during the last 3 months, would you say that you and your partner(s) used a condom:** ❑ **always (every time)** ❑ **almost always** ❑ **sometimes** ❑ **rarely** ❑ **never** ❑ **declined to answer**
Condom use at last sex with most recent partner, by type	**The last time that you had sexual intercourse with your most recent regular partner, did you and your partner use a condom?** *The same question can be posed for casual partners, sex worker partners and male partners (for male respondents).*
Reasons for not using a condom at last sex (optional)	**Why didn't you or your partner use a condom the last time you had sex with a regular partner/non-regular or casual partner/sex worker?**

f. Knowledge of regular partner's HIV status and disclosure of own status

Knowledge of regular partner's HIV status and disclosure of status to regular partner are core variables for all prevention studies, as they can influence condom use. More details about how to collect information on this variable are available in the Testing and Counselling chapter.

g. Sexual activity among men who have sex with men

Depending on the research objectives and the extent of same sex behaviour among men who have sex with men in the study sites, researchers may want to include a section on this type of sexual activity in the questionnaire. For studies exploring whether such behaviour exists in the community, this line of enquiry can be limited to a few survey questions. For more detailed information, researchers can ask survey questions similar to those for other types of partners. Variables may include: sexual intercourse ever with a male partner (for male respondents), sex with a male partner in the last 3 months, number and type of male partners in the last 3 months and condom use with male partners in the last 3 months.

h. Concurrent sexual partners

Researchers with a special interest in concurrent sexual partnerships may want to ask detailed questions about the duration of sexual relationships (including start and stop dates) with various partners over a fixed time frame. This requires a full set of partner related questions, however, which lengthens the questionnaire and may not always be feasible. A simpler global question is to ask: "During the last 3 months, did you have sexual intercourse with any partner during the same period of time that you were having an ongoing sexual relationship with someone else?"

i. Knowledge and attitudes related to HIV infection and treatment

In this volume, survey questions about knowledge and attitudes related to HIV and HIV treatment are included in the Testing and Counselling Module of the Client Instrument. Therefore, they are not repeated in the Prevention Module. Researchers who want to gather information on these variables without using the whole Client Instrument may want to extract survey questions from the Testing and Counselling Module on the following topics:

- **Knowledge of HIV transmission.** What are some ways that HIV can be transmitted?
- **Knowledge of ways to reduce the likelihood of sexual HIV transmission.** What are some ways that an HIV-positive person can reduce the likelihood that he or she might transmit the virus to another person through sexual contact?
- **Knowledge of people infected with HIV.** Does the respondent personally know anybody who is infected with HIV or who has died of HIV? Or, does the respondent have a close relative or close friend who is infected with HIV or who has died of HIV? If yes, who was this person in relation to the respondent?
- **Knowledge of HIV and HIV treatment.** Does the respondent believe that antiretroviral therapy can remove the virus from the body completely? Can HIV or AIDS be completely cured? Does the respondent think that a healthy looking person can be infected with HIV?

j. Attitudes and treatment optimism related to antiretroviral therapy

The items below have been adapted from questions developed and used in studies of treatment optimism (Van de Ven et al. 1999; Elford et al. 2002; Vanable et al. 2003). These items can be analysed individually, or they can be combined to create a composite variable for optimism. Ideally they would be used with a 5-point scale (such as strongly agree, agree, undecided, disagree or strongly disagree), but a 3-point scale may be preferable in some settings.

Please indicate whether you agree, are undecided or disagree with each of the following statements:

- **I would feel safe having intercourse with someone who has an undetectable viral load (or who is receiving treatment).**
- **I am less worried about HIV infection now than I used to be.**
- **The new HIV treatments make me less anxious about having unprotected sex.**
- **I believe that HIV treatment makes people with HIV less infectious.**

k. Fertility desires and family planning methods

Given the limited availability of assisted reproduction techniques (such as sperm washing or in vitro fertilization) in most developing countries, HIV-positive individuals who want children may have no other choice but unprotected sex. Research on prevention should, therefore, include some survey questions about number of living children, desire for more children and use of family planning methods, such as:

- **Desire for children.** Does the respondent want to have a child/another child? If yes, in what timeframe? Does the respondent's spouse or partner want to have a child/another child?
- **Current use of family planning.** Does the respondent or his/her partner/spouse use any family planning method? If yes, which one?

5.2 Additional variables and questions for research on prevention

Depending on feasibility and relevance in particular settings, researchers may consider collecting data on the following topics in prevention studies.

a. Biomedical variables

If researchers can gather biomedical data, viral load and CD4 counts are key variables. Viral load may influence the risk of transmission and should be obtained where possible. CD4 cell

counts reflect the degree of immune suppression as a result of HIV infection. CD4 measures can be used as surrogate markers of improved health status, and they are more readily available than viral load tests in most resource-limited settings. Variables might include:

- **Viral load at start of treatment (if available)**
- **Viral Load – most recent/current**
- **CD4 at start of treatment (if available)**
- **CD4 – most recent/current**

b. Alcohol and Drug use

Depending upon the context, prevention strategies may need to consider addressing alcohol and drug use, either as a mode of HIV transmission (in the case of injecting drug users) or as a factor that may increase the risk of sexual HIV transmission. Alcohol use and drug use questions can be used individually or combined to develop index scores. Drug use questions are generally structured to ask about ever use, active drug use in a certain reference period and high-risk behaviours related to injecting drugs that are commonly available in the community. The reference period used to define active drug use varies with surveys. The widely used Behavioral Surveillance Surveys (Amon et al. 2000) use 6 months as the reference period. This volume contains an optional module for the purpose of gathering data on respondents' use of alcohol and other types of drugs.

5.3 Variables and survey questions related to prevention for health care providers

There are a number of variables and survey questions related to prevention in the Provider Instrument in this volume. Single or composite variables on prevention services can be generated from the following types of questions for health care providers:

- **Are clients provided information on risk reduction and safer sex at clinics where they receive treatment?**
- **Are condoms available at and distributed by the clinic?**
- **Do health providers discuss disclosure of HIV status to partners?**
- **Do they recommend partner testing?**

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Annexure 5

Perceived stigma among patients receiving antiretroviral treatment: A prospective randomized trial comparing m-DOT strategy with standard of care in Kenya

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Perceived stigma among patients receiving antiretroviral treatment: A prospective randomised trial comparing an m-DOT strategy with standard-of-care in Kenya

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Abstract

HIV and AIDS remain highly stigmatised. Modified directly observed therapy (m-DOT) supports antiretroviral treatment (ART) adherence but little is known about its association with perceived stigma in resource-constrained settings. In 2003, 234 HIV-infected adults enrolled in a two-arm randomised trial comparing a health centre-based m-DOT strategy with standard self-administration of ART. Data on perceived stigma were collected using Berger's HIV stigma scale prior to starting ART and after 12 months. This was a secondary analysis to examine whether perceived stigma was related to treatment delivery. Perceived stigma scores declined after 12 months of treatment from a mean of 44.9 (sd=7.6) to a mean of 41.4 (sd=7.7), (t=6.14, P<0.001). No differences were found between the mean scores of participants in both study arms. Also, no difference in scores was detected using GLM, controlling for socio-demographic characteristics and baseline scores. Findings indicate that a well managed clinic-based m-DOT does not increase perceived HIV-related stigma.

Keywords: *HIV/AIDS, perceived stigma, attitudes, Africa, directly observed therapy.*

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Résumé

Le VIH et le SIDA restent fortement stigmatisés. Le traitement modifié sous surveillance directe (m-DOT) favorise l'adhésion au traitement antirétroviral (ARV) mais il existe peu d'informations sur son association à la stigmatisation perçue dans des environnements pauvres en ressources. En 2003, 234 adultes infectés par le VIH étaient inscrits à un essai randomisé à deux bras comparant une stratégie m-DOT se déroulant dans un centre de santé à une auto-administration standard des ARV. Des données sur la stigmatisation perçue ont été collectées en utilisant l'échelle de stigmatisation du VIH de Berger avant d'entamer les ARV puis 12 mois plus tard. Une seconde analyse a été réalisée afin de déterminer si la stigmatisation perçue était associée au mode d'administration du traitement. Les résultats de la stigmatisation perçue ont baissé au bout de 12 mois de traitement, passant d'une moyenne de 44,9 ($\sigma = 7,7$), ($t = 6,14$, $p<0,001$) à une moyenne de 41,4 ($\sigma = 7,7$), ($t=6,14$, $p<0,001$). Aucune différence n'a été observée entre les résultats moyens des participants dans les deux branches de l'étude. De plus, aucune différence de résultat n'a été observée en utilisant le MLG, qui permet de contrôler les caractéristiques sociodémographiques et les résultats de base. Les conclusions indiquent qu'un m-DOT se déroulant dans un centre médical bien géré n'augmente pas la stigmatisation perçue associée au VIH.

Mots clés: *VIH/SIDA, stigmatisation perçue, attitudes, Afrique, traitement sous surveillance directe.*

Introduction

In Kenya, there were 1.6 million adults and children living with HIV in 2007 (UNAIDS & WHO, 2008). As of March 2007, about half of the 263 000 HIV-infected individuals who required antiretroviral treatment (ART) had initiated it (PEPFAR, 2008). Rapid scale up of ART in the country began in 2004 when Kenya received nearly $92.5 million from the Presidential Emergency Fund for AIDS Relief, in addition to substantial support from the Global Fund to fight AIDS, tuberculosis and malaria. Non-adherence to ART is a formidable barrier to treatment success. Health programmes in sub-Saharan Africa and other parts of the world still grapple with low adherence and drug resistance issues. Inadequate adherence is associated with detectable viral loads, declining CD4 counts, disease progression, episodes of opportunistic infections, drug resistance, poorer health outcomes and death (Bangsberg et al., 2006; Carpenter, Cooper, & Fischl, 2000; Conway, 2007; Pearson *et al.*, 2007). Several studies have reported high levels of adherence across treatment programmes in sub-Saharan Africa (Conway, 2007; Mills, Nachega, Buchan *et al.*, 2006; Sarna *et al.*, 2008). However, a systematic review by Mills, Nachega, Bangsberg *et al.* (2006) showed that non-adherence to ART in adult populations in a diverse range of settings varied between 33%-88%, depending on how adherence was defined and evaluated. Moreover, an increasing number of programmes are reporting poor retention and adherence overtime (Chen *et al.*, 2008; Gill, Hamer, Simon, Thea, & Sabin, 2005; Rao, Kekwaletswe, Hosek, Martinez, & Rodriguez, 2007; Wakabi, 2008) . Adherence is expected to drop as treatment expands beyond the initial select privileged cohorts that belonged to well funded programmes and those that had not started experiencing long-term side-effects of treatment, for example neuropathy and lipodystrophy (Bangsberg, Ware, & Simoni, 2006; Kip, Ehlers, & van der Wal, 2009; Malangu, 2008; Murray *et al.*, 2009). Conway (2007) makes a strong argument that sub-optimal adherence continues to be one of the most frequent reasons for poor treatment outcomes in ART programmes.

Several strategies have been utilised to optimise adherence, for example: self-efficacy building, medication management skills, patient education and use of treatment buddies (Ickovics & Meade, 2002; Nachega *et al.*, 2006; Remien *et al.*, 2005; Sabin *et al.*, in press; Safren, Hendriksen, Desousa, Boswell, & Mayer, 2003; Safren *et al.*, 2001; Samet *et al.*, 2005; Sampaio-Sa *et al.*, 2008; Simoni, Amico, Pearson, & Malow, 2008; Smith, Rublein, Marcus, Brock, & Chesney, 2003; Tuldra *et al.*, 2000; Weber *et al.*, 2004; Wong, Lawrence, Struthers, McIntyre, & Friedland, 2006). These strategies have mainly been evaluated in high-income countries. Most adherence studies in Africa have focused on home-based support, building self-efficacy and assessing ART costs and adherence (Diabate, Alary, & Koffi, 2007; Hardon *et al.*, 2007; Mukherjee, Ivers, Leandre, Farmer, & Behforouz, 2006; Ramadhani *et al.*, 2007; Simoni *et al.*, 2008; Weidle *et al.*, 2006).

Innovative strategies such as modified directly observed therapy (m-DOT) have been used in ART programmes to support adherence (Abusabha & Woelfel, 2003; Altice, Maru, Bruce, Springer, & Friedland, 2007; Christopher, 2006; Farmer *et al.*, 2001; Macalino *et al.*, 2007; Mills, Nachega, Bangsberg *et al.*, 2006; Mitchell, Freels, Creticos, Oltean, & Douglas, 2007; Munoz *et al.*, in press; Page-Shipp *et al.*, 2007; Pearson *et al.*, 2007; Pearson *et al.*, 2006). The m-DOT strategy typically involves clinic staff or trained peers observing patients ingesting only some of their ART doses while the rest of the medication is self-administered by the patient (Page-Shipp *et al.*, 2007; Simoni *et al.*, 2008). Observations are tapered at some point under the assumption that the patients have internalised the drug-taking behaviour and will maintain adherence to all medication without further support (Simoni *et al.*, 2008). Unlike other adherence interventions, m-DOT helps address daily challenges to pill-taking, provides emotional and informational support, and is a strong link with health care services (Mukherjee *et al.*, 2006). This strategy has been found to be feasible and successful in supporting adherence in community-based ART programmes in resource-constrained settings and for patients in closed settings such as long-term care facilities, prisoners and for people enrolled in methadone clinics in developed countries (Altice *et al.*, 2004; Christopher, 2006; Farmer *et al.*, 2001; Liechty & Bangsberg, 2003; Pearson *et al.*, 2007; Santos, Adeyemi, & Tenorio, 2006; Sarna *et al.*, 2008).

The availability of ART and subsequent change in perceptions of HIV and AIDS as a manageable chronic disease has led to a decrease in stigma and discrimination in the industrialised world (Herek, Capitanio, & Widaman, 2002). The situation is different in countries in Africa (UNAIDS, 2007) where ART has only recently become available to a large number of people. In several recent studies, people living with HIV and AIDS have still

reported being stigmatised, because HIV is perceived as a signal of immoral or deviant behaviour (Greeff & Phetlhu, 2007; Katamba *et al.*, 2005; Wolfe *et al.*, 2006). A recent qualitative study from Tanzania revealed that the national antiretroviral scale-up led to an emergence of a new source of stigma that was associated with ART provision (Roura *et al.*, 2009).

According to Goffman (1963), stigma has two components, which include stigma as a trait and also as an outcome of possessing that trait. Firstly, stigma as a trait is a characteristic that is viewed negatively by society, and secondly, stigma as an outcome occurs when the negative social meanings that are attached to the discrediting characteristic become labelled to an individual (Berger, Ferrans, & Lashley, 2001; Goffman, 1963). HIV-related stigmatisation is an example of this negative social labelling which alters the way people living with HIV are viewed and treated by others (enacted stigma), and how they view themselves (self-stigma) (Thorsen, Sundby, & Martinson, 2008). In Berger and colleagues' (2001) view, perceived stigma of HIV occurs in the context of two factors, namely: the individual's knowledge of having or living with the HI virus, and her or his perception of societal attitudes toward people living with HIV and AIDS. Both views negatively affect an individual's self concept and emotional reactions towards perpetrators of stigma. People with perceived stigma sometimes attempt to avoid or minimise actual stigma by closely guarding disclosure of their HIV status.

Several studies have shown that HIV-related perceived stigma may result in negative health behaviour such as non-adherence, avoiding HIV testing, non-disclosure of HIV status and poor patterns of accessing health care (Dlamini *et al.*, 2009; Greeff & Phetlhu, 2007; Makoae *et al.*, 2008; Mills, Nachega, Bangsberg *et al.*, 2006; Mills, Nachega, Buchan *et al.*, 2006; Nyblade & MacQuarrie, 2006; Peltzer, Mosala, Shisana, Nqueko, & Mngqundaniso, 2007; Plummer *et al.*, 2006; Pulerwitz, Michaelis, Lippman, Chinaglia, & Diaz, 2008; Wolfe *et al.*, 2006).

Table 1. Items from the Berger's HIV stigma scale[a] that were used to assess perceived stigma among study participants

Items[b]
Disclosure concern factors
1. In many areas of my life no one knows I have HIV
2. Telling some one that I have HIV is risky
3. I work hard to keep my HIV status a secret
4. It is easier to avoid new friendships than worry about telling someone that I have HIV
5. I am very careful whom I tell that I have HIV
6. I never feel the need to hide the fact that I have HIV (R)
Negative self-image factors
1. I feel guilty because I have HIV
2. Peoples' attitude about HIV make me feel worse about myself
3. I feel I am not as good a person as others because I have HIV
4. I never feel ashamed of having HIV (R)
5. Having HIV makes me feel unclean
Concern with public attitudes about people with HIV
1. People with HIV loose their jobs when their employers find out
2. People with HIV are treated like outcasts
3. Most people believe that a person who has HIV is dirty
4. Most people are uncomfortable around someone with HIV
5. I worry that people may judge me when they learn I have HIV

Note:
R = reverse score
[a]Berger *et al.*, 2001
[b]Participants responded using a 4-point Likert-type scale *(1.Strongly disagree 2.Disagree 3.Agree 4.Strongly agree)*

A literature review using search terms 'DAART' or 'DOT' or ' 'm-DOT' and 'HIV stigma' or 'perceived stigma' or 'internalised stigma' or 'attitude' of the period 1980-2009 identified articles on the effect of DOT on study participants' (mainly drug users) adherence, viral loads, CD4 cell counts and drug resistance (Macalino *et al.*, 2007; Mitchell *et al.*, 2007; Pearson *et al.*, 2007). Two cross-sectional studies [in South Africa: (Page-Shipp *et al.*, 2007); in the US: Santos *et al.*, 2006)] focused on attitudes to directly-observed ART. Some participants thought that the m-DOT approach was unnecessary (since they could self-administer the drugs) and intrusive due to loss of privacy, and interference with family, work or home life. However, those who wanted to receive m-DOT indicated that they would prefer to receive it from the primary health centre rather than a colleague or family member. They also expressed a desire for secrecy and a fear of disclosure beyond family members. A recent longitudinal study promoting adherence to ART using m-DOT strategy among Mozambicans did not find an increase in stigma over time (Pearson *et al.*, in press). However, this study did not compare stigma between the m-DOT and standard-of-care arms. More recently, a community-based DOT accompaniment cohort study in Peru by Munoz *et al.* (in press) observed a significant reduction in stigma among participants in the DOT arm compared to the control arm.

We set out to explore changes in perceived stigma among a cohort of HIV-infected persons initiating ART in a clinic-based m-DOT intervention to promote adherence in Mombasa, Kenya. We examined perceived stigma among HIV-infected persons prior to starting ART and after 12 months of follow-up, and investigated whether m-DOT was associated with increased perceived stigma. The stigma study was a secondary analysis of data collected as part of a larger trial that was assessing the efficacy of m-DOT in improving adherence to ART. One key finding from this trial, published elsewhere, showed that adherence with m-DOT intervention was 4.8 times greater with adjustments for depression and HIV-related hospitalisations. However, the effects were not sustained after cessation of the intervention (Sarna *et al.*, 2008).

Methods

Study setting and antiretroviral treatment programme in Mombasa Kenya

In June 2003, a joint Government of Kenya (GOK) and USAID programme to introduce ART for the management of HIV-infected persons was approved by the Ministry of Health (MOH) and began at the provincial public hospital in Mombasa (Coast Province General Hospital-CPGH). It was designed to serve as a learning site for the anticipated massive scale-up of ART in the public. This programme was a collaboration between the MOH, Family Health International (FHI), Horizons project of the Population Council and MSH RPMPlus Project. The MOH

Table 2. Characteristics of study participants at entry to the modified directly observed therapy trial in Kenya

Variables	Total (N=183)	m-DOT (*n*=88)	Control (*n*=95)	X^2 statistic	*P*-value
Age: mean years (SD)	37.4 (7.9)	37.6 (8.3)	37.2 (7.7)	0.33*	0.74
Gender					
Female	63.4 (116/183)	63.6 (56/88)	63.2 (60/95)	0.01	0.95
Marital status					
Married/cohabiting	50.0 (91/182)	48.3 (42/87)	51.6 (49/95)		
Never married	11.5 (21/182)	11.5 (10/87)	11.6 (11/95)		
Divorced/separated	15.4 (28/182)	12.6 (11/87)	17.9 (17/95)		
Widowed	23.1 (42/182)	27.6 (24/87)	19.0 (18/95)	2.38	0.50
Highest education level					
Primary/no schooling	54.7 (99/181)	57.0 (49/86)	52.6 (50/95)		
Secondary education	38.1 (69/181)	39.5 (34/86)	36.8 (35/95)		
Post secondary	7.2 (13/181)	3.5 (3/86)	10.5 (10/95)	3.35	0.19
Employment status					
Unemployed	80.8 (147/182)	85.1 (74/87)	76.8 (73/95)	1.97	0.16
Depression					
None	35.4 (63/178)	31.3 (26/83)	39.0 (37/95)		
Mild	33.7 (60/178)	30.1 (25/83)	36.8 (35/95)		
Moderate/severe	30.9 (55/178)	38.6 (32/83)	24.2 (23/95)	4.27	0.12
Disclosed status to regular partner	47.0 (77/164)	44.7 (34/76)	48.9 (43/88)	0.28	0.60
Gets support from family/friends	85.2 (155/182)	83.9 (73/87)	86.3 (82/95)	0.21	0.65
Duration since HIV diagnosis					
≤1 year	50.3 (92/183)	50.0 (44/88)	50.5 (48/95)		
>1 year	49.7 (91/183)	50.0 (44/88)	49.5 (47/95)	0.01	0.94
Number of opportunistic infections					
0-1	52.5 (96/183)	46.6 (41/88)	57.9 (55/95)		
>1	47.5 (87/183)	53.4 (47/88)	42.1 (40/95)	2.34	0.13
CD4 cell count: mean cells/mm^3 (SD)	104.1 (54.9)	109.4 (57.6)	99.2 (52.1)	1.25*	0.21

*Two independent samples t-test. SD: standard deviation. Results are % (n/N) unless stated

provided the human resources, existing health services (including medications for the management of opportunistic infections) and health service infrastructure.

FHI implemented the programme and MSH RPM Plus offered technical advice on drug logistics and rational pharmaceutical use. Horizons Program (Population Council), in collaboration with International Centre for Reproductive Health (ICRH), designed and tested a two-arm randomised controlled trial comparing a comprehensive health centre-based m-DOT strategy to promote adherence with standard self-administration of ART medications (Sarna *et al.*, 2008). The study was conducted at two public hospitals and one private (not-for-profit) hospital in Mombasa which is a coastal city in Kenya.

Ethical approval for the study was obtained from the national Kenyan ethical review committee (KNH-ERC) as well as the Institutional Review Board of the Population Council. Researchers received specific training on confidentiality and on how to obtain written informed consent from study participants before administering the questionnaires.

Study design and procedures

Between September 2003 and November 2004, ART naïve adults (aged 18 years and above), living in Mombasa who were eligible for ART (CD4 cell count <200 cells/mm^3, or WHO clinical stage 3 or 4) were invited to participate. A sample size of 230 was chosen to detect a 20% difference in adherence between study groups (80% adherence with m-DOT versus 60% in controls) assuming 40% death or loss to follow-up, an alpha of 0.05 and power of 0.80 (Sarna *et al.*, 2008). Study participants (234 total: 149 women and 85 men) were randomly assigned to either the m-DOT or standard-of-care strategies. Computer generated random-number assignment was used, allocating an equal number of participants to treatment and control groups. Allocation concealment was maintained with sequentially numbered, opaque sealed envelopes. Prior to ART initiation, participants were randomly assigned to study groups in blocks of 40. It was not feasible to blind the m-DOT strategy, given the visible and obvious nature of the intervention. However, laboratory personnel were blinded to the study group allocation.

Treatment and care were provided within routine services at HIV clinics in participating facilities. Following initiation of ART, study participants visited treatment centres every four weeks for clinical follow-up. In addition to receiving standard-of-care, those in the intervention arm received m-DOT for a period of six months. This entailed twice weekly visits to a health facility, where participants met with a nurse who observed the ingestion of one dose, dispensed more medication and provided individualised adherence support. After six months of ART, study participants were changed to standard adherence case management, where

they were required to attend the clinic once a month for follow-up and collection of a months' supply of their medication. Community workers traced participants who missed visits or were unable to visit the health centre. In order to avoid possible increases in stigma resulting from home visits by community worker's known to be HIV carers, participants were encouraged to nominate a person who would actively trace and follow them up if they missed a visit. Some participants preferred to be traced by community workers unknown in their neighbourhoods.

Study questionnaires were translated into the local language (Swahili) and back translated to English. Trained researchers collected data using semi-structured questionnaires in face-to-face interviews. Researchers received training on how to obtain information from study participants in a non-judgmental way. Questions included background information such as age, sex, education level, marital and employment status, depression, disclosure of HIV status, family support and history of opportunistic infections.

Socio-demographic variables collected at baseline were categorised as follows: marital status was classified as married/cohabiting, never married, divorced/separated, and widowed; education as: none/primary education (0-8 years of school attendance), secondary education (9-12 years), and post-secondary education (>12 years); employment into currently employed and unemployed. Family support was assessed by asking participants whether family members supported them after disclosure of their HIV status, and categorised as a binary response (received support/did not receive support). Duration since HIV diagnosis was assessed by asking participants how long they had know their HIV status (weeks/months/years). For further analysis, this information was categorised as a binary response (1year or less/more than 1 year). The number of opportunistic infection episodes were collected from patients' medical records and categorised into two groups (0 to1 episode, or more than one episode) (see Table 2).

Information on perceived stigma was obtained prior to the start of treatment and after 12 months (0 and 48 weeks; two data points). Perceived stigma was assessed using a 16-item scale (Cronbach's alpha of adapted scale: 0.81) derived from Berger's HIV stigma scale (Cronbach's alpha: 0.96) (Berger *et al.*, 2001), and field tested for translation accuracy and comprehension before use. This scale covered three domains: disclosure concerns (6 items); negative self-image (5 items); and concerns with public attitudes about people with HIV (5 items). The items are displayed in Table 1. Berger's HIV stigma scale has four domains, but in this study the personalised stigma domain was not included, because similar questions regarding respondent's personal experiences with stigma were addressed in a separate section of the questionnaire. The Berger scale requires participants to respond on a four-item Likert scale (strongly disagree=1, disagree=2, agree=3 and strongly agree=4) to statements about their feelings and opinions regarding how people treated them because of their HIV status. The scale assesses perceived stigma cross-sectionally without a recall period. All items were coded so that a higher score indicated more stigma and vice versa. The range of possible scores for each item was 1 to 4; therefore, possible summed scores ranged from 16-64. Total stigma scores were categorised into four stigma levels: minimal (16-28), low (29-40), moderate (41-52) and high (53-64). For further analysis the scores were categorised into two categories (minimal or low (16-40), or moderate or high stigma (41-64)). The change score was derived as follows: baseline stigma scores were subtracted from follow-up stigma scores (i.e., follow-up score minus baseline score) to obtain the difference over the 12 month period after initiation of ART.

Depression was assessed at baseline, and weeks 24, 48 and 72 (four data points), using a culturally adapted 21 item Beck's Depression Inventory version I® (Cronbach's alpha: 0.86) translated into Swahili (Cronbach's alpha for the Swahili BDI: 0.84). The tool assesses depression over the past four weeks. Depression was categorised as none (0-9), mild (10-18), moderate (19-29) and severe (30-63) as per BDI guidelines (Beck & Mendelson, 1961). CD4 cell counts were determined at baseline and weeks 24, 48 and 72 using PARTEC (four data points) using PARTEC (Partec-GmBH, Münster, Germany) and FACS counters (Becton & Dickinson Immunocytometry Systems, California, USA). For the stigma analysis presented in this paper only two data points (0 and 48 weeks) were used for all variables: perceived stigma, depression and CD4 counts.

Data management and analysis

Data were double-entered by separate clerks in a Microsoft Access 2003 database and analysed using SAS version 9.1. Chi-square and Student's t test were used to compare socio-demographic characteristics and selected variables between the groups, and to confirm that the randomisation procedure successfully removed any potential confounding factors. As outcomes were integer-level data (stigma scores at 12 months and change in stigma scores), we used generalised linear models (GLM) to assess whether having received m-DOT was associated with stigma scores, after controlling for socio-demographic characteristics and baseline stigma scores.

Table 3. Perceived stigma mean scores among study participants at baseline and 12 months after initiating antiretroviral treatment

Variables	Baseline (*n*=183) Mean(SD)	Follow-up (*n*=183) Mean(SD)	t[a]	*P-value*
Total stigma score	44.9 (7.6)	41.4 (7.7)	6.14	<0.001
Domains				
Disclosure	17.9 (3.1)	17.2 (3.5)	2.67	0.008
Negative self-image	12.2 (3.4)	10.4 (3.5)	6.25	<0.001
Public attitudes	14.8 (3.1)	13.6 (3.4)	4.23	<0.001

[a]: paired t-test SD: standard deviation

Table 4. Perceived stigma baseline, follow-up and change mean scores among study participants by study arms

Variables	m-DOT(*n*=88) Mean(SD)	Control (*n*=95) Mean(SD)	t[b]	*P*-value
Baseline stigma				
Total stigma score	44.6 (7.7)	45.1 (7.5)	-0.49	0.62
Domains				
Disclosure	17.7 (2.9)	18.2 (3.3)	-1.07	0.28
Negative self-image	12.2 (3.5)	12.1 (4.1)	0.13	0.89
Public attitudes	14.7 (3.1)	14.8 (2.9)	-0.24	0.81
Follow-up stigma				
Total stigma score	41.7 (8.2)	41.1 (7.2)	0.56	0.58
Domains				
Disclosure	17.1 (3.5)	17.4 (3.5)	-0.59	0.56
Negative self-image	10.6 (3.6)	10.1 (3.4)	0.93	0.35
Public attitudes	13.8 (3.5)	13.5 (3.4)	0.66	0.51
Change stigma				
Total stigma score	2.9 (7.7)	4.0 (7.4)	-1.03	0.30
Domains				
Disclosure	0.6 (3.4)	0.8 (3.6)	-0.40	0.69
Negative self-image	1.6 (3.9)	2.0 (3.9)	-0.72	0.47
Public attitudes	0.9 (3.6)	1.3 (3.5)	-0.87	0.39

t[b]: Two independent samples t-test SD: standard deviation

Results

Background characteristics of study participants

Eight of the 234 participants did not initiate ART (two withdrew from the study, two died, one was lost to follow-up and three could not participate due to severe illness). A year after ART initiation, 21 people had died, 11 were lost to follow-up and 11 had discontinued study participation (five transferred to other hospitals and six had discontinued ART). No difference was detected between the baseline stigma scores of participants who completed the study, died or were lost to follow-up (F=2.20, P=0.114). This paper is based on findings from 183 study participants who had baseline stigma data and completed 12 months follow-up.

Mean age of the 183 participants was 37.4 years (sd=7.9 years; Table 2). Sixty-three percent were female, half (50%) were married and about one quarter (23.1%) were widowed. There were no differences noted between the m-DOT and standard-of-care groups with regard to the socio demographics and other variables, as would be expected with random allocation to treatment group (see Table 2).

The majority of respondents reported receiving support from family and friends (85.2%). However, less than half (47%) of the participants had disclosed their HIV status to a regular partner.

Perceived stigma

Prior to initiating treatment, about three quarters (72.2%) of study participants reported moderate to high levels of perceived stigma. There was no difference in the proportion with moderate or high levels of perceived stigma between the m-DOT and standard-of-care groups (69.8%, [60/87] versus 74.5%, [70/94]; P=0.48) (data not shown in tables). At the 12 month follow-up visit, the proportion of study participants who had moderate to high stigma scores declined from 72.2% (130/180) at baseline to 56.1% (101/180; P<0.001)). Again, there was no difference noted between the m-DOT and standard-of-care groups (56.3% [49/87] versus 55.9% [52/93]; P=0.96) (data not shown in tables).

Table 3 shows perceived stigma means scores among study participants at baseline and 12 months after initiating antiretroviral treatment. Overall, perceived stigma scores declined after 12 months of treatment from a mean of 44.9 (sd=7.6) to a mean of 41.4 (sd=7.7), (t=6.14, P<0.001). Results from the three stigma domains each followed a similar trend, with total mean scores declining; disclosure concerns (17.9 vs. 17.2, t=2.67, P=0.008), negative self-image (12.2 vs. 10.4, t=6.25, P<0.001), and public attitude concerns (14.8 vs. 13.6, t=4.23, P=<0.001) (see Table 3). No differences, however, were detected between the mean scores of participants in the m-DOT and standard-of-care arms (see Table 4).

GLM was used to analyse the relationship between m-DOT and perceived stigma scores. No significant association was detected between m-DOT and perceived stigma after controlling for age, sex, level of education, marital status and baseline stigma (see Table 5). In this analysis, the mean stigma score at 12 months was 0.90 higher in the m-DOT group than the controls, but the confidence interval included the null effect (95%CI= -1.06 to 2.87; P=0.36). The results were very similar when the outcome change in stigma score was assessed in a second GLM (data not shown). Mean stigma score at 12 months, however, was 4.54 points lower for people with post-secondary education compared with those with no or only primary education (95%CI= -8.58 to -0.49; P=0.03).

Discussion

Our study found that m-DOT strategy did not increase perceived stigma among persons receiving ART. These findings were similar

Table 5. GLM analysis to assess the effect of m-DOT on perceived stigma among study participants after 12 months of antiretroviral treatment

Variable	Coefficient	Standard error	(95% CI) Lower	Upper	*t* value	*P*-value
Intercept	21.81	4.14	13.65	29.98	5.27	<0.001
Treatment Group	-	-	-	-	-	-
m-DOT	0.90	0.99	-1.06	2.87	0.91	0.36
Baseline Stigma	0.51	0.067	0.37	0.64	7.56	<0.001
Age (years)	-0.064	0.069	-0.20	0.072	-0.93	0.36
Sex						
Female (ref)	-	-	-	-	-	-
Male	-0.59	1.18	-2.92	1.74	-0.50	0.62
Marital status						
Married/cohabit (ref)	-	-	-	-	-	-
Never married	-1.17	1.60	-4.33	1.99	-0.73	0.46
Divorced/separated	1.50	1.46	-1.38	4.38	1.03	0.31
Widowed	0.94	1.35	-1.73	3.61	0.69	0.49
Highest education level						
No schooling/primary(ref)	-	-	-	-	-	-
Secondary	-1.74	1.08	-3.87	0.39	-1.61	0.11
Post secondary	-4.54	2.05	-8.58	-0.49	-2.21	0.028

to a community-based DOT cohort study in Peru (Munoz *et al.*, in press) that observed a significant reduction in stigma among participants in the DOT arm compared to the control arm. Pearson and colleagues' (in press) assessment of stigma among Mozambicans who had been on a one year ART regimen did not find a change in stigma; however, stigma increased with depression and decreased with disclosure of HIV status to a friend.

Although the results from our study did not show differences in perceived stigma between the m-DOT and standard-of-care groups, overall, the level of stigma among study participants after 12 months of ART was still high. This supports the view that HIV stigma remains a problem in developing countries, and that there is a pressing need for effective stigma reduction interventions to facilitate normalisation of HIV and AIDS (Greeff & Phetlhu, 2007; Katamba *et al.*, 2005; Munoz *et al.*, in press; Pearson *et al.*, in press; Pulerwitz *et al.*, 2008; Sayles, Wong, Kinsler, Martins, & Cunningham, 2009; UNAIDS, 2007; Wolfe *et al.*, 2006).

A few previous studies indicated that patients did not favour m-DOT due to confidentiality concerns (Liechty & Bangsberg, 2003; Page-Shipp *et al.*, 2007; Santos *et al.*, 2006). Therefore, despite the findings of our study, concerns about confidentiality, together with persisting high levels of stigma, show that much care still needs to be taken to ensure that HIV-related interventions do not increase stigma. Liechty and Bangsberg (2003) noted that both the Haitian (Farmer *et al.*, 2001) and Rhode Island (Mitty, Stone, Sands, Macalino, & Flanigan, 2002) m-DOT initiatives were successful because the interventions were carefully designed to minimise stigma. In rural Haiti, accompagnateurs, who originally supervised therapy for tuberculosis in the 80s, delivered antiretroviral drugs to patients in the community, and were believed to be less stigmatising than witnessed dosing (Farmer *et al.*, 2001). Additionally, the community-based DOT study by Munoz *et al.* (in press) used paid community health workers to perform DOT at home, and offered additional emotional support to study participants. This led to behaviour change among family members and providers. Another example is the m-DOT study in Mozambique in which researchers repositioned the HIV clinic entrance to a quiet corridor of the hospital prior to the start of the study to reduce the stigma of entering and exiting the HIV care facility (Pearson *et al.*, 2006).

There are several reasons why our m-DOT intervention did not increase stigma. One major plausible explanation was that our intervention was tailored using qualitative information from formative research (Sarna *et al.*, 2008). Findings from formative research showed that patients preferred to select the sites where they would be observed ingesting their medication, and the community health workers who would trace them when they failed to show up for their clinic visits. Moreover, they confirmed that they wanted a family member or close friend to accompany them for the clinic visits. In our study, m-DOT participants were observed twice a week by well trained nurses in confidential rooms at several sites selected by patients. Home visits were restricted to participants who had missed clinic appointments. Trained community health workers, who were selected by patients, delivered medications and provided emotional support. Additionally, study participants were encouraged to bring a family member or friend to the twice-weekly m-DOT clinic visits and counselling sessions. Our study suggests that formative research is useful in tailoring m-DOT to ensure that it does not increase stigma. Further research is needed to confirm this observation.

Another observation that warrants further research is the relationship between the duration of the m-DOT and level of stigma. In the community-based DOT by Munoz and colleagues (in press), participants were supported for 12 months; with Pearson *et al.* (in press) m-DOT was done for six weeks; and our m-DOT intervention was conducted for six months. Does the length of m-DOT have an effect on perceived stigma? More research needs to be done to answer this pertinent question.

This study has several limitations. First, some aspects of stigma may be specific to local settings, limiting the generalisability of the findings. Second, the study was done in a health facility, and it is therefore uncertain whether we would find similar findings if m-DOT services were primarily community-based. Third, given that each patient only received six months of m-DOT services, more research is needed to assess the impact of a longer m-DOT intervention on perceived stigma. Fourth, the Berger HIV stigma scale mainly measures perceived stigma and may not capture compound or layered stigma (Nyblade, 2006). Fifth, the follow-up data collection exercise was done six months after the m-DOT intervention had been completed, and the time lag between measures could have influenced our findings to some extent. A dedicated m-DOT stigma study is warranted to explore the relationship of stigma and the duration of m-DOT implemented in clinic- and community-based settings.

The larger RCT demonstrated that the use of m-DOT did increase adherence; and evidence from this secondary analysis indicates that perceived stigma did not increase post m-DOT. These findings suggest that m-DOT could be a useful strategy to improve adherence in resource constrained settings.

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