

The Impact and Importance of Voluntary Counselling and Testing for HIV in sub-Saharan Africa

Íde Cremin

Department of Infectious Disease Epidemiology, Imperial
College London

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Abstract

Voluntary counselling and testing (VCT) for HIV is promoted as a primary prevention strategy to reduce the heterosexual transmission of HIV in sub-Saharan Africa. A theoretical framework for the determinants of uptake of VCT and behavioural outcomes following VCT was developed. Demographic and Health Survey (DHS) data collected from 2003 to 2005 from ten countries were analysed to test the framework by comparing nationally representative trends in uptake of testing. Data from a population-based open cohort study in Manicaland, Zimbabwe was also used to test this framework by analysing trends in sexual behaviour and behaviour change associated with having received VCT.

DHS data indicate that knowledge of serostatus varied widely between countries and ranged from 2% among women in Guinea to 27% among women in Rwanda. Despite these varied levels of testing, univariate analysis showed the profile of testers to be remarkably similar across countries with respect to socio-demographic characteristics. Adjusted analyses indicate that a secondary or higher level of education and an awareness that treatment exists are key determinants of uptake of VCT. Uptake of VCT in the Manicaland cohort is low, at 8.6% in the most recent survey. Against a background of behavioural risk reduction in the general population, there was no evidence for additional risk reduction associated with having received VCT in the Manicaland cohort.

This work provides a baseline for monitoring trends in testing and exploring changes in the profile of those who get tested as provision of testing and treatment services increase. Within the Manicaland study population, these results do not provide evidence that VCT can promote behavioural risk reduction, in a context of background reductions in risk. Uptake of VCT is expected to increase in this population as treatment becomes available. It is important that VCT services are monitored and evaluated and the importance of risk reduction is emphasised through good quality counselling. To succeed as a prevention measure, VCT must attain a high coverage of the sexually active population and lead to sustained risk reduction among both infected and uninfected individuals.

Declaration

I declare that the work in this thesis is my own work.

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Abbreviations and Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Clinic
ART	Antiretroviral Therapy
BRTI	Biomedical Research and Training Institute
CDC	Centers for Disease Control and Prevention
DF	Degrees of Freedom
DHS	Demographic and Health Survey
EIA	Enzyme Immunoassay
FACT	Family AIDS Care Trust
FDA	United States Food and Drug Administration
HIV	Human Immunodeficiency Virus
IDU	Injecting Drug User
MSM	Men Who Have Sex With Men
NGO	Non-Governmental Organisation
OR	Odds Ratio
PMTCT	Prevention of Mother-to-Child Transmission
PSI	Population Services International
PY	Person Years
RCT	Randomized Controlled Trial
SD	Standard Deviation
STI	Sexually Transmitted Infection
UNAIDS	Joint United Nations Programme on HIV/AIDS
VCT	Voluntary Counselling and Testing
WHO	World Health Organisation

Outline and structure of thesis

Key research questions

The overall aim of this thesis is to understand the determinants of uptake of HIV counselling and testing and how sexual behaviour changes following counselling and testing, through the development and testing of a theoretical framework. Data from: (i) nationally representative DHS and (ii) a population-based cohort study in Manicaland, Zimbabwe are analysed to address this aim. This analysis is guided by the following key questions, which fall into two broad categories:

(i) Uptake of HIV counselling and testing

- What is the level of uptake of HIV counselling and testing?
 - What are the determinants of uptake HIV counselling and testing?
- These questions are addressed in Chapter 4 using data from DHS and in Chapter 6 using data from the Manicaland cohort in Zimbabwe.

(ii) Behavioural outcomes following HIV counselling and testing

- What are the general trends in sexual behaviour, regardless of receiving counselling and testing?
- This is addressed in Chapter 5 using data from the Manicaland cohort in Zimbabwe.
- What is the impact of receiving VCT on subsequent sexual behaviour?
- This question is addressed in Chapter 6 using data from the Manicaland cohort in Zimbabwe.

Organisation of chapters

Chapter 1 provides a general background to the thesis by outlining a broad overview of various aspects of counselling and testing for HIV. A theoretical framework for the determinants of uptake and behavioural outcomes following HIV counselling and testing is developed in Chapters 2 and 3. The determinants of uptake of testing are reviewed in Chapter 2, which outlines how contextual factors, type of service provision and individual level characteristics influence the uptake and testing. Behavioural outcomes following counselling and testing are discussed in Chapter 3, which provides an overview of behavioural theories, a discussion of the role of counselling and testing for changing risk behaviour, and a comprehensive review of studies from sub-Saharan Africa analysing the impact of counselling and testing on sexual behaviour.

The socio-demographic profile of individuals testing for HIV has implications for equitable access to treatment and has not been described at a nationally representative level in an African context. Chapter 4 presents a cross-country comparison of trends in uptake of testing in sub-Saharan Africa. DHS data from ten African countries are analysed to describe patterns of uptake of HIV testing. To understand the impact of counselling and testing on sexual behaviour, trends in behaviour must first be described. Thus, in Chapter 5 behavioural data from the Manicaland cohort study are analysed to examine trends in behavioural indicators. In Chapter 6 this longitudinal behavioural data is analysed to determine the patterns of behaviour change associated with receiving counselling and testing. The provision and uptake of counselling and testing services in the Manicaland study are also described in Chapter 6.

The main findings of this thesis and directions for future research are outlined in the final chapter. Appendix A contains results of multivariate analyses of characteristics associated with having tested for HIV in six countries, as a supplement to chapter 4. Appendices B and C contain published manuscripts based on work included in this thesis.

Chapter 1: Introduction

1.1 Background

The first cases of acquired immunodeficiency syndrome (AIDS) were identified in the United States in 1981 [1]. The discovery of the retrovirus, subsequently named Human Immunodeficiency Virus (HIV), which causes AIDS was announced in 1984 [2, 3]. Since then, HIV has become one of the leading causes of death worldwide [4].

As of November 2009, it is estimated that 33.4 million [95% confidence interval, 31.1 million – 35.8 million] people worldwide are infected with HIV [5]. Global HIV incidence is estimated to have peaked in 1996, when 3.5 million new infections occurred in this year [5]. Despite some success in HIV prevention efforts, the global rate of new infections remains high; an estimated 2.7 million people were newly infected in 2008 [5].

Sub-Saharan Africa bears the largest burden of disease, with an estimated 22.4 million [95% confidence interval, 20.8 million – 24.1 million] HIV positive people in 2008, accounting for 67% of all HIV infections worldwide [5]. Although the rate of new infections in sub-Saharan Africa is declining, it exceeds AIDS-related mortality; in 2008, an estimated 1.9 million people became newly infected with HIV, while an estimated 1.4 million AIDS-related deaths occurred [5].

The adult HIV prevalence for sub-Saharan Africa is estimated to be 5.2% [95% confidence interval, 4.9 -5.4] overall, notwithstanding large variations among and within countries. The epidemic is most severe in southern Africa, with seven countries in the region having HIV prevalence of greater than 15% among adults aged 15 to 49 years (Botswana (23.9%), Lesotho (23.2%), Namibia (15.3%), South Africa (18.1%), Swaziland (26.1%), Zambia (15.2%) and Zimbabwe (15.3%) [6]. The demographic impact of this epidemic has been severe. For example, in Swaziland, average life expectancy has fallen from 72 years in 1990 to 37 years in 2007, largely as a result of HIV-related mortality [7].

The primary mode of transmission of HIV in sub-Saharan Africa is unprotected heterosexual intercourse, and women are disproportionately affected, especially among

younger age groups [5]. In the nine countries in southern Africa most affected by HIV (those listed above, Malawi and Mozambique), prevalence among women aged 15-24 years was three times greater, on average, than that of men of the same age [8].

Despite the severity of the epidemic in sub-Saharan Africa, the majority of infected individuals are unaware of their serostatus, due to the long asymptomatic period of infection. Consequently, counselling and testing for HIV can play an important role in the response to the HIV epidemic as an entry point for prevention, treatment, care and support services.

This chapter provides a general background for various aspects of HIV counselling and testing. In the following section, the importance of HIV counselling and testing for prevention and treatment is outlined. Next, the history of HIV testing and policy recommendations regarding HIV testing are summarised. This is followed by an overview of types of service provision for HIV counselling and testing, developments in diagnostic tests for HIV, and a brief discussion of the approaches to counselling. Finally, a synopsis of increases in provision and uptake of counselling and testing services is provided.

1.2 Importance of HIV counselling and testing

Counselling and testing plays a key role in both treatment and prevention of HIV, as testing is necessary to identify those in need of treatment, and counselling provides an opportunity to encourage safer sexual behaviour so that: (i) those who are infected can avoid infecting others and (ii) those who are uninfected can prevent themselves from acquiring infection.

Testing for HIV is an entry point into a number of prevention, treatment and care services (Figure 1.1). HIV testing alone does not guarantee appropriate services, but without testing many services are unattainable, for example prevention of mother-to-child transmission (PMTCT) services.

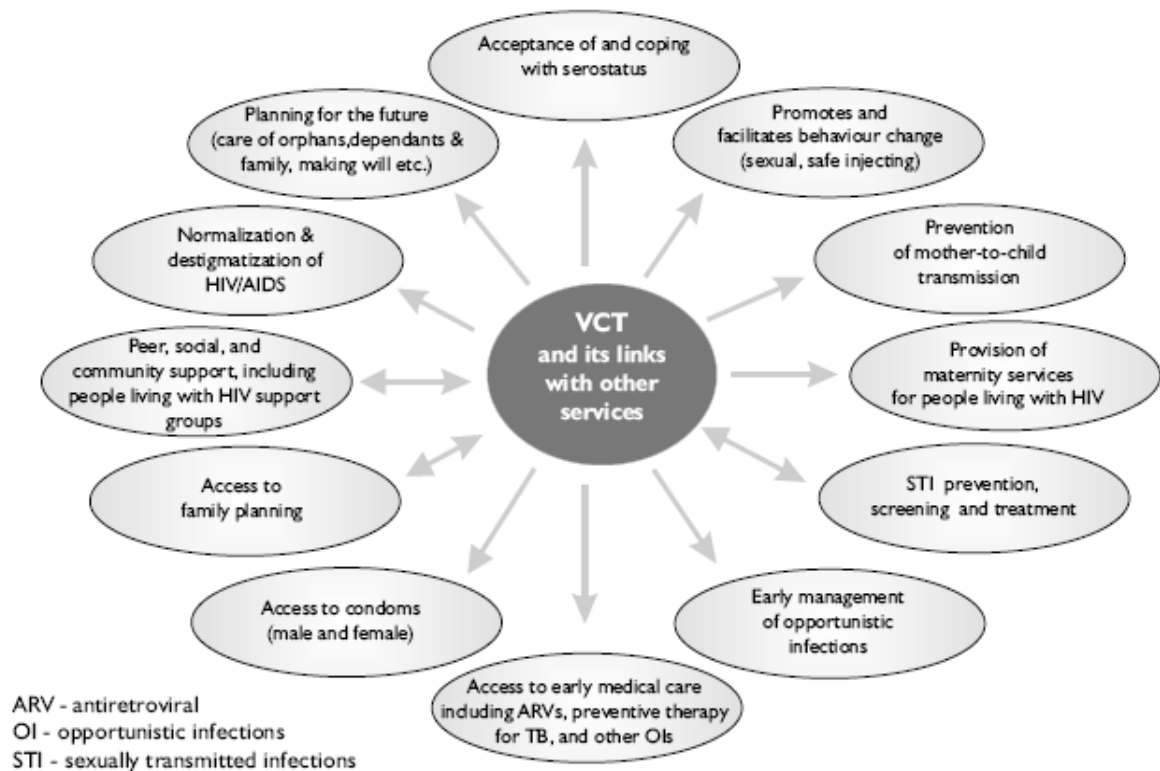


Figure 1.1 Voluntary counselling and testing (VCT) as an entry point for prevention and care. Source: UNAIDS [9].

Pre- and post-test counselling sessions are a means of encouraging behavioural risk reduction by assisting with risk assessment, encouraging disclosure of serostatus to partners and discussing a risk reduction plan if necessary [10]. In addition to encouraging behavioural risk reduction, counselling and testing can contribute to prevention by enabling those who are infected to receive treatment, thus reducing their viral load and therefore their infectiousness [11, 12].

Given low uptake of testing, it has been shown that the majority of new infections occur through transmission from persons who are unaware of their HIV-positive status [13]. Furthermore, low uptake of testing is one of the reasons for late diagnosis of infection, late entry into medical care and access to treatment, and hence, high mortality in the months following treatment initiation [14, 15]. Late diagnosis is also a lost opportunity to

reduce onward transmission, either behaviourally, through reducing sexual risk behaviour or biologically, through reducing an individual's infectivity [16].

Thus, HIV counselling and testing has become increasingly important in the response to the AIDS epidemic. The WHO made HIV testing its first strategic priority for tackling the AIDS epidemic [17]. Furthermore, there have been calls for universal HIV testing in Africa [18], and the WHO have frequently called for knowledge of serostatus among all citizens in high-prevalence countries to be a goal of prevention efforts [19, 20].

1.3 History of HIV counselling and testing

Early debate regarding HIV testing

The history of HIV testing is rooted in a debate between public health and human rights. The initial response to HIV was influenced by disputes between civil liberty proponents and the public health establishment in the United States. When HIV tests first became available in the mid 1980s, standard public health measures such as surveillance testing, contact investigation and tracing and quarantine, were highly controversial. The stigma associated with an HIV diagnosis and fears that a traditional public health approach could “drive the epidemic underground” meant that HIV testing was largely a voluntary practice [21]. However, this policy was criticised for maintaining “HIV exceptionalism”, which was blamed for low testing rates [22].

The public health approach (i.e. standard public health measures for disease control) argues that HIV should be treated like other diseases, for which consent for testing is implicitly assumed by virtue of medical consultation. Most medical tests, even those for lifelong illnesses such as diabetes and cancer, are offered and explained by health providers in a manner such that the majority of patients have the test; they are told that they need a particular test, why they need the test and what is going to be done if the test indicates disease.

The criticisms of AIDS exceptionalism and “rights-based” approaches, with respect to HIV testing, have been outlined in hindsight [23]. First, the international response to HIV

was largely determined by early experience in the United States, rather than in sub-Saharan Africa where the epidemic is most severe. Second, the exceptionalist approach focused on individuals, whereas in severely-affected countries in sub-Saharan Africa, HIV has affected families and whole societies. Third, failure to diagnose HIV co-infection with diseases such as tuberculosis, lead to compromised medical care. Fourth, a focus on an individual's privacy as a priority, and under-emphasis of prevention, may have had the adverse outcome of increasing HIV-related stigma. Finally, HIV testing was not initially advocated for prevention and care.

Official guidelines and policies regarding HIV testing

The guidelines and policies regarding HIV counselling and testing have evolved as the response to the epidemic has progressed and key developments, such as the discovery of treatment and increased financial resources for HIV/AIDS, have taken place. Prior to the development of treatment, the only situations in which HIV testing was recommended were: (i) screening of blood and organs for transplantation; (ii) unlinked anonymous testing for epidemiological surveillance; (iii) diagnosis of symptomatic infection among patients suspected of having AIDS; and (iv) for those who wish to know their status [24].

Subsequent to the development of treatment, policy recommendations became increasingly supportive of expanding testing. In 1997, UNAIDS issued a policy statement which encouraged countries to make good-quality voluntary HIV counselling and testing available and accessible [25]. In 2003, WHO and UNAIDS published a report introducing new approaches to HIV counselling and testing [26]. This emphasised the need to expand access to counselling and testing and make HIV testing widely available in tuberculosis clinics, sexually transmitted infection (STI) clinics and antenatal clinics (ANC), as well as for those who want to know their status. This was followed by a policy statement in 2004 that recognised the different reasons for testing and was permissive of different approaches to HIV testing in different settings [27]. This policy recommended a routine offer of testing, with the choice to opt-out, for pregnant women, all patients assessed in an STI clinic, and all patients seen in health service settings where HIV is prevalent and treatment is available. However, this policy failed to be widely put into

practice due to lack of adequate follow-up and some ambiguity in the text [28]. Thus, in 2007, in the context of accelerating access to treatment, WHO and UNAIDS issued guidance on provider-initiated HIV counselling and testing in health facilities in countries with generalised HIV epidemics explicitly recommending an opt-out approach [29]. In practice, this means that health care workers should recommend a HIV test to all patients regardless of their symptoms or reason for attending the health facility. The policy for provider-initiated opt-out testing acknowledges a rights-based approach to expanding HIV testing, which emphasises that the voluntariness of testing must remain central [30]. It has been also emphasised that testing should not be carried out against a patient's will, without their knowledge, without information and counselling and without referral to appropriate services [28].

The adoption and implementation of testing policies is a gradual process and has varied by country. In 2008, twenty countries in sub-Saharan Africa with generalized HIV epidemics reported having testing policies which encouraged health care workers to offer testing and counselling to everyone, regardless of the patients symptoms and type of facility. For example, Cameroon adopted provider-initiated testing in 2007 and Zambia has done so since 2008 [31, 32]. Provider-initiated testing initiatives and outreach testing programmes have been successfully established in many countries including Kenya, Malawi, Uganda and Zimbabwe [33-35]. In many countries this policy is being implemented in a phased manner. The early implementation of provider-initiated counselling and testing in Botswana, in 2004, and the subsequent increase in uptake of counselling and testing are discussed in Chapter 2 (section 2.5.1 regarding provision of testing and treatment services). In addition to implementing the policy of provider-initiated testing, there is increasing promotion of testing in many countries with Burkina Faso, Kenya, Lesotho, Malawi, Namibia, Rwanda, South Africa, Swaziland, Uganda and Tanzania having already held, or are planning to hold, national HIV testing and counselling campaigns [17].

Similar policy developments to increase levels of HIV testing have occurred in the United States [10]. In 2006, guidance which recommended routinely testing all individuals (aged 13 to 64 years) attending health-care facilities was issued by the Centers for Disease Control and Prevention (CDC) [36]. Although there is verbal consent and the option to refuse, separate written consent for testing is no longer required and these guidelines also state that risk reduction counselling is advisable but not mandatory.

Recent debate regarding HIV testing

The availability of treatment and increased financial resources to expand access to treatment means that an AIDS exceptionalism approach to HIV testing has become less justifiable [23]. Thus, the discussion of a rights-based approach versus a public-health based approach to HIV testing has been surpassed by a debate regarding the recent policy of provider-initiated opt-out testing.

Advocates of provider-initiated opt-out testing emphasise the importance of testing for identifying those in need of treatment and the missed opportunities of not diagnosing infected individuals when they present at health care facilities [18, 28]. It has been suggested that routine testing may lead to reductions in stigma through normalising HIV testing, as stigma may persist in areas where uptake of testing is low and only a small proportion of individuals know their status [26, 28].

Critics of opt-out testing, albeit a minority, question the feasibility of providing the needed referral, treatment and prevention services given the weak health system, shortages of health care workers and a culture of low health service utilization in sub-Saharan Africa [37]. There are also concerns regarding ensuring consent and confidentiality [38]. In particular, provider-initiated opt-out testing has been criticized for implicitly compromising the voluntariness of HIV testing as it may potentially be coercive, given that many individuals may feel obliged to agree to a test recommended by a health care professional [38]. There are also concerns that provider-initiated testing could deter individuals from accessing health services, that counselling will no longer be practiced, that there will be a lack of protection for those testing positive and that stigma

and HIV-related violence against women could increase (as women are more likely to come into contact with health services and hence are more likely to get tested) [37, 39, 40]. However, both advocates and critics agree that there is a need to increase access to HIV testing services and that these services should be evaluated [41, 42]. Importantly, where provider-initiated opt-out testing has been implemented, in Botswana for example, there is little evidence to support the concerns outlined above [43, 44].

1.4 Provision of HIV counselling and testing

Type of provision of HIV counselling and testing services

There are many contexts for HIV testing [45]. Testing can be mandatory for certain groups such as sex offenders and prisoners, and mandatory testing is also used in some countries for immigration purposes and pre-employment screening for armed services. HIV testing without consent has also been used in medical circumstances, for example, for unconscious patients. However, because of human rights issues, the vast majority of HIV testing is voluntary and requires consent.

There are many types of service provision for voluntary counselling and testing, which include free-standing services, integrated services and outreach services. Free-standing services involve a “stand-alone” clinic, which is only used for HIV counselling and testing. These services have the advantage of flexible opening hours and strong community links, but AIDS-related stigma may deter individuals from attending. Counselling and testing is often integrated into existing health facilities such as STI clinics, tuberculosis clinics, family planning services and mother and child health services (e.g. PMTCT programmes). Integrated services allow ease of cross-referrals and can be less expensive than free-standing services. However, as with free-standing services, they rely on individuals presenting at a health facility. Outreach services typically involve mobile counselling and testing to provide access for “hard-to-reach” populations, most typically relatively isolated rural areas. However, they often require community mobilization and can be expensive.

Developments in diagnostic tests for HIV

There are three types of HIV diagnostic test: antibody, antigen and Nucleic Acid Test. In 1985, one year after the HIV virus was discovered; the first test for HIV was approved and licensed by the United States Food and Drug Administration (FDA) [46]. This was an antibody test, with a high sensitivity but low specificity, and was used for screening blood donations for transfusion. Since then, there have been many advances in HIV testing technology. In 1996, the first antigen test was approved [47]. The p24 antigen test has much higher specificity than the original antibody test as it detects the virus itself (i.e. the p24 surface protein), hence it does not require an immune response. In 1999, the first Nucleic Acid Test was licensed [47]. This test detects and amplifies precisely defined regions of the viral genome and is thus highly sensitive and specific. In 2004, the OraQuick Rapid HIV-1 antibody test for oral fluid was approved [47]. There are many HIV diagnostic tests currently available and as of 2009, the FDA had licensed 15 HIV diagnostic tests, 5 viral load assays, 12 assays for donor screening and 2 genotyping kits [47].

Initially the window period (the time during which someone is infected but antibody negative) was estimated to be six months [48]. However, with each generation of antibody assay, the timing of identification of infection has reduced. Third generation antibody-tests have narrowed this period to 20-30 days after viremia. Currently, the earliest at which HIV can be detected is 10 days after infectious viremia, using Reverse transcription polymerase chain reaction (RT-PCR) for HIV Ribonucleic Acid [49].

Current HIV tests are highly accurate in terms of sensitivity and specificity. A study of HIV testing in 752 laboratories in the United States from 1988-1989 reported a sensitivity of 99.7% and specificity of 98.5% for enzyme immunoassays [50]. Furthermore, a study among blood donors in the United States found that with a confirmatory Western blot the probability of a false-positive test result in a low-prevalence setting is approximately 1 in 250,000 (95% C.I. 1 in 173,000 to 1 in 379,000) [51]. Advances in HIV testing, such as the development of rapid testing, have allowed counselling and testing services to better meet client needs.

There are a number of enzyme immunoassay and rapid tests which detect HIV-1, HIV-2 and both HIV-1 and HIV-2. According to the FDA, of the available enzyme immunoassay tests: four detect HIV-1; one detects HIV-2; and two detect both HIV-1 and HIV-2, and of the rapid tests available: two detect HIV-1; and three detect both HIV-1 and HIV-2 [47]. Tests approved for detecting either HIV-1 or HIV-2 are highly sensitive for HIV-1 and for HIV-2 (mostly found in West Africa). For example, the OraQuick rapid HIV-1/2 antibody test has a sensitivity of 100% for detecting HIV-2 and a sensitivity ranging from 99.3% (for oral fluid) to 99.6% (for plasma and whole blood) for HIV-1 [52]. The specificity of this test ranges from 99.8% for oral fluid to 99.9% for plasma and 100% for whole blood [52]. Importantly, a positive test result with any rapid test is preliminary and requires a confirmatory test before HIV infection is diagnosed [53]. Different sensitivities for HIV-1 and HIV-2 have implications for the provision of testing services (i.e. the choice of test used) in different settings. In addition, there may be slight differences in sensitivity for different subtypes of HIV-1 [54]. It is recommended that HIV tests should be evaluated for sensitivity and specificity in a local population prior to widespread use [55].

Pre- and post-test counselling

There are a number of different approaches to counselling for HIV testing. These include client-centred, psychodynamic, cognitive-behavioural, existential and systemic [56, 57]. Although approaches, protocols and standards for counselling vary, a common set of key elements are usually covered during counselling sessions. Pre-test counselling can be provided to an individual, a couple or in some cases to a group and involves a face-to-face session with a trained counsellor. During pre-test counselling, the counsellor generally addresses the client's needs for support, provides accurate information about HIV/AIDS, corrects any misconceptions, discusses the implications of the test, assists the client in conducting a personalized risk assessment, negotiates a risk reduction plan in preparation for receiving the test results and provides advice, encouragement and support to reach behaviour change goals [9]. Following the test, post-test counselling is required to discuss the test results, review the risk reduction plan and provide support and referrals

as needed. For those who test negative, it is recommended that at a minimum the counsellor should explain and discuss the test result, provide advice on prevention methods as well as providing condoms and guidance on their use [29]. Those who test negative may also be alerted to the pre-seroconversion window period and be advised to re-test in 2-3 months if recent exposure to HIV may have occurred [58]. For those who test positive, the focus of post-test counselling is to provide psychosocial support to cope with the emotional impact of diagnosis. In addition, it is necessary for the counsellor to discuss prevention of onward transmission, disclosure to sexual partners and to facilitate access to treatment and care services. It is recommended that counsellors should also allow the patient to ask questions, discuss any immediate concerns, describe the follow-up services that are available and provide information on other relevant preventive health measures such as good nutrition and use of co-trimoxazole for opportunistic infections [29].

1.5 Uptake of HIV counselling and testing

Access to counselling and testing services in sub-Saharan Africa has increased considerably in recent years, as provision of anti-retroviral treatment (ART) expands [59]. Zambia represents a model of rapid expansion of counselling and testing services, having progressed from a few services in 1999 to some 100 VCT sites nationwide two years later [60]. Similarly, in Kenya only three sites provided VCT in 2000 and by the end of 2005 there were 680 sites [61]. In Malawi, there were 70 VCT sites in 2002; three years later this number had increased to almost 250 [62]. These examples indicate the rapid rate at which testing services are being rolled out.

In accordance with the increased provision of counselling and testing services, uptake of testing is increasing. During the period 2003 to 2005, a median of only 12% of men and 10% of women in twelve high-prevalence countries in sub-Saharan Africa had tested for HIV and received their results [63]. More recent data indicate that between 2006 and 2008 a median of 22% of people aged 15-49 years old knew their HIV status in sub-Saharan African countries [17]. Despite these increases, knowledge of serostatus is still inadequate, and HIV infection is often diagnosed late. For example, in Kenya, although

uptake of testing doubled between 2003 and 2007 an estimated 83% of Kenyans living with HIV remained undiagnosed in 2007 [5].

These increases in uptake of testing have been concomitant with increased treatment provision. By December 2008, almost three million people in sub-Saharan Africa were receiving ART [17]. This represents an estimated 44% [41%-48%] coverage of those in need of treatment, and is a dramatic increase in provision as in 2005 estimated coverage of treatment in the region was only 2% [17].

Given the self-selection of individuals who come forward for VCT, the determinants of uptake of testing are of importance. Furthermore, although testing is necessary to provide treatment, its efficacy for promoting behavioural risk reduction is uncertain. A theoretical framework for the determinants of uptake of HIV testing and the behavioural outcomes following HIV testing is outlined in the following two chapters.

Chapter 2:
**A theoretical framework for the determinants of uptake and
behavioural outcomes following HIV counselling and testing:**
Part I

2.1 Aims and organisation of chapter

The aim of this chapter is to develop a theoretical framework for the determinants of HIV testing and the behavioural outcomes following HIV testing. This chapter begins by providing the rationale for developing a theoretical framework and giving an overview of the proposed framework. The framework is structured in three parts. First, the broader contextual factors which influence the uptake of testing and behavioural outcomes following testing are considered. These contextual factors are categorised as social, political and cultural. Second, a range of motivations for and determinants of uptake of testing are discussed. The final section of the framework, regarding behavioural outcomes following testing, is outlined in chapter 3.

2.2 Background

The literature regarding HIV counselling and testing is extensive but fragmented. Studies have broadly been concerned with: attitudes to testing, barriers to testing, socio-demographic characteristics associated with having tested, behavioural outcomes following testing, acceptability and cost-effectiveness of testing, and evaluations of various models of service provision, including couple counselling. These have been carried out in many settings, often among specific population sub-groups (e.g. pregnant women).

The purpose of a theoretical framework is to structure concepts and ideas so as to identify causal connections between events, experiences and exposures. A theoretical framework also provides a means for identifying gaps in knowledge and for structuring research required to fill these gaps.

A number of theoretical frameworks have been developed to understand factors influencing HIV transmission. The most well known and widely used is the proximate determinants framework, originally developed for demographic studies of the determinants of fertility and subsequently adapted for the study of child survival, it was then modified further for the study of the distribution and determinants of HIV infection in populations [64].

Overall, the proximate determinants framework serves to link social and epidemiological systems with biological systems. It has a multilevel structure consisting of: (i) three levels of determinants; underlying, proximate and biological, and (ii) two levels of outcome; health and demographic. The underlying determinants are social, economic and environmental. The proximate determinants have both biological components (e.g., viral load) and behavioural components (e.g., abstinence). The underlying determinants act through the proximate determinants to affect the biological determinants and outcome. By describing the determinants which lead to exposure, transmission of infection, disease and death, this framework provides an explanatory sequence of events while capturing the multilevel nature of the determinants.

The validity of the proximate determinants framework has been evaluated using data from the Manicaland cohort in Zimbabwe [65]. Such an appraisal is useful as it shows that much of the variation in risk of HIV infection at the individual level can be explained through proximate determinants. The authors suggest that the proximate determinants may not have been measured adequately. In addition, this framework may not be as appropriate for HIV research as it is for fertility, as the factors affecting HIV infection are more complex than those affecting fertility [65].

Poundstone *et. al.* use a different research paradigm, that of social epidemiology, to propose an heuristic framework for the social epidemiology of HIV/AIDS [66]. This framework outlines three levels of determinants of transmission: individual (e.g. behaviour and socio-demographic characteristics), social (e.g. social capital and cultural context) and structural (e.g. demographic change, violence and discrimination, policy environment and war) [66]. Despite the absence of an explanatory sequence, this framework is useful for conceptualizing the hierarchical nature of factors that affect HIV transmission and population-level HIV incidence.

The frameworks outlined above consider the determinants of HIV infection. Other theoretical frameworks use the HIV epidemic as their basis to understand, for example,

the mechanisms by which the HIV epidemic acts as a determinant of socio-demographic change [67]. Unlike these, this proposed framework considers an intervention, namely HIV counselling and testing, with the aim of understanding the determinants of uptake testing and behavioural outcomes following testing.

HIV tests are carried out for different purposes and in different circumstances. The various factors influencing uptake of counselling and testing services in different contexts and how they interrelate has not been addressed. In a review of the social and behavioural evidence regarding the utilization of counselling and testing for HIV, Obermeyer and Osborn note that although gender, stigma and poverty are frequently cited as barriers to HIV testing, the reasons for differential uptake of counselling and testing are not well understood [68].

Understanding the context for testing, attitudes towards testing, motivations for testing and barriers to testing is important, as testing can only be successful as an entry-point for treatment and prevention if barriers to testing are overcome, adverse outcomes following testing are avoided, and effective referral systems are in place. Thus, an understanding of the various contextual factors that hinder or facilitate testing in different settings is required. Although a formal theoretical framework has not been proposed for the determinants of uptake and outcomes following HIV counselling and testing, many potential determinants of uptake of testing and outcomes following testing have been hypothesised and described.

With respect to determinants of uptake, in an evaluation of provider-initiated opt-out testing policy in Botswana, Weiser *et. al.* present an overview of predictors of testing, that includes: socio-economic characteristics, HIV-risk behaviours, health status, access to high quality medical care, HIV knowledge and HIV-related stigma [43]. With respect to outcomes, in a meta-analysis of VCT and behavioural risk reduction, Denison *et. al.* use the decision to seek testing as a starting point and outline potential outcomes following VCT [69]. Immediate outcomes are categorised as individual psychosocial, relational level and community level, which lead to individual behavioural outcomes,

resulting in reduced HIV and STI transmission [69]. The framework proposed here consolidates previous work by Denison, Weiser and others to capture (i) the determinants of uptake of testing and (ii) the potential behavioural outcomes following testing.

2.3 Framework overview

The proposed framework is contained within a broad background which consists of social, political and cultural contexts. Determinants of uptake of testing act at different levels, including at the individual and community levels. At an individual-level, marital status, sexual behaviour and health status may influence uptake of counselling and testing. At a community-level, accessibility of health services and testing facilities and the availability of treatment can be key determinants for the uptake of testing. Social factors such as the extent of HIV-related stigma in the area and social support may also influence the decision to test.

In this framework uptake of testing refers to testing through client-initiated testing and provider-initiated testing, as well as through other forms of service provision such as home-based and workplace based testing. However, with respect to uptake of testing much of the framework is regarding client-initiated VCT whereby an individual actively seeks counselling and testing.

Following testing, the immediate individual-level effects are largely emotional and psychological. Subsequent effects are changes in sexual behaviour. At the community-level, outcomes such as a reduction in stigma may occur through raising community awareness. A schematic illustration of the proposed framework is provided in Figure 2.1.

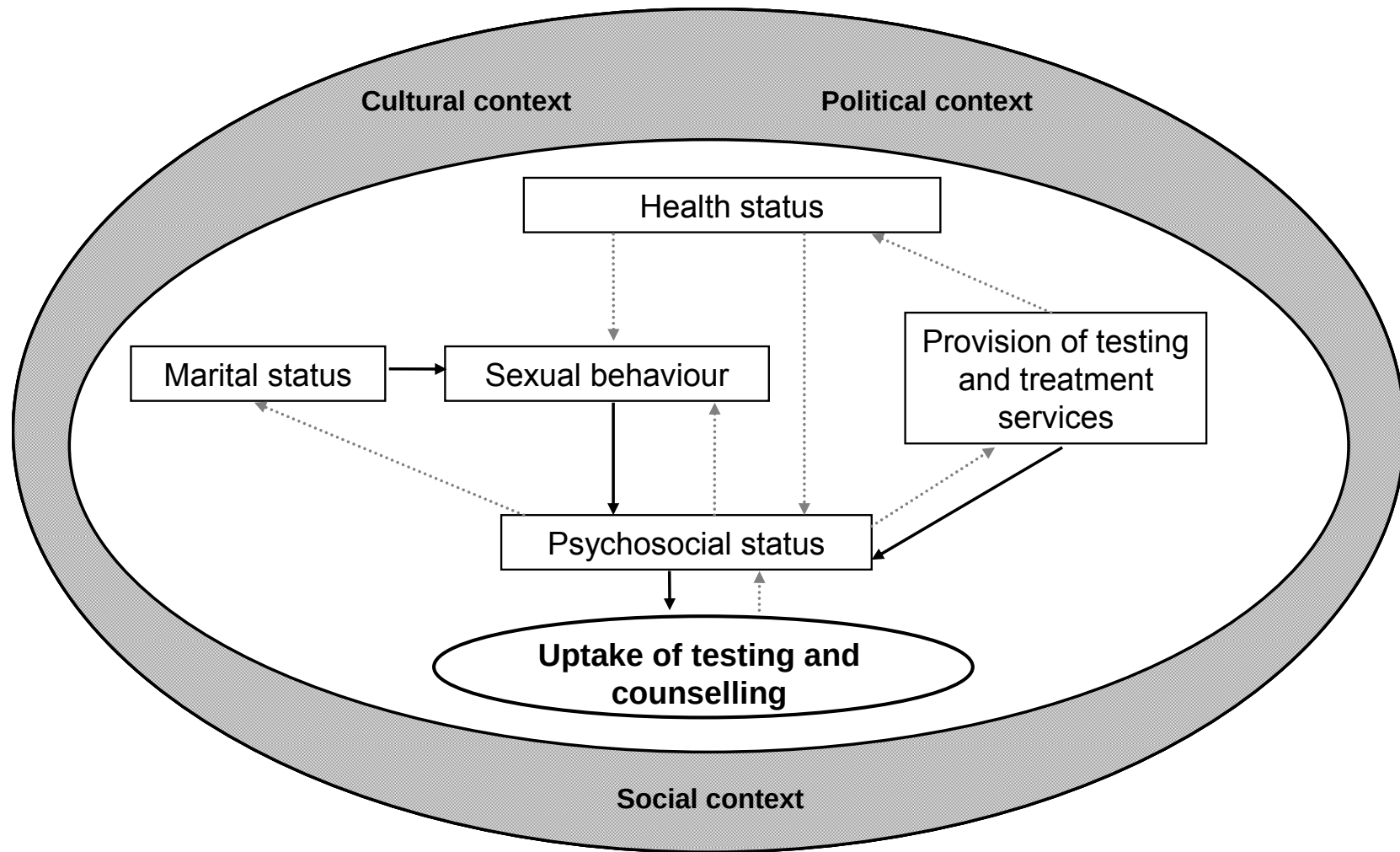


Figure 2.1 A theoretical framework for the determinants of uptake and behavioural outcomes following HIV counselling and testing.

2.4 Context – social, political, and cultural

In this section, the broader contextual issues surrounding HIV counselling and testing are discussed: firstly, the social context; secondly, the political context; and finally, the cultural context.

2.4.1 Social context

Social context plays an important role in the effectiveness of HIV prevention programs [70]. One aspect of social context is social capital, which can be defined as: “social networks, the reciprocities that arise from them, and the value of these for achieving mutual goals” [71]. The theory of social capital hypothesises that individuals living in communities which are characterized by a positive identity, trust, reciprocal help and support, in addition to having well-functioning local groups and organizations (i.e. high levels of social capital), are more likely to change behaviour to improve their health [72, 73]. Despite an extensive literature on social capital and health, few studies have explicitly examined social capital in the context of HIV and AIDS in Africa. Campbell *et. al.* investigated civic participation as a proxy for understanding the community influences on HIV infection in South Africa and found that membership in some organizations such as youth clubs and sports groups was protective for HIV infection, whereas participation in other types of groups increased risk [74]. Gregson *et. al.* produced similar findings by examining community group participation and HIV avoidance among young women in Zimbabwe [75].

Social networks refer to how individuals or groups are connected and so may be regarded as the “structural element of social capital” [76]. Social networks have been studied in relation to HIV transmission, among injecting drug users (IDUs) in particular [77, 78]. Social networks have also been studied in relation to how information and attitudes about HIV are shared. Qualitative data on informal conversations in social networks in rural Malawi, as recorded in journals by diarists, provide an insight into everyday discussions regarding HIV/AIDS and how these have changed over time (from 1999 onwards) [79]. Initially, there was much debate among men regarding behaviour change [80]. Over the years this dialogue has changed with most individuals coming to believe that behaviour

change for HIV prevention is effective and feasible. These ethnographic data show that individuals were discussing HIV testing before it was widely available in rural Malawi. The introduction of free treatment and the expansion of testing services introduced a new debate: the advantages and disadvantages of knowing one's HIV status. The most frequently expressed concern regarding testing was that a positive test result would cause intense fear and anxiety and that this would hasten death. Accessing treatment and knowing "the truth about one's body" were the most frequently expressed benefits of HIV testing. However, negative aspects of HIV testing were more frequently discussed (63% of all references to HIV testing in everyday conversations), than positive aspects. Despite this, when participants of a survey carried out in these communities were offered home-based HIV testing, 91% agreed [81].

Social support is often considered to be one of the most important aspects of social networks and has been demonstrated to influence a variety of health-related behaviours (e.g. smoking cessation) [82]. Social support may be emotional (e.g. understanding and sympathy) or behavioural (e.g., assistance with tangible needs) [73]. Social support may influence the decision to test and influence risk behaviour following testing. High levels of social support experienced by an individual (e.g., emotional support and understanding) may encourage or facilitate the decision to test. For example, encouragement or support from someone who tested previously has been reported as a facilitator for testing in Botswana [43]. In addition, advice, approval and encouragement from family members and friends has been shown to influence the decision to test among adolescents in Zambia [83].

Just as strong social support can positively influence uptake of testing, a lack of social support can also impede it. For example, worry over damaging relationships with family members and with friends [84], and an anticipated lack of social support if infected, have been cited as barriers to testing [43]. Other aspects of social issues such as fear of discrimination and violence, concerns about confidentiality, and fear of unsolicited disclosure have also been highlighted as barriers to HIV testing [85]. Subsequent to counselling and testing, the initiation and maintenance of behaviour change may be

influenced by an individual's ability to cope and adapt, which can be facilitated by strong social support or inhibited by lack of social support.

Stigma and discrimination against people living with HIV have been well-documented [86, 87], and stigma has been reported to be a barrier to HIV testing in Tanzania [88], Nigeria [89], Uganda [90-92], Zambia [93], Botswana [93] and in particular, South Africa [94-97]. Despite being frequently cited as an obstacle to testing, few studies actually quantify the effect of stigma on HIV testing, as surveys typically collect data on cognitive measures of stigma, which focus on an individual's beliefs and attitudes rather than measures of stigmatising behaviours and their consequences [68]. In addition to a fear of experiencing stigma deterring individuals from testing, those expressing stigmatising attitudes have been shown to have lower uptake of testing. A study assessing the effects of HIV-related stigma on the uptake of counselling and testing in Zimbabwe found that expressing social rejection (e.g. refusing to buy vegetables from a vendor with HIV) was predictive of not having tested [98]. Kalichman and Simbayi propose that seeking VCT is a function of social barriers to getting tested, particularly stigma surrounding HIV/AIDS, rather than a lack of perceived value of knowing one's HIV status and receiving counselling [94].

2.4.2 Political context

AIDS has become a top political priority [99]. The AIDS epidemic has the potential to impede and even reverse the economic development of many countries [100]. Besides potentially threatening national security, AIDS undermines the three components of the human development index – education, life expectancy, and standard of living [101].

The uptake of testing may be influenced by political context via factors such as the level of political commitment and leadership in the response to AIDS, the capacity to provide and scale-up testing services and treatment, the level of involvement of NGOs and support from external donors, and government policies determining how testing and treatment are provided. Political leaders have the power to raise awareness of testing for

HIV. For example, President Kaunda of Zambia was the first African leader to publicly test for HIV, saying:

“I urge all Zambians without exception to take their tests because this is the only way that will help us to fight the disease” [102, 103].

Bor presents a theoretical framework to outline the role of political commitment in government response to HIV and AIDS. Within this framework he defines political commitment to be the extent to which government leaders support the response to AIDS as a priority on the national agenda [104]. A key aspect of this framework is that political commitment acts through government policies, programmes and interventions to influence epidemiological outcomes. However, political commitment and leadership requires concomitant political action and social mobilization.

Parkhurst and Lush provide an analysis of political circumstances that influence the implementation of HIV prevention programs using a comparison of Uganda and South Africa [105]. Uganda’s “*zero grazing*” and “*love carefully*” slogans illustrated how population level risk behaviour can be influenced by key messages disseminated to the public from a top political level [106]. In Uganda, President Museveni spoke often and openly about AIDS and published articles on the subject [107]. He highlighted AIDS as a serious problem that all Ugandans must face. In contrast, in South Africa, HIV/AIDS was surrounded by much controversy, denial and stigma [108-110].

These political contexts (not limited to political commitment) have influenced the response to HIV, and hence provision and uptake of HIV testing in both Uganda and South Africa. In Uganda, the provision of testing services and uptake of testing have increased rapidly. Community surveys have found high levels of willingness to test and some studies have achieved over 90% uptake of testing [34, 111, 112]. However, in South Africa there is a reluctance to test among some individuals, even in the context of treatment availability [113]. A survey in Cape Town found that almost half (48%) of those who had never tested for HIV reported that they would prefer not to know if they had HIV [94]. Such resistance to testing has been attributed to high levels of stigma

surrounding HIV/AIDS [113, 114]. Kalichman and Simbayi note that given the discrimination experienced by black South Africans during apartheid, it is not surprising that some refuse a medical test that potentially adds another source of stigma and discrimination [94]. One consequence of the extreme racial discrimination of apartheid, and the subsequent HIV denialism, is the theory of HIV as a genocidal conspiracy, belief in which has been shown to be a barrier to testing among South Africans (30% of individuals surveyed endorsed this theory) [115].

However, there have been many efforts to reduce these social barriers to HIV testing through mass media campaigns and public demonstrations and the level of uptake of testing has increased in recent years. From 2005 to 2008 nationally representative surveys show that the percentage of those aged 15 years and older who tested for HIV in the 12 months preceding the survey increased from 12% to 25% [116]. Furthermore, a large campaign to mobilise all South Africans to get tested for HIV was announced in December 2009 [117].

2.4.3 Cultural context

Aspects of cultural context such as the respective gender roles of men and women in society can determine the uptake of testing and behaviour change following testing. Gender influences attitudes toward HIV testing, with women generally reporting more fears regarding testing and potential negative consequences following testing than men [68]. Women's decisions to test, however, are influenced by their plans to have children and their intentions for breastfeeding. There are often strong cultural pressures on women to bear children, for example, to prove that they are fertile [118]. This may act as a barrier to HIV testing (through fear of a positive test result) and also as a deterrent to the use of contraception, such as condoms. In addition, gender influences risk perception (e.g. men tend to underestimate their risk of HIV infection [68]), which influences the decision to test.

Traditionally, males are the “dominant” gender in many African cultures [119]. For example, in Botswana, customary Tswana law regarded women as socially inferior to

men [120]. The relative infrequency of marriage in Botswana is said to be due, partly, to the significant loss of legal rights that women experience within marriage. However, the law has been reviewed and Abolition of Marital Power Bill was passed in 2004 (the same year the policy of provider-initiated opt-out testing was introduced) to ensure “full gender equality under the law with respect to all civil marriages in Botswana” [121]. Restrictions on female autonomy may influence uptake of counselling and testing among women. For example, qualitative work from Tanzania has found that the pattern of decision-making between partners can be a barrier to testing for some women, with participants discussing the need to “seek permission” from their partner prior to testing [85].

In addition, some cultural norms restrict female sexual autonomy while placing men in a dominant position with greater decision-making power [122]. Sexual coercion or the inability to insist on or discuss condom use may make intended behavioural risk reduction for women difficult or unattainable [123]. In Tanzania, a qualitative study found that restrictive norms on female sexual behaviour apply largely to married women. Men were unanimous in stating that they would not accept their spouse having an extra-marital relationship, although it was acceptable for non-marital partners (both casual and longer-term) to do so [124].

Social, political and cultural contexts are often interrelated. For example, high levels of political commitment and leadership can help to increase awareness of testing which may in turn reduce stigma surrounding testing. Conversely, poor political leadership may negatively influence aspects of social context such as the level of stigma. South Africa provides an example whereby the political history of apartheid and HIV denialism by political leaders may have negatively influenced the social context surrounding HIV testing by maintaining high levels of stigma and discrimination [94]. However, there has recently been much effort to reduce social barriers to testing in South Africa, as discussed above.

2.5 Determinants of uptake of counselling and testing

In this section, the determinants of uptake counselling and testing are considered. Each component of the framework is discussed (see Figure 2.1). Firstly, the role of provision of testing and treatment services in determining uptake is outlined. This is followed by a discussion of individual-level determinants, which include marital status, sexual behaviour, health status and psychosocial status.

2.5.1 Provision of testing and treatment services

Testing service provision

Type of service provision influences uptake of HIV counselling and testing [45]. The traditional VCT delivery systems of free-standing and health-centre-based VCT services have often had disappointingly low uptake (often below 15% among the general population) [91, 125, 126]. However, easily accessible testing services are important, as long distances and transport costs may deter people from seeking testing [92, 97, 127-129]. Other logistical barriers such as the cost of testing and long and unpredictable waiting times have been reported as frequent reasons for not having attended VCT [128]. Newer, more convenient delivery approaches such as home-based VCT, workplace-based VCT, same-day mobile VCT, and provider-initiated opt-out HIV testing have achieved much higher levels of uptake [45]. Each of these approaches to service provision are discussed in the following section.

Home-based testing

Offering HIV counselling and testing services in clients' homes makes testing accessible and convenient, avoids transport costs, improves privacy and avoids potential stigma associated with going to a free-standing VCT centre [45, 130].

Fylkesnes and Siziya carried out a randomized trial (RCT) assessing the acceptability of VCT in Zambia [131]. Participants were randomly allocated to either receive VCT at a local clinic or at an "optional location" (i.e., the home, the clinic, or a place suggested by the respondent). Of those offered VCT at the local clinic, only 12% completed VCT (i.e.

received their results and post-test counselling), whereas of those allocated an optional location, 56% completed VCT. Furthermore, of those who were allocated to an optional location, 84% chose to receive counselling and testing at home.

In Rakai, Uganda, the option of home-based VCT increased uptake, in the absence of treatment availability; from 10% in 1990 [132] to 33% in 1994-1995 [133] to 62% in 1999–2000 [134]. By 2000, the majority of participants requesting to receive counselling and testing insisted that the service be provided in their homes, rather than at a community-based counselling office [135]. Rakai provides an interesting example of increasing uptake of HIV testing in a changing context: in the early 1990s awareness of HIV/AIDS was high but treatment did not yet exist; by the mid to late 1990s treatment for HIV/AIDS existed but was not yet available; by 2004 treatment had been introduced and knowledge of one's serostatus was common, and even repeat testing was widespread [112]. The observed increase in uptake of HIV testing may reflect increased exposure to testing services and changing attitudes towards testing, and HIV/AIDS generally, over time.

In Masaka, Uganda, annual VCT uptake at a free-standing facility remained below 10% for the first 10 years of a cohort study (1989 – 2000) and by 1999 only 20% of adults had ever tested for HIV [91]. However, in 2001 VCT uptake increased to 37% following the introduction of home-based services. Uptake of home-based VCT was almost six times greater than uptake of facility-based VCT among 15-24 year olds. Provision of home-based VCT also increased uptake among women, which had previously been 40% lower than men. Elsewhere in Uganda, in 2003 Were *et. al.* reported near complete uptake of home-based VCT in a community in Mukono district, with 98% consenting to HIV testing and requesting to receive results, and 93% of these actually receiving their results and post-test counselling [111]. The study sample (n=3338) consisted of 94% of the total population of the community. Importantly, this high level of uptake was in the context of very limited access to treatment, but it had been preceded by extensive community-wide mobilization. These different levels of testing observed in rural Uganda (37% in Masaka and over 90% in Mukono) indicate considerable variability in uptake of counselling and

testing through home-based VCT. A key factor influencing uptake of counselling and testing is the availability, or perceived availability, of treatment. The widespread roll-out of treatment in Uganda began in 2003 [136]. Thus, those in the Mukono district may have anticipated treatment availability in the near future. Also, increased awareness of the benefits of testing as promoted through community-wide mobilization may have contributed to the exceptionally high uptake of home-based testing in Mukono district.

Given the success of home-based testing in increasing levels of uptake [130], its use, along with an increased emphasis on couple counselling and testing, has recently been advocated for achieving universal coverage of HIV counselling and testing in Africa [18]. Some countries have already adopted this approach. Lesotho, with the highest levels of HIV prevalence in the world, began implementing a national level home-based VCT program in 2005 [137]. It is envisaged that all households will be offered HIV counselling and testing services. This intensive approach is relatively achievable given that Lesotho is a geographically small country with a population of two million people.

While home-based VCT has been shown to increase convenience, remove logistical barriers to testing, reduce the inequalities in access to services [91, 127], and potentially offers more privacy than facility-based VCT, the shortcomings of home-based testing are that it is logistically challenging and can be expensive to provide, especially if multiple visits are required. It is also may lead to domestic conflict, for example among couples with conflicting attitudes regarding HIV testing [91]. Concerns have been raised regarding lack of confidentiality and inadvertent disclosure of the test results when given at home. However, in the Masaka cohort, there were no reports of lack of confidentiality among those who received counselling and testing at home [91].

Workplace-based testing

As with home-based VCT, workplace VCT makes testing services more accessible. In Zimbabwe, a randomized trial investigating the uptake of rapid HIV testing at the workplace found that uptake was significantly greater (adjusted risk ratio 12.5, 95% CI 8.2 – 16.8) when provided at the workplace (51.1% uptake), than when a voucher was

provided for non-workplace VCT (4.3% uptake) [138]. In Rwanda, a workplace testing and treatment program at Heineken Breweries was found to be similarly successful, with 73% of employees going for counselling and testing [139]. Infected employees were also offered treatment when they were identified to be in need of treatment, based on CD4 monitoring.

In South Africa, HIV testing has been available since 1991 through employee health services provided by the mining industry [140]. Initially, voluntary uptake was low and the majority of testing carried out was that which was routinely offered to those diagnosed with tuberculosis or an STI. A workplace-based clinic for HIV infected mineworkers in the Free State province, set up in 1999, was found to be effective for delivering counselling and support as well as preventive therapy for tuberculosis [140]. Subsequently, a workplace ART programme, covering seven provinces of South Africa, was successfully established in 2002 [141]. Thus, workplace testing programmes have been shown to be acceptable and effective; however, while convenient, workplace-based services can only reach those in formal employment and may lead to discrimination or even job loss.

Mobile testing

Mobile VCT removes the logistical barriers for those who want to receive counselling and testing in areas where access to VCT services is limited. In Kenya, a large-scale mobile VCT program has been implemented to meet the demand for testing among remote rural populations [61]. In Ethiopia, mobile VCT has been used to provide services for hard-to-reach populations since 2004 [142]. This Ethiopian outreach service has been successful for diagnosing infected individuals and referring them to receive treatment and support [142]. In Cameroon, mobile VCT has also been found to be highly acceptable, with 99.7% of those who received pre-test counselling opting to receive their results and post-test counselling on the same-day as testing [143].

In Zimbabwe, 40% of PSI's clients are reached through mobile VCT services, with demand for VCT often exceeding the capacity of staff and supply of equipment [144].

These services are primarily delivered to rural communities where access to VCT is limited. PSI also use mobile VCT at brothels and nightclubs to target high-risk groups (such as commercial sex workers), in an effort to avoid these individuals experiencing stigma at traditional counselling and testing facilities [144]. Morin *et. al.* reported high acceptability of same-day mobile VCT in Zimbabwe, with demand for testing exceeding the available resources and 99% of participants opting for same-day results [128]. In a separate qualitative component to this study, women reported that community-based testing services meant that they did not have to ask men for permission or money to go to receive VCT [128].

Although mobile VCT programmes are effective in reaching populations, communities and individuals who would not have access to services otherwise, referral following VCT can be difficult given the transitory nature of mobile services. One other limitation of mobile VCT programmes is that participation and refusal rates are difficult to calculate, as many clients voluntarily request testing, whereas others accept VCT that has been offered to them.

Provider-initiated opt-out testing

The WHO and UNAIDS guidance on provider-initiated opt-out testing recommends that a HIV test should be recommended to all patients attending health care facilities, in countries with generalised epidemics, regardless of the patient's symptoms and the patients reason for attending the health facility [29]. This applies to all health facilities: public and private hospitals and clinics, medical and surgical services, inpatient and outpatient settings as well as mobile or outreach medical services. Given that provider-initiated testing may require phased implementation, it is recommended that the priority settings for implementation are hospital medical wards, tuberculosis clinics, antenatal services for pregnant women and STI services [29].

Where implemented, provider-initiated opt-out testing in general medical settings has substantially increased access to and uptake of HIV counselling and testing. For example, in Uganda, provider-initiated testing was initiated in two large tertiary hospitals in 2004

[34]. Previously, testing was only available upon request and cost US\$3. Over a 16 month period 51,624 patients were offered HIV testing. Of these 98% accepted. HIV prevalence among those who accepted testing and had not previously tested HIV positive was 25%, four times greater than the national prevalence of 6.4% [145]. Importantly, 81% of those who tested had not tested previously. In addition to the introduction of provider-initiated testing, the provision of testing free of charge and improved access to treatment and care are also likely to have contributed to the exceptionally high level of acceptance of testing observed. Nonetheless, this study illustrates the feasibility of provider-initiated testing for achieving high levels of uptake and identifying previously undiagnosed infections in a medical setting.

In Botswana, the national policy of provider-initiated opt-out HIV testing, implemented since 2004, has led to increases in testing uptake. A population-based survey almost a year after the introduction of provider-initiated opt-out testing found that almost half of respondents (48%) reported to have ever received HIV counselling and testing [43]. Furthermore, there was widespread support for the policy of provider-initiated opt-out testing, with 81% of respondents being extremely or very much in favour, and 8% being somewhat in favour [43]. A more recent survey found that over half (55%) of respondents had tested within the last year and 94% of respondents reported to be in favour of provider-initiated opt-out testing [146].

In addition to general medical settings, provider-initiated testing has been widely implemented within PMTCT programmes, which involve offering HIV counselling and testing to pregnant women when they attend ANC. Women testing positive are then offered treatment, if available, around the time of delivery to prevent transmission to their newborn. In the past, PMTCT programmes have had low uptake largely due to: (i) women not being offered testing (due to insufficient staff to test and counsel all ANC attendees and lack of test-kits) and (ii) women refusing testing when offered [147]. However, in recent years, a rapid expansion of provision of PMTCT services in sub-Saharan Africa and the move towards opt-out testing has led to increased uptake.

In Zimbabwe, an acceptability study in two rural districts found that 79% of women who had not received an HIV test at ANC would accept opt-out testing [35]. The subsequent introduction of provider-initiated opt-out testing for women attending ANC in one of these districts actually achieved a higher uptake of 93% [148]. In Malawi, offering opt-out testing as part of a PMTCT programme in Thyolo district hospital resulted in 95% of new antenatal mothers completing VCT [149]. In Botswana, the introduction of provider-initiated opt-out testing at ANC in Francistown increased the proportion of infected pregnant women who learned their status from 47% to 78% and increased the proportion receiving PMTCT interventions from 29% to 56% [150]. In Uganda, following the introduction of provider-initiated opt-out testing in two large hospitals in 2004, 98% of patients accepted HIV testing [34]. Provider-initiated opt-out intra-partum HIV counselling and testing integrated with PMTCT, in a rural Ugandan hospital, has also been found to have high uptake (86% among women and 98% among their male partners) [151].

By 2007, provision of PMTCT services at ANCs had increased to 38%, and in Eastern and Southern Africa an estimated 28% of women received testing during their last pregnancy [152]. Consequently, the provision of testing through PMTCT programmes is increasing; a trend largely attributable to the expansion of provider-initiated opt-out testing in health care settings and the use of rapid testing with same day results [17].

Provider-initiated opt-out testing in general medical settings and integrated into antenatal care is acceptable, achieves higher uptake and causes less anxiety than opt-in testing [153]. In addition to being well-accepted, opt-out testing identifies many previously undiagnosed individuals [34, 151], enables early referral for prevention, treatment and care services [150], allows women to receive testing without having to receive permission from their partner [154], and is perceived to reduce HIV-related stigma [43]. Unlike testing which is actively sought, opt-out ANC testing is done for the benefit of the baby (as well as the mother) and thus avoids an implication of promiscuity [68]. However, integrated opt-out HIV testing services may be more successful than free-standing services in achieving high levels of uptake as they avoid potential stigma surrounding

HIV (i.e. the possible speculation and rumours of HIV infection associated with being seen going for a HIV test as a free-standing facility) [91].

Rapid testing

In addition to more convenient forms of service provision, the development of rapid HIV tests has been a major improvement to how HIV testing is delivered [155, 156]. Clients can receive their test results and post-test counselling on the same day as testing, often within an hour, removing the need for them to make a return visit to collect their results. Prior to the introduction of rapid tests, enzyme-linked immunosorbent assay (ELISA) testing was used. This process can take a week or longer [157]. Thus, the time taken to receive test results was typically one to two weeks. However, with ELISA testing the time taken to receive results is typically longer in rural areas as compared to urban areas, as samples have to be sent to a laboratory with the facilities to perform ELISAs. Thus, the time taken to receive results in remote rural areas is variable - depending on the distance from a laboratory and the frequency at which samples are sent to the laboratory - and may even take months. For example, participants waited two to four months to receive their HIV test results in a panel survey in rural Malawi in 2004 [129].

Besides convenience, provision of results as soon as possible after the test may help to alleviate anxiety and has been shown to increase the proportion of clients who collect their test result [158]. For example, in Uganda, receipt of test results increased from 79% to 100% following the introduction of rapid tests at the AIDS Information Centre counselling and testing sites [159]. Previously, clients had to return after two weeks for their results and post-test counselling. In Nairobi, Kenya, a randomized clinical trial among pregnant women found that receipt of test results was significantly higher for those randomized to receive rapid testing as compared to ELISA testing (96% vs. 73%, OR 1.3; 95% CI 1.2-1.4, $P < 0.001$) [160]. The median time to receiving results was 0 days and 11 days for those receiving rapid testing and ELISA testing, respectively.

Although rapid testing has been shown to increase the proportion of clients who receive their test results, it is not clear if rapid testing increases uptake of testing. A survey in

rural Malawi offering home-based testing in 2004 found that 91% of participants agreed to be tested and 70% of those who tested received their results [161]. In a subsequent survey in 2006 ELISA testing was replaced with rapid testing. Uptake of testing remained high, at 92%, but receipt of results increased to 98% [161]. Given that acceptance of testing in this study was high prior to the introduction of rapid testing it is not known if rapid testing would have increased uptake from a lower level.

Mkwanazi *et. al.* argue that rapid testing may not improve uptake of HIV testing and receipt of same day results, based on a study among pregnant women in KwaZulu-Natal, South Africa, carried out from 2001 to 2004 [162]. Acceptance of testing remained unchanged at 74.6% following the introduction of rapid testing. However, only 3.45% (166/4810) of women who received rapid testing at ANCs requested to receive their results on the same day as testing, with the remainder opting to receive their results at a later appointment [162]. Importantly, however, this exceptionally low uptake of results collection is not uncharacteristic of this population, as a population-based survey in the same area found that although 58% of participants consented to receive counselling and testing, less than 5% of those tested returned for their results [162].

Counselling provision

Counselling is an integral part to the provision of HIV testing. Despite many guidelines on the provision of counselling, the quality and duration of the counselling session can vary considerably [68]. The importance of providing counselling has been questioned. Koo *et. al.* called for reducing or even omitting pre-test counselling completely in the US, on the grounds that lengthy counselling sessions may be a barrier to testing [163]. However, it is not clear if the removal of pre-test counselling would facilitate testing by omitting a potentially “cumbersome” time-consuming practice or if it would hinder testing as clients do not receive the necessary information and advice [68]. Although it has been suggested that an aversion to counselling may deter some individuals from receiving testing and counselling, this hypothesis has not been tested as it would not be ethical to provide testing without counselling. Also, it is not clear if different approaches to counselling influence the uptake of testing.

Treatment availability

Lack of treatment is an important barrier to HIV testing, as knowledge of one's infection may be viewed as futile if treatment is unavailable. In theory, the availability of treatment transforms HIV from a deadly disease into a chronic disease, therefore changing the context of HIV testing.

Botswana was the first African country to institute universal access to ART, and therefore it provides an opportunity to examine the effect of provision and scale-up of treatment on testing behaviour. The national ART treatment programme, which aims to provide free ART to all HIV-positive individuals with a CD4+ count below 200 or with an AIDS-defining illness and to those under 13 years of age, commenced in January 2002 [164, 165]. Initially uptake of treatment was low due to under-utilisation of HIV testing services [44]. In an effort to identify infected individuals, the policy of provider-initiated opt-out testing was therefore introduced in 2004, whereby all patients are tested as a routine part of a medical visit, unless they explicitly refuse.

Nationally, a greater than two-fold increase in uptake of HIV testing was observed between 2001 and 2004 in Botswana [166]. The introduction of opt-out testing increased the population testing rate from 40 per 1000 persons in 2004, to 93 per 1000 persons in 2005 and 104 per 1000 persons in 2006 [44]. An increasing demand for testing services was also noted. A cross-sectional survey of a probability sample of adults in Botswana 11 months after the introduction of provider-initiated opt-out testing found that 71% of those who had not tested intended to do so in the next six months [43]. Furthermore, one of the most commonly reported reasons for having tested was the knowledge that treatment was available. In the district of Tutume, Botswana, the introduction of ART in 2003 led to a five-fold increase in uptake of HIV testing by reportedly removing the residual reluctance to test for HIV as some individuals were previously averse to HIV counselling and testing, largely due to stigma [164].

Elsewhere in sub-Saharan Africa, the availability of treatment has led to large increases in uptake of testing. In Uganda, a 27-fold increase in volume of clients accessing VCT services was observed following the introduction of treatment in Masaka district [167]. Before the introduction of ART, uptake of testing was low (297 clients from January to December 2000). VCT was not available throughout 2001, and with the resumption of VCT and introduction of ART in 2002, a large client volume was observed (8286 clients in 2002). In Namibia, a 41% increase in the uptake of HIV testing from free-standing VCT centres was observed following the introduction of ART in government hospitals in 2003 [168].

Knowledge that treatment is available may allay the fears of those who would otherwise refuse to test for fear that they are be infected. The availability, or perceived availability, of treatment strongly influences the decision to test, as receipt of a positive result when treatment is available is entirely different to receipt of a positive result when treatment is not available. In terms of outcomes following testing, initiation of treatment for those who are infected leads to improved health outcomes and survival [169]. Improved health following treatment initiation may influence sexual behaviour, for example a resumption of sexual activity, if an individual was previously abstaining due to illness (Figure 2.1).

2.5.2 Marital status

Marriage can influence uptake of testing as a couple may decide to test for HIV before getting married. Moreover, many churches actively encourage pre-marital testing. For example, in Ghana, Pentecostal churches imposed obligatory HIV testing for couples intending to get married (“no medical certificate, no marriage” [170]), whereby the test results are given to the couple who, in turn, give these to a member of the clergy who discusses the implications of their results as part of the church’s marriage preparation and counselling process [170]. Qualitative work among pastors and marriage counsellors found a strong defence of obligatory pre-marital testing, with the view that those who may be HIV positive should not be spreading infection to those who are HIV negative [170]. Indeed, if one member of a couple tested positive, the church would advise for the marriage not go ahead. Although pre-marital obligatory testing was widespread, churches

switched to strongly encouraging, rather than imposing, testing following public criticisms regarding human rights violations and opposition from the National Anti-AIDS Commission [170].

In Uganda, nearly 80% of couples attending the AIDS Information Centre request HIV testing as a pre-marital screening process, described as “planning for marriage” [171, 172]. However, going for testing may raise issues of trust in a relationship, for example a woman receiving counselling and testing may be viewed by her partner as a sign that she has been unfaithful. In addition, concern that the first member of a couple who is tested will be blamed for bringing HIV into the relationship has been reported in Botswana and Zambia [93].

2.5.3 Sexual behaviour

Sexual behaviour is strongly determined by an individual’s marital status and also family planning intentions [173]. Sexual behaviour (number of partners, types of partnership and frequency of unprotected sex within these partnerships) is central to the framework (Figure 2.1). The relationship between receiving counselling and testing and subsequent sexual behaviour is complex, as behaviour is mediated by several factors and events including partnership formation and dissolution, and pregnancy.

Anxiety or guilt over past risky behaviour, or worry due to a partner’s risky sexual behaviour, may prompt an individual to receive counselling and testing [43, 85, 128, 166]. Having to stop some sexual practices, if infected, has been reported as a barrier to HIV testing in Botswana [43].

2.5.4 Health status

An individual’s health status may be another motivator for seeking testing, as many individuals will decide to go for testing only once they are ill and showing symptoms of an AIDS-related illness [43, 128, 131, 133]. Death of one’s spouse or partner, through AIDS or other ill health, may act as a motivator for testing, as it prompts an individual to consider their own serostatus.

2.5.5 Psychosocial status

An individual's psychosocial status (knowledge, risk perception, personal experiences of HIV morbidity and mortality) is illustrated adjacent to the uptake of testing (Figure 2.1), as all processes act through one's psychosocial status to influence the decision to test.

An individual's own risk perception is important with regard to HIV testing; if one believes that they have not been at risk of HIV infection then they may not see the need to undergo a counselling session and receive a HIV test. For example, a survey in Botswana found that of those who had not tested, 43% had not done so because they had no reason to believe they were infected [43]. However, an individual's perception of their risk does not always correspond to their actual level of risk. Denial, indifference or misunderstanding may lead an individual who is putting themselves at risk of HIV infection to mistakenly believe that they are not at risk. Equally, some individuals may have convinced themselves that they are already infected, in which case they may regard going for testing to be futile. In a discussion of uncertainties regarding the benefits and detriments of HIV testing by Kaler and Watkins, going for counselling and testing with the belief that one is infected is expressed by a rural Malawian as "Asking god about the date you will die" [84].

The principal psychological barrier to testing is fear of a positive result and the associated anxiety and worry [35, 43, 68, 84, 91, 95, 154, 174]. However, it has been shown that perceived risk of being infected is frequently overestimated. In rural Malawi it was found that of those who reported a high likelihood that they are HIV positive, 95% of women and 96% of men were incorrect [175]. Qualitative work in rural Uganda found that most people mentally prepare to be told that they are infected with HIV before going to collect their test results [91].

There are many possible motivations for seeking HIV testing, however, often the decision to test is not an easy one [113]. The perceived benefits of testing will be balanced against the perceived consequences of testing when considering whether or not to test for HIV.

One's own belief about one's serostatus will strongly influence this process. Prochaska's stages of change theory: pre-contemplation, contemplation, preparation, action and maintenance is a useful model when considering the mechanisms involved in wanting to know one's HIV status and actually going for counselling and testing [176]. In practice, an expression of willingness to test, or desire to know one's HIV status does not always translate into actually going for counselling and testing [126, 131, 177]. However, individuals reporting a desire to know their status may be at the preparation stage but not yet ready to test. For example, a survey in Uganda found that while 70% expressed a desire to be tested, only 15% had actually done so [177].

2.6 Discussion

This section of the framework outlines the many influences on the utilisation of HIV testing and counselling services. There are many reasons and motivations for testing as well as many deterrents from testing. In considering the determinants of uptake of testing, two broad themes emerge: firstly psychological determinants, which include social barriers to uptake of VCT (such as stigma) and individual factors (such as anxiety and fear); secondly practical determinants, such as service constraints (availability and access to services) and the availability of treatment.

Uptake of testing is increased by removing the logistical barriers to testing, although the psychological barriers may remain. However, removing the logistical barriers to testing may create a positive-feedback effect: whereby an *increasing* proportion of individuals who know their HIV status leads to a change in social norms regarding counselling and testing (i.e. normalizing HIV testing) and hence reduces the psychological barriers to testing and *increases* the uptake of testing.

In addition to making testing more conveniently available, alternative ways to remove barriers to knowing one's serostatus are being investigated. For example, in Malawi, a small randomly assigned monetary incentive (ranging from zero to three dollars, the average - \$1.04 - was worth less than a day's wage) doubled the proportion of individuals returning for their test results (from 39% to 80%) in a population-based survey [129].

Overall, uptake of testing among study participants was high, with 91% of those approached agreeing to test. Although offering a cash incentive may be ethically dubious (in effect paying people to know their serostatus) and not a feasible intervention outside of a research setting, Thornton argues that barriers to testing can be easily overcome by offering an incentive [129].

Corbett *et. al.* suggest that convenience, a direct offer of testing, and positive attitudes of staff may outweigh individual-related factors with regard to uptake of HIV counselling and testing [138]. However, Wolff *et. al.* argue that convenience is important, but must be balanced against social consequences, such as stigma [91].

This framework has placed much emphasis on the motivations for testing, barriers to testing and the considerations involved in the decision to test, however not all individuals will be particularly concerned about knowing their HIV status as they may have more immediate issues (e.g. other illnesses) to cope with.

Given the potential importance of behavioural risk reduction for HIV prevention, the effectiveness of counselling and testing in achieving such risk reduction has received much attention. A comprehensive review of published analyses regarding the impact of receiving HIV counselling and testing on subsequent sexual behaviour is provided in the following chapter.

Chapter 3:
**A theoretical framework for the determinants of uptake and
behavioural outcomes following HIV counselling and testing:**
Part II

3.1 Aims and organisation of chapter

The aim of this chapter is to complete the theoretical framework by considering the outcomes following counselling and testing, in terms of impact on sexual behaviour. Firstly, an overview of behavioural theories and a discussion of the role of counselling and testing for changing risk behaviour is provided. This is followed by a comprehensive review to address the question: What impact does receiving HIV counselling and testing have on subsequent sexual behaviour? Within this review, an overview of studies from both Western and African settings which have been reviewed and analysed to date (1986-2009) is provided. Next, individual studies based in sub-Saharan Africa are considered in more depth, organized by study design. Observational studies are reviewed, organized by behavioural outcome. Studies with respect to sero-discordant couples are then considered. Finally, a discussion of the main findings and methodological issues is given.

3.2 Background

Behavioural risk reduction is promoted to reduce the spread of HIV. The provision of counselling and testing services is a potential means of facilitating such behaviour change. Thus, determining the impact of counselling and testing on subsequent sexual behaviour is of importance. However, there are a number of potential challenges to using counselling and testing as a successful prevention measure. These include changing long-term behaviour based on a single point-in-time intervention, poor quality prevention counselling, denial and stigma as barriers to uptake, maintaining quality counselling with widespread scale-up and the inability of current HIV tests to detect acute infections [178]. It has also been argued that clinics are not appropriate places for prevention, as people are positioned as patients and prevention is individualistic [40]. Despite these concerns, given the necessity of counselling and testing, it is argued that the use of counselling and testing for prevention must be maximised. Behavioural theories and the individual-level psychosocial mechanisms - by which combining knowledge of one's serostatus with personalised risk reduction counselling may motivate individuals to change their behaviour to prevent infection - are outlined in the following section.

3.3 Behavioural theories and the role of HIV counselling and testing for changing risk behaviour

Counselling and testing is one approach to encourage behaviour change; other approaches include providing information and education (e.g. mass media education, peer education, and small group education) [179]. Providing information and education are necessary for prevention, but not always sufficient. Thus, a number of theories of determinants of behaviour and behavioural change have been developed, some which are HIV/AIDS specific, others have been applied from other areas of health research and psychology [180, 181]. An overview of behavioural theories is presented in Table 3.1.

Theories such as the Transtheoretical Model, the AIDS Risk Reduction Model and the Precaution Adoption Process Model describe the process of behavioural change by outlining an individual's progression through a series of stages of "readiness" to change their behaviour. In contrast, the other theories presented above focus on predicting and explaining behaviours, rather than on behaviour change specifically. Theories such as the AIDS Risk Reduction Model, the Information-Motivation-Behavioral Skills model, the Integrated Model and the Multiple Domain model were all developed specifically to understand sexual risk behaviour in the context of HIV/AIDS. The other, more general, theories such as the Theory of Planned Behavior, which was established before the AIDS epidemic, have been used to explain and predict other health-related behaviour (e.g., smoking cessation) [182].

Each of the behavioural theories summarized in Table 3.1 focus principally on individual-level psychosocial factors (e.g. attitudes, intentions and beliefs) to understand and predict risk behaviour (with the exception of the Theory of Gender and Power). However, sexual behaviour is not determined by an individual's psychological processes alone. In addition, many behavioural theories have been based on the assumption that counselling leads to a rational, considered decision to change behaviour. However, for many individuals and women in particular, sex is tied with livelihood, duty and even survival, in poor societies [183]. Thus, the broader social, cultural and environmental influences also need to be considered. To capture the context in which behaviour occurs (i.e. beyond

the individual level) a number of social theories, such as the diffusion of innovation theory and the social influence model, have been developed that include factors such as relationships, societal norms, religious criteria and gender-power relations [181, 184].

The behavioural theories presented in Table 3.1 share a number of constructs, including: attitudes; social norms (behavioural expectations within society); self-efficacy (the belief that one is capable of attaining certain goals); risk perception; knowledge and intentions. However, the importance of each varies among theories. For example, the Theory of Reasoned Action is defined using three central tenets: attitudes, perceptions of social norms and intentions. In a comparison of behavioural theories, Noar points out that the concepts of attitude and self-efficacy are of importance in almost all of these theories [180].

These behavioural theories are useful when considering the behavioural impact of VCT. Receiving counselling may facilitate behavioural risk reduction through improving risk perception, increasing self-efficacy, reinforcing social norms, providing support for sustaining risk reduction and increasing an individual's ability to communicate about sex [181, 185]. Factors such as the test result, the individual's level of risk, receptiveness to counselling messages and readiness to reduce risk (if necessary) and the quality of counselling may influence the behavioural outcomes following testing. Additionally, the psychological "determinants" of behaviour are likely to be differentially influenced by the HIV test result. Learning that one is not infected may motivate an individual to reduce their risk, if necessary, to avoid acquiring infection in the future. De Zoysa *et. al.* outline how receiving a negative test result may increase self-efficacy and reinforce confidence in the effectiveness of risk avoidance, conversely, however, it may also reinforce a low risk perception [185]. Equally, learning that one is infected may have a direct effect on sexual behaviour, as learning that one is HIV positive is often highly emotionally distressing. Obermeyer and Osborn outline how the significance of a HIV test result goes beyond conveying medical information (one is simply infected or not infected), as a test result may have impact on an individual's life by leading to a "complete redefinition of a person's social relationships" [68].

Theoretical model	Description
Behavioural <i>change</i> theories:	
Transtheoretical Model [176]	Outlines stages which individuals move through when changing behaviour: (i) pre-contemplation, (ii) contemplation, (iii) preparation, (iv) action and (v) maintenance. Movement between stages depends on cognitive-behavioural processes.
AIDS Risk Reduction Model [186]	Outlines three stages involved in reducing risk: (i) behaviour labelling, (ii) commitment to change (iii) and action. Based on a combination of previous models and developed specifically to understand HIV risk.
Precaution Adoption Process Model [187]	The adoption of behaviour change is a dynamic process with many determinants. Change is conceptualised as an orderly sequence of qualitatively different cognitive stages.
Behavioural theories:	
Health Belief Model [188]	Health behaviour is a function of an individual's socio-demographic characteristics, knowledge and attitudes. Prompting behavioural change involves changing individual personal beliefs.
Theory of Reasoned Action [189]	Focuses on the role of personal intention as a determinant of behaviour. Intention is a function of attitudes, intentions and social influence. Assumes that behaviour is under volitional control and is rationally considered.
Theory of Planned Behaviour [190]	Revision and extension of Theory of Reasoned Action. Composed of three constructs: behavioural intention, attitude and subjective norms. A person's attitude, combined with subjective norms, forms their behavioural intention.

Integrated model [191]	Integration of several theories of behavioural prediction and behaviour change. Behavioural change occurs if an individual has strong intention to change their behaviour, has the necessary skills and abilities required and if there are no environmental constraints preventing behavioural change.
Social Cognitive Theory [192]	Regards behaviour as a continuous interaction between cognitive behavioural and environmental determinants. Focuses on the ideas of self-efficacy and outcome expectancies.
Information-Motivation-Behavioral Skills Model [193]	Risk reduction, with respect to HIV/AIDS, is a function of an individual's information about transmission and prevention of HIV, motivation to reduce their risk, and behavioural skills to carry out risk reduction.
Multiple Domain Model [194]	Behaviour is determined by personality characteristics (e.g. sensation seeking and impulsivity) and psychosocial characteristics (e.g. attitudes, norms and self-efficacy).
Extended Parallel Process Model [195]	Extension of "Protection Motivation Theory" for fear appeal research (i.e. fear-based messages). When an individual fears a significant threat and when they perceive a response that would avert the threat, they are motivated to control the danger and think of strategies to avert the threat.
Protection Motivation Theory [196]	Aims to understand how individuals react to fear-based messages. Consists of three components: (i) magnitude of harm of a potential event (e.g. infection with HIV); (ii) the probability of that events occurrence; and (iii) the efficacy of a protective response. Each of these three factors initiates cognitive appraisal processes that mediate attitude and behaviour.
Theory of Gender and Power [197]	A social structural theory. Encompasses issues including power and authority, affective influences, and gender-specific norms within heterosexual relationships, with a focus on women.

Table 3.1 Overview of behavioural theories. This table is based on work by Noar [180].

3.4 The impact of HIV counselling and testing on subsequent sexual behaviour

To identify the relevant literature, a PubMed search was performed using combinations of the terms “HIV”, “counselling”, “testing”, and “sexual behaviour”. The reference list of each study included was also fully checked to identify any additional relevant studies. Results that were only available as conference abstracts were not included in this review as they did not contain sufficient detail.

3.4.1 An overview of the epidemiological evidence regarding the impact of VCT on sexual behaviour

Two reviews and two meta-analyses have provided an overview of the literature regarding the efficacy of HIV counselling and testing on behavioural risk reduction in a wide range of contexts. Higgins *et. al.* reviewed 50 studies published between 1986 and 1990 [198]. A broad range of studies were included, categorised as those on homosexual and bisexual men, IDUs, pregnant women and other heterosexuals at high risk of infection. Only three of the fifty studies reviewed were based in an African setting. Furthermore, these three studies were referenced as conference proceedings and not published papers. Overall, dramatic reductions in risk among homosexual men were found; both tested and untested, indicating that risk reductions were independent of having received counselling and testing. Reductions in risk were observed among sero-discordant couples following counselling and testing. However, on the whole, the authors concluded that HIV counselling and testing does not affect behavioural change, as reductions in risk were reported regardless of having received counselling and testing.

As a follow-up to Higgins’s review, Wolitski *et. al.* carried out a systematic review of published studies from 1990 to 1996 [199]. Studies were classified according to participants: (i) men who have sex with men (MSM); (ii) injecting and other drug users; (iii) women and heterosexual couples; and (iv) mixed samples recruited from STI clinics and other settings. Of the 35 articles reviewed, eight were from an African setting. Overall, the findings were mixed, with the most consistent evidence for reduced risk following counselling and testing among sero-discordant couples. Despite finding some

evidence that counselling and testing influences risk behaviour many studies did not, and so the review was largely inconclusive.

Weinhardt *et. al.* carried out the first meta-analysis of the effects of HIV counselling and testing on sexual risk behaviour [200]. This meta-analysis included 27 studies published between 1985 (the year an HIV antibody test was first licensed) and 1997. Six of these studies were based in African countries, with the majority being based in the United States. The inclusion criteria required that studies report sexual behaviour outcome data assessed before and after counselling and testing. However, the studies included were diverse with respect to study design, length of follow-up and recruitment of participants. In particular, a number of the studies reported behavioural outcomes among IDUs. The conclusions from this analysis were that infected individuals who received counselling and testing reduced their risk behaviour, whereas uninfected individuals did not (relative to untested participants). Consequently, the authors concluded that counselling and testing is a means of secondary, but not primary, prevention of HIV. Of note, the CDC immediately issued a cautionary letter on the conclusions of this meta-analysis with respect to client-centred counselling. This letter stated that the findings were not a reflection of the impact of client-centred counselling in clinical settings, as the majority of the studies analysed were published before a client-centred approach was recommended in 1993 [201].

A more recent meta-analysis has been conducted by Denison *et. al.* using studies in developing countries occurring between 1990 and 2005 [69]. Only seven studies met the inclusion criteria, largely due exclusion of studies from Western settings. Of the seven included, four were based in Africa and three in Thailand. The analysis was structured to analyse the impact of VCT using two outcome measures: (i) number of sex partners; and (ii) occurrence of unprotected sex. Based on data from three studies, it was found that VCT had no effect on number of sex partners. With respect to unprotected sex, the pooled effect size from all seven studies showed that those who received VCT were significantly less likely to engage in unprotected sex compared to before they received VCT or compared to participants who had not received VCT [OR 1.69; 95%CI 1.25 – 2.31, where

an OR>1 indicates reduced risk] [69]. The greatest effect sizes for unprotected sex were observed among HIV positive individuals and sero-discordant couples. The authors concluded that this analysis provides moderate evidence to support counselling and testing as a prevention strategy.

In addition to these reviews and meta-analyses, a UNAIDS report on the benefits and challenges of VCT included a brief review of thirteen studies carried out between 1990 and 2000 [58]. This review only included studies in sub-Saharan Africa and concluded that VCT can promote reductions in risk behaviour among sero-discordant couples in particular, but that long-term changes in behaviour are unknown and need to be understood.

Much work has been carried out in the United States regarding the efficacy of HIV counselling and testing in promoting behavioural risk reduction. A multi-centre RCT carried out by the CDC in STI clinics, known as project RESPECT, demonstrated that personalized risk reduction counselling can increase condom use [202]. However, the effects were short-lived as the significant reported increases in condom use were not maintained at 12-month follow-up. A more recent RCT, known as the EXPLORE study, has provided evidence for risk reduction among MSM in the United States [203]. Despite the evidence that counselling and testing can reduce risk behaviour in these settings, it has been estimated that in the United States in 2005 individuals who knew that they were HIV positive accounted for 30-46% of new infections, whereas those unaware of their serostatus contributed to 54%-70% of new infections [13]. However, those unaware of their serostatus had a disproportionately large contribution to the transmission rate of new infections (at least 3.5 times that of the aware group), as only 25% of infected individuals in the United States were estimated to be unaware of their serostatus at the time of the study. Thus, it was concluded that the spread of HIV can be reduced by increasing the number of HIV positive individuals who know their status.

In summary, the available data that has been reviewed to date provides some evidence for risk reductions among those testing positive and sero-discordant couples. However, the

studies reviewed were mostly conducted among high-risk groups (MSM and IDUs) and based in Western settings (mostly the United States); few studies from African settings were either available or met inclusion criteria. Overall, the results vary considerably, both across and within populations. Given this heterogeneity and diversity in results among different population groups, it is useful to focus on studies from sub-Saharan Africa. A review of these studies is found in the following sections.

3.4.2 Evidence from a randomized controlled trial: The VCT Efficacy Study Group

Given the heterogeneity among individuals with respect to patterns of risk behaviour, as well as intention and motivation for behaviour change, the ideal study design to determine the impact of VCT on sexual behaviour is a randomized controlled trial (RCT). Furthermore, individuals who self-select to attend VCT may be more likely to have low risk behaviour and may be more likely to be more receptive to prevention messages than those who do not self-select for VCT. A RCT minimises this bias.

To date, there has been a single RCT to investigate the impact of VCT in reducing unprotected intercourse [204]. This trial was carried out in 1995-1998 by the VCT Efficacy Study group, in Nairobi (Kenya), Dar es Salaam (Tanzania) and Port of Spain (Trinidad). Recruitment was carried out among individuals and couples seeking HIV-related services. Individuals and couples were randomly assigned either VCT or health information (representing best practice). VCT was provided at free-standing facilities. Sexual behaviour in the previous two months was assessed by face-to-face interview at baseline and two follow-up surveys. At the first follow-up (mean 7.3 months after baseline) VCT participants were offered a repeat test and health information participants were offered VCT. Sexually transmitted infections were diagnosed and treated among all participants. HIV incidence was not used as an outcome due to ethical issues.

Those individuals receiving VCT reduced reported levels of unprotected sex with *non-primary* partners (i.e. casual or commercial partner). Among men, a reduction of 35% was observed in those receiving VCT compared to 13% in those receiving health information. Among women, a reduction of 39% was observed in those receiving VCT

compared to 17% in those receiving health information. Importantly, these reductions were maintained (i.e. reported unprotected sex remained at a similar level to that observed at first follow-up) at the second follow-up (mean 13.9 months after baseline).

Individuals infected at baseline were significantly more likely to reduce unprotected intercourse with their *primary* partner (i.e. spouse or “steady” partner) between baseline and first follow-up, compared to those who were uninfected (OR = 0.60, 95% CI = 0.40 – 0.89). These reductions were maintained at second follow-up. Individuals infected at baseline were also more likely to reduce unprotected intercourse with their *non-primary* partners between baseline and first follow-up. However, this effect was confounded by gender as greater reductions were observed among infected men (OR = 0.19, 95% CI = 0.05 – 0.81), than infected women (OR = 0.90, 95% CI = 0.49 – 1.66), compared to uninfected men and women respectively.

Among couples, those assigned to receive VCT significantly reduced unprotected intercourse with their *enrolment* partners compared to those assigned to receive health information (OR = 0.72, 95% CI = 0.53 – 0.99). However, no differences were found in reported unprotected sex with *non-enrolment* partners, although levels of unprotected intercourse were much lower with non-enrolment partners than with enrolment partners. Sero-discordant and sero-concordant-positive couples were significantly less likely to report unprotected intercourse with *enrolment* partners at both follow-ups than couples who were concordant-negative. However, rates of unprotected intercourse with *non-enrolment* partners remained unchanged among sero-discordant and sero-concordant couples receiving VCT.

The validity of self-reported sexual behaviour data is supported by the finding that unprotected intercourse with a non-enrolment partner was significantly associated with an increased risk of STI acquisition - gonorrhoea, chlamydia or syphilis - (OR = 2.97, 95% CI = 1.12 – 7.24). Moreover, agreement between couple’s reports of behaviour was high, at about 90%.

Although there is evidence for the efficacy of VCT for reported risk reduction among individuals with their *non-primary* partners, reported risk reductions with individual's *primary* partners were not observed. Conversely, among couples, strong evidence is found for reported risk reduction with *enrolment* partners but no reported reductions in risk were observed with *non-enrolment* partners. Furthermore, in the meta-analysis conducted by Denison *et. al.*, the frequency of unprotected sex is averaged [205]. When combined, these data show no impact of VCT on the reported levels of unprotected sex, for neither individuals nor couples in this trial. This suggests that the behaviour change observed is very specific to the type of sex partner.

Importantly, significant reported reductions in risk were also observed among the control group receiving health information as well as those receiving VCT. This trial is frequently cited as definitive evidence that VCT is effective in changing behaviour and thus can be a successful and cost-effective HIV prevention measure [206]. While the results do provide some support for the efficacy of VCT in promoting behavioural risk reduction, it must be acknowledged that there are some mixed findings. On the whole, the finding that VCT is more effective for risk reduction among infected individuals and sero-discordant couples is consistent with the conclusions drawn from the meta-analyses conducted by Weinhardt *et. al.* [200] and by Denison *et. al.* [69].

3.4.3 Evidence from observational studies

In this section, behaviour change is considered with respect to two broad categories (i) condom use and unprotected sex, and (ii) number of sexual partners. Studies among sero-discordant couples are then considered separately, in more detail, where the findings are somewhat different. A summary of published studies in sub-Saharan African settings that evaluate the impact of VCT on sexual behaviour is provided in Table 3.2.

Condom use and unprotected sex

Data from four cohort studies indicate increases in reported condom use following VCT. Firstly, Allen *et. al.* report increased condom use following testing among a cohort of women attending an outpatient clinic in Kigali, Rwanda in 1988. Before counselling and

testing 7% of women reported *ever* having used a condom, whereas 22% reported using condoms regularly after one year follow-up, following testing [207]. The strongest predictor of condom use was receipt of a positive test result. Furthermore, women whose partner also received counselling and testing were twice as likely to “become condom users”, than women whose partners had not. All the spouses and cohabiting partners of these women were subsequently enrolled in a male-focused HIV counselling and testing programme, carried out in 1991 [208]. Thirty-seven percent of these men had previously received counselling and testing from the study. Large increases in condom use were reported following testing, except for sero-concordant negative couples. These increases were greatest among couples in which the male partner had not previously tested (from <30% to >70%).

Secondly, a health centre based cohort in Kenya, carried out from 1999 to 2001, found significantly less reporting of unprotected sex with any partner type (primary or non-primary) following VCT [209]. Reporting of unprotected intercourse decreased from 95% before VCT to 89% following VCT ($P = 0.021$). Thirdly, in Mozambique, Mola *et. al.* report that the percentage of individuals reporting condom use (always or sometimes) increased between a baseline survey in 2002 and two follow-up surveys in 2003, among those who received VCT [210]. However, an increase in reported condom use was also observed among those who did not receive VCT. Nonetheless, reported condom use was significantly higher among those who had received VCT than those who had not, at 6 month follow-up (76% vs. 63%, $P = 0.01$). Despite this, reported rates of casual sex also increased among those who received VCT and those who didn't.

Fourthly, Sherr *et. al.* analysed two rounds of data, from a population-based cohort in Manicaland, Zimbabwe, during the period 1998 to 2003, and reported that women who tested positive increased their reported levels of consistent condom use (i.e. use in 100% of sex acts) in the last two weeks, with their regular partners [125]. Men and women testing negative did not increase consistent condom use with their regular partners. A follow-up analysis, using an additional round of data, is presented in detail in Chapter 6.

In addition, Wiktor *et. al.* found increased levels of reported consistent condom use with a partner who was not a sex worker following counselling and testing, among male, but not female, tuberculosis patients in Côte d'Ivoire during the period 1995 to 1996 [211]. Among males, reported consistent condom use increased from 9.9% prior to counselling and testing to 23.6% at a 4 month follow-up visit (4 months after pre-test counselling, 2 months after post-test counselling). More recently, Turner *et. al.* analysed data from a hormonal contraception study carried out from 1999 to 2004 among 18 to 35 year old women in Uganda and Zimbabwe, to compare reported condom use before and after HIV testing [212]. Women received counselling and testing every 3 months for 2 years (i.e. up to 12 sessions). It was found that the proportion of women reporting any unprotected sex decreased from 74% to 56%, following receipt of a positive test result. Importantly, however, the proportion of unprotected acts reported changed little (i.e., a 7% reduction). No change in either the number or proportion of unprotected acts reported was observed among HIV negative women.

Conversely, there is much evidence which suggests that condom use is not increased following VCT in a variety of contexts. A study among female sex workers in The Gambia in 1989 found no increase in levels of reported condom use two to five months following counselling and testing [213]. However, reported levels of condom use among these high risk women were relatively high before receiving counselling and testing. Infected and uninfected women reported condom use for 89.3% and 88.0% of all client contacts respectively (range 31-100%). Thus, the potential to increase levels of condom use was small, as many of the women reported levels of condom use of 90-100%, and these levels remained unchanged following counselling and testing.

In a community-wide HIV counselling and testing program in Kigoyera, rural western Uganda in 1993, Kipp *et. al.* report that those who tested showed no significant difference in reported condom use than those who had not (4.3% vs. 5.5%) [214]. Behavioural data were compared for those who had received counselling and testing and those who had not, but no data on behaviour previous to testing are presented, so it is not possible to determine if there was an actual change in reported condom use attributed to VCT.

Subsequent focus group discussions in this community revealed that participants felt that a single testing program is insufficient and did not cause changes in sexual behaviour to occur [215].

A behavioural risk reduction programme providing testing, counselling and condom promotion as well as STI diagnosis and management among trucking company workers in Kenya carried out from 1993 to 1995, found no change in reported consistent condom use during extramarital sex [216]. The percentage of men who reported consistent condom use remained at 30%, following counselling, testing, and condom promotion. However, no data were available for men who did not receive counselling and testing in this setting.

A study among women at a maternity hospital in Nairobi, Kenya in 1998 concluded that testing and subsequent post-partum counselling did not increase levels of condom use [217]. However, the actual change due to counselling and testing is unknown because no baseline data is presented for condom use. The comparison made was between infected and uninfected women followed-up one year post-partum. Furthermore, the measure of condom use is not defined and is based on reports from only 24 positive women and 33 negative women who were followed-up, from an initial sample of 107 [217].

Matovu *et. al.* report no significant changes in reported condom use (none, inconsistent or consistent) at one year follow-up among those who either accepted or refused VCT in a cohort study in Rakai, Uganda in 1999 [134]. Furthermore, there were no significant differences in reported levels of condom use among those who accepted VCT and those who refused VCT. Pre-test counselling and testing was provided to all consenting adults (n =10618), thus accepting VCT refers to receiving results and post-test counselling. Almost half (47.2%) of participants had previously received VCT from the Rakai program. The majority, 93% (9910 of 10618), of participants requested their test results. Of these, 62% received their results and post-test counselling. Thus, among those who are defined as having “refused” VCT, the majority initially requested their results but did not receive them. Furthermore, it is important to note that of those who “refused” VCT, only

12.4% were no longer interested in receiving their results and the main reasons for not receiving results were absenteeism (48.8%) and migration (19.5%). Of the 38% (4016 of 10618) who “refused” VCT; 48% (1938 of 4016) had previously received VCT either from the Rakai program or other providers. For these reasons, it may not be surprising that no differences were observed.

Matovu *et. al.* subsequently published a secondary analysis to describe the effects of repeat VCT on reported sexual behaviour and HIV incidence among 6377 initially negative participants who had participated in at least two of the annual surveys [112]. However, the behavioural data presented are cross-sectional and so it is not possible to establish what changes, if any, are occurring subsequent to first-time testing and repeat testing. There was no significant difference in HIV incidence between first-time acceptors and non-acceptors of VCT (1.6/100 py vs. 1.6/100 py, adjusted IRR = 1.00, 95% CI 0.72 – 1.39), or between repeat acceptors and non-acceptors (1.4/100 py vs. 1.6/100 py, adjusted IRR = 0.85, 95% CI 0.58 – 1.23) [112]. However, those who actually received VCT are not distinguished from those who accepted VCT, which limits these conclusions considerably.

Matambo *et. al.* report no change in the percentage of participants reporting unprotected sex with their primary partners three months after receiving VCT in Harare, Zimbabwe (72% pre-VCT vs. 71% post-VCT) [218]. However, this study, which was carried out from 2002 to 2004 and nested within a larger trial of the impact of VCT on HIV incidence, only presented data for individuals testing negative and no data for individuals who did not test are available.

Overall, evidence regarding the efficacy of counselling and testing for increasing condom use is varied. One of the caveats for interpreting these results is that many of the measures used to define condom use are not comparable. Furthermore, the baseline levels of condom use vary widely. Although many studies report that condom use does not increase following counselling and testing, the variety of methods and potential

limitations in the analysis of the available data make it difficult to conclude no association between receiving VCT and subsequent condom use.

Number of sexual partners

Fewer studies have analysed change in reported number of sexual partners as an outcome following VCT. An evaluation of a community-wide counselling and testing programme in western Uganda in 1993 concluded that testing is not sufficient to reduce high risk behaviour [214]. The findings show no difference in the mean number of reported sexual partners in the past three months among those who received counselling and testing (1.8 partners) and those who didn't (2.0 partners). However, behaviour was not compared pre- and post-testing and so it is not possible to establish if any behaviour change associated with having received testing occurred.

Matovu *et. al.* report no significant change in risk during follow-up among those who accepted or refused VCT in Rakai, Uganda in 1999 [134]. Among males, the percentage reporting one, two and three or more sexual partners (in the last six months) remained the same after a one year follow-up among those initially infected individuals who accepted VCT and those who refused VCT. Among females, the percentage reporting three or more partners decreased among those who accepted VCT and among those who refused VCT. Also, the analysis excludes those who report having no sexual partner. Matovu *et. al.* subsequently carried out a secondary analysis of the effects of repeat-testing in which behavioural data for non-acceptors, first-time acceptors and repeat acceptors was compared [112]. No significant difference in reported multiple sexual partnerships between repeat acceptors and non-acceptors of VCT (18.1% vs. 15.0%, adjusted prevalence OR = 0.84, 95% CI: 0.68 – 1.06) was found. However, first time acceptors were significantly less likely to report multiple sexual partnerships than non-acceptors of VCT (14.1% vs. 15%, adjusted prevalence OR = 0.75, 95% CI: 0.61 – 0.92).

Arthur *et. al.* report a significant decrease in the proportion of individuals reporting having two or more partners in the past six months (16% to 6%, $P < 0.001$) among clients receiving counselling and testing at three government health centres in Kenya from 1999

to 2000 [209]. In a cohort study in Manicaland, Zimbabwe those testing positive reduced their reported number of partners in the last year, subsequent to receiving VCT [125], whereas those testing negative increased their reported number of partners in the last year, in particular those who did not receive counselling. A follow-up analysis to this work, using an additional round of data, collected from 2003 to 2005, is presented in detail in Chapter 6.

Behaviour change among sero-discordant couples

Couple counselling and testing has been identified as a potential “high-leverage” HIV prevention intervention, as counselling couples together overcomes the issue of disclosing test results and obstacles to risk reduction can be discussed [172]. VCT has been shown to be most effective in reducing risk when couples attend VCT together; in particular among sero-discordant couples. One of the earliest studies (conducted from 1987 to 1989) on the efficacy of VCT was carried out by Kamenga *et. al.* among 149 sero-discordant married couples at an HIV counselling centre in former Zaire [219]. Couples were required to attend monthly counselling sessions and complete a sexual activity calendar. Those couples who failed to attend their appointments, or those deemed to be at risk of separation, were visited at their homes. In addition, couples were requested to retain the condom wrapper each time a condom was used. At each visit to the counselling centre numbers of wrappers were counted and the sexual activity calendar was discussed. Prior to receiving VCT, less than 5% of couples reported having ever used a condom. At 18 months follow-up, 77% of couples reported using condoms for every act of intercourse. In addition, 20% of couples reported to be abstaining from sex. Relatively low participation (65%) may have influenced these results if those couples most willing to increase condom use were also those most likely to participate. The same group of researchers carried out a study in the same location two years later to determine the impact of HIV counselling and testing on behaviour among child-bearing women [220]. Among HIV positive women, 70.8% planned on using condoms; however, 12 months later, only 20% actually used condoms. Among HIV negative women, 52.6% planned on using condoms but 12 months later, 17% actually used condoms. Furthermore, only 8%

of the women who had requested assistance in notifying their partner actually returned with their partners for HIV counselling and testing.

Equally dramatic increases in reported levels of condom use following VCT were reported by Allen *et. al.*, in a study of sero-discordant cohabiting couples in Rwanda in 1988 [221]. Among 53 sero-discordant couples, the proportion reporting to use condoms increased from 4% before receiving VCT to 57% after one year of follow-up. In comparison, reported condom use among couples in which only the woman had tested was much lower, at 16%, possibly due to lack of disclosure of serostatus. A similar study among sero-discordant cohabiting couples was carried out, also by Allen *et. al.*, at a VCT centre in Lusaka, Zambia from 1994 to 1999 [222]. Before receiving VCT, less than 3% of couples reported current condom use, whereas after a one year follow-up, over 80% of couples reported using condoms during all episodes of sexual intercourse. In comparison, among concordant negative couples, condom use was reported in 28% of sexual contacts at one year follow-up. This suggests that substantial declines in risk may be attributed simply to the newly-acquired knowledge of sero-discordance rather than receiving VCT, regardless of individual serostatus.

Overall, there is evidence for dramatic increases in reported levels of condom use among sero-discordant couples following VCT and rigorous condom promotion. However, observed effects may be overestimated due to under-reporting of unprotected sex. The prevalence of sero-conversions, the occurrence of pregnancy or the presence of sperm in vaginal smears, among couples that reported no unprotected sex, or by positive women in a sero-discordant partnership reporting only one lifetime partner, strongly suggests that a significant amount of unprotected sex is not reported [219, 221, 222]. In each of these three studies, a highly rigorous approach was taken, whereby couples were requested to keep a sexual diary or sexual activity calendar, which was discussed with a counsellor each month or at 3-month intervals. Such an intensive approach demonstrates substantial risk reductions are attainable; nevertheless this approach may be unsustainable outside of a research setting.

Author & Year	Setting & population	Study design	Service provision	Outcome measures	Findings
Temmerman <i>et al.</i> , 1990	Kenya, Nairobi (urban). Asymptomatic HIV positive women who had recently given birth.	Prospective cohort Follow-up = 1 year N = 1507	Testing & counselling provided by the study.	Condom use; Contraceptive use & pregnancy	No impact. No baseline data for condom use is presented.
Allen <i>et al.</i> , 1992	Rwanda, Kigali (urban). Women recruited from an outpatient research clinic.	Prospective cohort Follow-up = 2 years N = 1458	Testing & counselling provided by the study. Pre-test counselling consisted of an educational video & group discussion. Results & post test counselling were given 3 weeks later. Participants were obligated to receive their results.	Proportion of couples using condoms; Spermicide use	Increased condom use. The proportion using condoms increased from 7% (ever using condoms) to 22% after 1 year follow-up. 10% reported using spermicide after 1 year follow-up.
Müller <i>et al.</i> , 1992	Uganda, Kampala (urban). Clients attending the AIDS Information Center (AIC).	Prospective cohort Follow-up = 6-months (Follow-up only refers to repeat testers) N = 500 individuals, 86 couples, 200 repeat testers	AIDS Information Center provided voluntary & anonymous counselling for HIV/AIDS and testing for HIV. Counselling given by professional health workers.	Abstinence; Unprotected causal sex; Number of partners in previous 6 months	Uncertain. Behaviour at baseline was not compared to that at follow-up. Repeat-testers reported less casual sex than first time testers (6% v 25%).
Allen <i>et al.</i> , 1993	Rwanda, Kigali (urban). Women recruited from an outpatient research clinic.	Prospective cohort Follow-up = 2 years N = 1458	Testing & counselling provided by the study. Pre-test counselling consisted of an educational video & group discussion. Results & post test counselling were given 3 weeks later. Participants were obligated to receive their results.	Hormonal contraceptive use Pregnancy	Decrease in contraceptive use. Half of infected individuals and one third of negative individuals using hormonal contraceptives had discontinued use one year following testing & counselling. No impact was observed on rates of pregnancy.
Pickering <i>et al.</i> , 1993	The Gambia (urban & rural). Female sex workers	Prospective cohort Follow-up = 5 months N = 31	Testing & counselling provided by the study - medical research clinic staff (trained field workers)	Condom use: (as a % of all contacts, per individual)	No impact. Condom use remained at a high level overall.

Lander <i>et al.</i> , 1996	Rwanda, Kigali (urban). Pregnant women	Prospective cohort Follow-up = 4 months after delivery (<6 months after post-test counselling) N = 1233	Testing & counselling provided by the study.	Condom use: (% of individuals reporting to have used a condom at least once)	Uncertain. Before testing and counselling 14% of women had used a condom at least once. At follow-up, 8.8% of infected women and 3.8% of uninfected women reported condom use since delivery.
Jackson <i>et al.</i> , 1997	Kenya, Mombasa (urban). Uninfected male trucking company workers	Prospective cohort Follow-up at 3 month intervals Mean follow-up = 1 year (range 21 - 588 days) N = 556	Behavioural intervention for high-risk individuals. Testing, risk-reduction counselling, condom promotion.	Extramarital sex; Condom use (100%); Sex with commercial sex worker (CSW)	Reductions in high risk sexual behaviour. Significant reduction in sex with CSW. No change in condom use - 30% of men reporting consistent condom use during extramarital sex.
VCT Efficacy study group, 2000	Kenya, Nairobi (urban). Tanzania, Dar es Salaam (urban) Trinidad, Port of Spain (urban). General population.	Randomised controlled trial Mean follow-up = 7.3 months (1st), 13.9 months (2nd). N = 3120 individuals & 586 couples, before randomization	Participants assigned VCT or health information. Testing & counselling provided by study - US CDC client-centered HIV-1 counselling model. 2 free standing clinics 1 hospital based clinic.	Unprotected intercourse	Reduced levels of unprotected intercourse. Proportion of individuals reporting unprotected sex with <i>non-primary</i> partners decreased significantly more for those receiving VCT than those receiving health information (Men: VCT 35% reduction vs. health info. 13% reduction; Women: VCT 39% reduction vs. health info. 17% reduction).
Roth <i>et al.</i> , 2001	Rwanda, Kigali (urban). Husbands & partners of women in a longer term study recruited into a testing & counselling programme.	Prospective cohort Follow-up = 1 year N = 684 couples	Men participated in extensive male-focused counselling programme, based on the AIDS risk reduction model. All women had previously received standard testing & generic counselling.	Condom use Frequency of intercourse (with and without condoms)	Increased condom use. Frequency of unprotected sex decreased except for concordant negative couples. Greatest increases in condom use among discordant couples in which the man had not tested previously. Large increases in proportion of couples using condoms regularly (>90%)
Wiktor <i>et al.</i> , 2004	Côte d'Ivoire, Abidjan (urban). Out-patients from TB treatment centres.	Prospective cohort Follow-up = 4 months (2 months after post-test counselling) N = 457 (approx 50% collected result)	Testing & counselling provided by TB treatment centre and conducted by medical staff who had received training.	Consistent condom use; Contact with a sex worker; Contact with a partner who is not a sex worker	Consistent condom use with a partner who is is not a sex worker increased from 9.9% to 23.6% among men, and did not change among women (9.9% to 9.5%).

Farquhar <i>et al.</i> , 2004	Kenya, Nairobi (urban) Women attending antenatal care	Prospective cohort Follow-up = 2 weeks N = 2104 women; 308 (15%) had partner come for VCT	Testing & counselling provided by the study at Nairobi City Council clinic.	Condom use	Couple counselling associated with increased condom use, but not among those testing negative. Women testing negative and counselled with their partner were significantly less likely to use a condom post-testing, than those counselled individually.
Matovu <i>et al.</i> , 2005	Uganda, Rakai (rural). General population.	Prospective cohort Follow-up = 1 year N = 10618 VCT: 5788, No VCT: 4830	Testing & counselling provided by the study. Trained Rakai Program community counsellors provided VCT in participants homes or local health units.	Condom use in past 6 months; number of sexual partners in past 6 months	No impact. No significant difference in risk between those receiving or declining VCT, and no significant change in risk between baseline & follow-up, among those receiving or refusing VCT.
Matambo <i>et al.</i> , 2006	Zimbabwe, Harare (urban). Employees recruited from 11 businesses.	Nested study within a cluster randomised trial. Follow-up = 3 months N = 388 negative individuals (87% male)	Testing & counselling provided by the study - occupational health nurses provided VCT at the workplace.	Unprotected sex with primary and non-primary partners	No impact. Unprotected sex reported by 82% before VCT and 83% after VCT, most reported a primary partner only.
Mola <i>et al.</i> , 2006	Mozambique, Beira & Chimoio (urban). General population Participants recruited from VCT centres.	Prospective cohort Follow-up at 4 & 6 months N = 1220 VCT: 622, No VCT: 598	Provided by VCT centre	Sex with friend/prostitute in last month; condom use: always or sometimes; condom use at last sex	Increased condom use. Condom use at last sex increased from 30% to 71% among those who received VCT, & from 29% to 47% among those who did not receive VCT.
Sherr <i>et al.</i> , 2007	Zimbabwe, Manicaland (rural). General population.	Prospective cohort Follow-up = 3 years N = 5775	Testing & counselling provided by the study (mobile clinic) and other providers (NGO's). At follow-up, 12% of men and 10% of women had ever collected an HIV test result.	Visited bar/beer hall; New partner in last year; Sexual partner in past month; Multiple concurrent partners; Total partners in last year; Consistent condom use in last two weeks with regular and non-regular partners	Individuals testing positive reported fewer sexual partners in the year prior to follow-up. Infected women reported increased levels of consistent condom use in their regular partnerships. Those testing negative and receiving counselling were more likely to increase risk in terms of beer hall attendance, new partners in the last year, and concurrent partnerships. Those testing negative & did not receive counselling were more likely to become more risky in terms of partners in the last month and last year.

Matovu <i>et al.</i> , 2007	Uganda, Rakai (rural). General population.	Prospective cohort Mean follow-up = 1.9 years N=6,377 initially negative: • 2294 non-acceptors • 2539 1st time acceptors • 1544 repeat VCT acceptors	Testing & counselling provided by the study. Trained Rakai Program community counsellors provided VCT in participants homes.	HIV incidence; Consistent condom use; Number of partners in the last 6 months; Current non-regular partnership	No impact on behaviour or incidence. No difference in HIV incidence between repeat testers, first time acceptors and non-acceptors. No difference in condom use. A higher proportion of repeat testers reported 2+ partners, compared to first time acceptors and non-acceptors.
Arthur <i>et al.</i> , 2007	Kenya, (1 urban & 2 rural sites). Government health centres	Prospective cohort Mean follow-up = 7.5 months N = 540	Government health centres	Number & type of partners; Unprotected intercourse	Proportion of individuals reporting multiple sexual partners reduced significantly from 16% to 6%
Turner <i>et al.</i> , 2009	Uganda and Zimbabwe (urban). Women using hormonal contraception.	Prospective cohort Follow-up = every 3 months for up to 2 years N = 808, in short-term (2 - 6 month follow-up) analysis. N = 801, in long-term (12 - 16 month follow-up) analysis.	Testing & counselling provided by the study.	Number of unprotected sex acts in a typical month	The proportion of infected women reporting <u>any</u> unprotected sex declined from 74% to 56%. Infected women reduced their <i>number</i> of unprotected acts, however, only a slight change in the <i>proportion</i> of acts which were unprotected was observed. Little behavioural change was observed among uninfected women.
Cremin <i>et al.</i> , 2009	Zimbabwe, Manicaland (rural). General population.	Prospective cohort Mean follow-up = 4.2 years N = 17874	Testing & counselling provided by the study (mobile clinic) and other providers (NGO's).	Visited bar/beer hall; New partner in last year; Sexual partner in past month; Multiple concurrent partners; Consistent condom use in last two weeks with regular and non-regular partners	Women who received VCT reduced their number of new partners in the last year, more than those who did not test. Greater reductions were observed among those who were infected, and this reduction was enhanced with time since testing. No significant risk reduction was observed among men, regardless of serostatus.

Sero-discordant couples:					
Kamenga <i>et al.</i> , 1991	Zaire, Kinshasa (urban). Married discordant couples.	Prospective cohort Follow up = 18 months (6 month minimum) N = 149 couples	Initial interview & testing at workplace medical centre. Counselling: monthly at a specially established centre.	Abstinence; condom use (pre test: % of couples ever having used a condom post test: % of couples using a condom in all acts)	Increased condom use. The proportion using condoms increased from <5% (ever used a condom) to 70.7% (using a condom in all sex acts) one month later. After 18 months follow-up, 77.4% of couples reported condom use in all sex acts. Increased abstinence.
Allen <i>et al.</i> , 1992	Rwanda, Kigali (urban). Cohabiting discordant couples.	Prospective cohort Mean follow-up = 2.2 years N = 53 couples	Testing & counselling provided by the study. Educational videos & group discussions.	Condom use: (% of couples reporting using condoms always sometimes and never)	Increased condom use. The proportion using condoms increased from 4% to 57% after a 1 year follow-up. Decreased seroconversion rates among women whose partners were tested.
Allen <i>et al.</i> , 2003	Zambia, Lusaka (urban). Cohabiting discordant couples.	Prospective cohort Mean follow-up = 14 months N = 963 couples	Testing & counselling provided by VCT centre. Same-day couples services (free syphilis treatment)	Condom use: (pre test: % of couples reporting current condom use post test: proportion of acts in which a condom is used)	Increased condom use. The proportion using condoms increased from <3% (ever used a condom) to >80% (using a condom in all sex acts) in the year following testing & counselling.

Table 3.2 Overview of studies evaluating the impact of VCT on sexual behaviour in sub-Saharan Africa, by year of publication

3.5 Discussion

Evaluating the evidence for the impact of HIV counselling and testing on sexual behaviour as a whole is difficult because studies vary with respect to: (i) design, (ii) behavioural outcome measures, (iii) statistical analyses and comparison groups, (iv) length and frequency of follow-up, (v) participant characteristics, (vi) sampling strategies, (vii) service provision (including the nature and quality of counselling provided) and (viii) setting. The majority of studies which assess the impact of VCT are observational in design and their findings are limited by various confounding factors. However, despite methodological limitations and heterogeneities, it is clear that counselling and testing *can* and sometimes does motivate behavioural risk reduction. Overall, the greatest changes in behaviour have been observed among those in sero-discordant partnerships in particular and among individuals testing positive.

In statistical analyses, VCT has to be considered as a single event at a single point in time, potentially giving the impression that something that happens during counselling and testing may “cause” behaviour change. In reality however, deciding to test, going for testing and what happens before and after testing with respect to motivation for behaviour change may be more of a process, rather than a single “trigger” for behaviour change. Prochaska’s stages of change model is a useful framework for capturing this process [176]. Prochaska’s framework has two applications with respect to counselling and testing: (i) uptake – an individual may go through the stages of change process when considering to test, with the final stage being actually going for testing; and (ii) impact on behaviour – going for counselling and testing may bring about progression through successive stages of change i.e. increase an individual’s “readiness” to adopt safe behaviour. Individuals may be at different stages of change (in terms of risk reduction) when they receive counselling and testing. For example, an individual may be at the preparation stage, in which case counselling and testing may move them to the action stage i.e. actually reducing risk. If an individual has not previously considered behavioural risk reduction, prevention counselling will move them from the pre-contemplation stage to the contemplation stage (i.e. considering their risk and considering

reducing their risk). Thus, risk reduction may be facilitated, but not immediately realised, through counselling and testing [185].

The role of counselling and testing in changing sexual risk behaviour is not straightforward as there are many psychological and behavioural factors to consider (e.g. the individuals level of risk, their willingness to change their behaviour if they are at risk, and their control over their risk (e.g. coerced sex)). In terms of psychological factors, whether a HIV test confirms an individual's pre-conceptions of their status may be an important influence on their subsequent behaviour (i.e. those who think they are negative, testing positive and those who think they are positive testing negative). For example, an individual who thinks they are negative and tests positive may have a different reaction, both emotionally and behaviourally, to an individual who thinks they are positive and the test confirms their own perception of their serostatus. Boozer and Philipson argue that those who are most surprised by their results (i.e. individuals who think they are "low-risk" who test positive and individuals who think they are "high risk" who test negative) are most likely to respond to counselling and testing [223]. In terms of behavioural factors, while counselling and testing may increase motivation for behavioural risk reduction, a conscious decision to adopt safer sexual behaviour may be difficult to put into practice, as it depends on circumstances such as a partner's willingness to also adopt safer behaviours (e.g. consistent condom use). This highlights the advantages of couple counselling and testing, whereby a couple receive their test results and prevention counselling together [172].

An important feature by which studies vary is the participant's volition for counselling and testing. Participants may have independently sought testing themselves, accepted testing when offered as part of the study, or have been assigned to receive testing as part of the study, following consent. In the meta-analysis by Weinhardt *et. al.*, it was found that behaviour change, with respect to unprotected intercourse, was greater among those who actively sought VCT compared to those who were approached by researchers and invited to participate in a study and receive counselling and testing [200]. However, no difference between these two groups was found with respect to number of sexual

partners. The current move towards provider-initiated testing is likely to influence the interplay between volition for testing and any subsequent behavioural impact [29]. The impact of testing on subsequent behaviour in the context of provider-initiated testing has not yet been evaluated.

The epidemiological context (the state and trends in behavioural and biological factors that determine transmission dynamics) may influence the results of studies examining the efficacy of VCT in reducing risk behaviour [58, 224]. In terms of epidemic stage, as an epidemic progresses awareness of HIV increases, concomitant with the level of morbidity, mortality and personal experience of HIV/AIDS. These changes may influence: sexual behaviour (independently of having tested and received counselling); uptake of testing; and also the impact of testing on sexual behaviour, through the mechanism of influencing personal risk perception.

In addition to the epidemiological context, the social context of testing may influence the impact of testing on sexual behaviour. For example, an increasing proportion of individuals in a community going for testing and disclosing their serostatus may lead to increased communication and discussions regarding HIV prevention and risk reduction, and greater acceptance and support for those who are infected, “diffusing” through the community [185], thus indirectly facilitating behaviour change, through the mechanism of increased awareness and social support. It has previously been argued that where only a minority of a community know their serostatus individual behaviour change may be difficult [125]. In addition, aspects of cultural context such as norms regarding female sexual autonomy may influence the behavioural impact of VCT, whereby intended behaviour change, such as condom use, may be difficult or unattainable (as discussed in chapter 2). This emphasises the importance of couple counselling, as risk reduction can be discussed together with the counsellor [172].

Despite the large array of observational studies, all are based in urban settings, with the exception of two large population-based cohort studies in Rakai, Uganda, and in Manicaland, Zimbabwe [112, 125, 134, 225]. Furthermore, the majority of these studies took place before the introduction of rapid tests and increased access to treatment, factors which are likely to influence the uptake of VCT and the efficacy of VCT for behavioural risk reduction. In addition, much of the evidence regarding the efficacy of VCT is obtained from studies specifically set up to determine its impact and little is known about the efficacy of VCT outside trials of its impact, with the exception of the Rakai and Manicaland cohorts.

A population is highly heterogeneous with respect to risk behaviour as well as willingness, intention and volition to change behaviour [226]. Sexual behaviour changes over time regardless of receiving counselling and testing, as patterns of sexual behaviour and behaviour change can be influenced by many factors, which include relationship status, motivation for change, risk perception, attitudes towards risk behaviour and factors at a partnership level such as fertility intentions, communication and sexual decision making [227, 228]. Furthermore, although there is much attention on the potential for knowing one's HIV status and receiving counselling to encourage risk reduction, not everyone who goes for HIV counselling and testing will be at risk of infection or will be engaging in "risky" behaviour. All of these studies rely on self-reported behavioural data which may be subject to social desirability bias. In VCT evaluation studies, such bias may be greater among individuals testing positive, as they may feel under pressure to report less risk subsequent to intensive risk reduction counselling.

Approaches to counselling are often poorly described. The provision (for example individual, couple or group) and quality of counselling undoubtedly varies widely. Such variation is likely to influence the efficacy of counselling. Variations in the content, quality and number of sessions of counselling make comparing studies difficult. For example a counselling session in a busy STI clinic may be brief and didactic, whereas, the counselling described in the studies among sero-discordant couples would have been

more in-depth and repeated regularly. Furthermore, prior to HIV, formal counselling services were rare and hence, unfamiliar to many people in sub-Saharan Africa [58].

De Zoysa *et. al.* note that although the HIV/AIDS behavioural literature is voluminous, rigorous evaluations of behavioural interventions are limited [185]. Although this observation was referring to research up to 1995, to some extent this still applies to the literature regarding HIV counselling and testing. An important methodological limitation with some previous analyses is comparing cross-sectional behavioural data for those who have received VCT to those who have not, or comparing cross-sectional data from first time attendees to repeat clients [214, 229], and concluding that any differences are due to having received VCT, without measuring how behaviour has changed over time. Such comparisons evaluate differences between different groups but do not evaluate if risk has increased, decreased or remained the same over time. To correctly establish a change in behaviour which can be associated with receiving VCT, pre-test data must be compared to post-test data, at the individual level.

Many longitudinal studies only consider behaviour among those who have received counselling and testing. Thus, trends in behaviour among those who didn't test cannot be compared to trends among those who did. If there are secular declines in risk behaviour, such as those observed in Uganda and Zimbabwe [106, 230], these will be ignored, potentially overstating the impact of VCT on sexual behaviour. In a critique of VCT evaluation studies, Glick argues that changes in behaviour may reflect general changes over time rather than the intervention (counselling and testing), especially when awareness and knowledge of the epidemic is increasing [231]. Prospective cohort studies and RCTs in which behaviour is recorded prior to receiving VCT and at some interval following VCT among participants followed over time are ideal, because comparisons can be made between those who received VCT and those who didn't as well as before and after VCT for those who did test.

Many of the analyses regarding the impact of counselling and testing on sexual behaviour are descriptive in nature and present the results as dichotomous proportions. Also, many

comparisons do not capture the magnitude of behaviour change. There may be large increases in risk among some individuals which are masked by slight reductions in risk among a greater number of people. For example, Ladner *et al.* report that before counselling and testing, 14% of women reported using condoms at least once, whereas 4 months after testing, 8.8% of positive women and 3.9% of negative women reported using condoms, among a sample of pregnant women in Kigali, Rwanda [232]. While this gives the impression that condom use may have increased, it is not clear what the actual change is, as different measures relating to different time periods are being compared for different groups. However, assessing behavioural change was not the objective of this study.

Further study weaknesses include short follow-up times, low participation rates and high rates of loss to follow-up. Denison *et al.* assess the quality of the studies included in their meta-analysis using an eight point score [69]. This score was additive, with one point given for each of eight study quality criteria. Of the seven studies included the average score was low, at 2.4/8, excluding the RCT by the VCT Efficacy study group, which scored 6/8. The Rakai cohort in Uganda was the only cohort to fulfil the criteria of comparison of groups equivalent at baseline on the outcome measure. Lack of rigorous behavioural research, in these studies up to 2005, is cited as the one of the main limitations of this literature.

While this review has focused on the impact of VCT on sexual behaviour, the subsequent impact, if any, on incidence is of importance for both prevention and treatment of HIV. To establish if counselling and testing is an effective prevention measure, rather than just a gateway for treatment provision, the impact on incidence must be measured. Moreover, for treatment programmes to be sustainable, reductions in incidence are required [233, 234].

A recent cluster-randomized trial of workplace VCT, of predominantly male participants, in urban Zimbabwe, found no reduction in HIV incidence after a two year intervention [235]. In addition, findings from two rural population-based cohorts (namely Rakai in

Uganda and Manicaland in Zimbabwe) indicate no difference in HIV incidence between those who received VCT and those who did not [125, 134]. However, the epidemiological context is important and an intervention, such as provision of VCT, may have a large impact on behaviour but may have little impact on HIV incidence if inappropriately targeted or implemented late in the epidemic [224, 236]. Notably, early work by Allen *et. al.*, among a sample of 1458 women in Kigali, Rwanda, found a much greater reduction in incidence among those women whose partners received counselling and testing (from 4.1 to 1.8 per 100 person-years; $P<0.04$), than among women whose partners had not received counselling and testing (from 4.1 to 3.4 per 100 person years, $P=0.06$) [207]. Thus, future work should investigate if couple counselling is an effective means of reducing incidence.

Insights regarding how the impact of VCT on behaviour at an individual level subsequently impacts the spread of HIV at a population level have been gained from mathematical modelling. Hallett *et. al.* show that the impact of counselling and testing services, in terms of infections averted, depends on the magnitude, type and duration of behaviour change [237]. In particular, the maintenance of behaviour change was found to be of key importance for the prevention potential of counselling and testing services. For example, a 20-30% increase in condom use that is maintained permanently was found to be equivalent to a three-fold increase in condom use which is maintained only for a period of 1 year [237].

Many of the studies included in this review are limited by short follow-up periods (1 to 2 years) and so the impact of counselling and testing on sexual behaviour over the long term is not well understood. The question of duration of behaviour change is addressed in Chapter 6, where three rounds of data from the Manicaland cohort in Zimbabwe are analysed to determine the impact of testing on subsequent sexual behaviour.

**Chapter 4: Patterns of uptake of HIV testing in Sub-Saharan
Africa: 2003-2005. A cross-country comparison of
Demographic and Health Survey data.**

4.1 Aims and organisation of chapter

The aim of this chapter is to compare nationally representative trends in self-reported uptake of HIV testing and receipt of results in selected countries and to characterise the profile of individuals who report to have tested for HIV with respect to socio-demographic characteristics and behavioural risk as well as expression of stigma and experience of AIDS. The survey methodology and data analysis are described in Section 4.3. Next, an overview of levels of uptake of HIV testing is given, followed by the results of univariate and multivariate analyses of characteristics associated with having tested for HIV. Finally, the main findings are discussed in Section 4.5.

4.2 Background

Prior to provider-initiated opt-out testing, individuals going for HIV testing were generally a small self-selecting group of the wider population who chose to access testing services. It is important to monitor trends in testing uptake for a number of reasons. Firstly, it is useful to look at the patterns of uptake of testing with respect to socio-demographic characteristics, as this has implications for equitable access to treatment [62, 126]. Secondly, in terms of prevention, analysing testing patterns with respect to behavioural indicators can help identify if those individuals most at risk of acquiring or transmitting infection are seeking testing. Finally, understanding the factors affecting the use of testing services is essential for the success of testing programmes in achieving high levels of coverage. The profile of those coming forward for testing has not previously been described at a nationally representative level in an African context. However, Gage and Ali analysed Ugandan DHS survey data to determine the factors associated with having tested among married men [238].

4.3 Methods

4.3.1 Survey methodology

DHS programme has been conducting household surveys since 1984 in developing countries. A wide range of demographic and reproductive health data are collected [239]. The samples are representative at the national level, at the residence level (urban or rural)

and at the regional level [240]. Given the focus of the survey on fertility, women of reproductive age (15-49 years) were the initial participants of DHS surveys, but men aged 15-59 years are also now included. Since 2001, survey questionnaires have included sections on HIV testing. Standard questionnaires are used, as far as possible, to allow cross-country comparisons to be made. Separate questionnaires are used for women and men.

A two-stage cluster design is used to obtain the samples [240]. Firstly, random sample clusters, called enumeration areas, are selected from a national sampling frame, usually the country's population census. Secondly, a complete list of households is compiled for each of these clusters, and households are chosen at random for participation in the survey. A household questionnaire is used to identify women and men eligible for the individual interview. All women aged 15-49 years and men aged 15-59 years who were either permanent residents or visitors present the on the night before the survey in selected households are eligible to be interviewed. However, in some surveys a sub-sample of households is chosen (e.g. every second household), from which men are selected to participate. An individual is considered absent after three call-back visits. Surveys are usually conducted over a period of 18-20 months (from survey design to dissemination of the final report), and fieldwork usually takes four to five months to complete.

Consenting participants provide blood for anonymous HIV testing, subsequent to the interview. Testing is carried out using dried blood spot samples of capillary blood from a finger prick collected on filter paper. A standard testing algorithm which uses two different HIV antibody ELISAs, based on different antigens is used.

All participants receive referrals for free counselling, testing, and educational materials, whether or not they consent to anonymous testing. In some countries, mobile counselling and testing provided by the DHS programme, is made available after the interview, when the anonymous test has been completed.

4.3.2 Data analysis

Surveys from sub-Saharan Africa countries with data available on HIV status, and HIV testing and results collection for men and women were included in the analysis. Ten surveys met these criteria.

To assess levels of uptake of HIV testing, participants were asked “I don’t want to know the results, but have you ever been tested to see if you have the AIDS virus?”. The question was asked in this way for each of the surveys included, with the exception of the Zimbabwean survey, in which “Have you ever been tested to see if you have been infected with HIV? was used. Responses to this question and data on receipt of test results were used to define an outcome variable for having tested and received the result (i.e. knowing one’s HIV status). Thus, the self-reported HIV testing data analysed here refer to a wide range of HIV testing services (e.g. from free-standing VCT centres, from hospital- and clinic-based services, and through PMTCT programmes), but not to the anonymous testing carried out through the DHS programme.

In the construction of the socio-demographic variables, a wealth index was used to capture poverty level. This index is constructed by means of a principal component analysis using any indicator variable that reflects economic status (e.g. type of toilet and type of flooring) [241]. Quintiles are calculated based on the distribution of the household population.

Univariate logistic regression models were fitted to analyse socio-demographic and behavioural characteristics, as well as expression of stigma and experience of AIDS, associated with the uptake of testing and collection of results. Following this, a full model containing all variables identified *a priori* as characteristics of interest, with the aid of the theoretical framework presented in Chapter 2, was fitted, to identify those characteristics which were independently associated with having received HIV counselling and testing. Multivariate results are presented in detail for four selected countries: Zimbabwe, Lesotho, Rwanda and Senegal. These four countries were chosen to compare uptake of

testing in different contexts with respect to HIV prevalence and uptake of HIV testing. Multivariate results for the remaining six countries are presented in Appendix A.

All analyses were carried out separately for males and females and restricted to the non-virgin population, as those who have never had sex have had no sexual exposure to HIV and, thus, are likely to have little impetus for seeking HIV counselling and testing. All analyses were carried out using sample weights provided by the DHS [242]. Analyses were carried out using STATA version 10 (STATA Corp., College Station, Texas, USA).

4.4 Results

4.4.1 Data overview and response rates

Table 4.1 shows the household and individual response rates for the ten completed surveys, and the response rates for HIV testing.

Country	Year	Household response rate (%)	Individual response rate (%)	N interviewed	N eligible for HIV testing	HIV response rate (%)
Zimbabwe	2005-06	95.0				
Male			81.9	7175	8761	63.4
Female			90.2	8907	9870	75.9
Senegal	2005	98.5				
Male			86.0	3761	4375	75.5
Female			93.7	14602	5350	84.5
Rwanda	2005	99.7				
Male			97.2	4820	4959	95.6
Female			98.1	11321	5837	97.3
Guinea	2005	99.2				
Male			94.5	3174	3360	88.2
Female			97.2	7954	4189	92.5
Cote D'Ivoire	2005	95.5				
Male			87.5	4503	5148	76.3
Female			89.8	5183	5772	79.1
Malawi	2004	97.8				
Male			85.9	3261	3797	63.3
Female			95.7	11698	4071	70.4
Lesotho	2004	95.2				
Male			84.6	2797	3305	68.0
Female			94.3	7095	3758	80.7
Cameroon	2004	97.6				
Male			93.0	5280	5676	89.8
Female			94.3	10656	5703	92.1
Kenya	2003	96.3				
Male			85.5	3578	4183	70.3
Female			94.0	8195	4303	76.3
Ghana	2003	98.7				
Male			93.8	5015	5345	80.0
Female			95.7	5691	5949	89.3

Table 4.1 Response rates, participation and HIV testing in selected DHS surveys.

Footnote: All data are unweighted, and are compiled from DHS country-specific data and final reports. In Rwanda, Guinea, Cameroon and Kenya all men in 50% of households were sampled. In Senegal and Malawi all men in 25% of households were sampled.

Overall, household response rates are high and range from 95.0% to 99.7%. The individual response rate in each survey is higher among women than among men, and ranges from 81.9% among men in Zimbabwe to 98.1% among women in Rwanda. The largest gender differential in participation is observed in Malawi. HIV testing response rates were lower than participation rates and ranged from 63.3% among men in Malawi to

97.3% among women in Rwanda. In each survey the HIV testing response rate was lower for men than for women.

4.4.2 Testing and counselling service provision

The level of provision of HIV testing services in 2007 and 2008 are shown in table 4.2.

	Number of facilities with HIV testing and counselling			Population ≥ 15 years per testing and counselling facility		
	2007	2008	% increase	2007	2008	% decrease
Zimbabwe	791	1560	97.22	8000	4000	50.00
Senegal	190	281	47.89	31000	21000	32.26
Rwanda	312	341	9.29	15000	14000	6.67
Guinea	-	-	-	-	-	-
Côte D'Ivoire	124	457	268.55	79000	21000	73.42
Malawi	504	677	34.33	13000	10000	23.08
Lesotho	163	204	25.15	6000	5000	16.67
Cameroon	1107	1860	68.02	8000	5000	37.50
Kenya	-	-	-	-	-	-
Ghana	422	524	24.17	28000	22000	21.43

Table 4.2 Number of health facilities with HIV testing and counselling services and number of adult population per testing and counselling facility, by country, 2007 and 2008. Adapted from: Towards Universal Access. Scaling up priority HIV/AIDS interventions in the health sector. Progress report 2009 [17]. Data for Guinea and Kenya were not available.

Unsurprisingly, given different population sizes and health service infrastructure, the number of testing and counselling facilities varied widely by country. However, adult population size per facility also varied widely, from 22,000 in Ghana to 4,000 in Zimbabwe, in 2008. The number of facilities offering testing services increased from 2007 to 2008 in each country, particularly in Côte D'Ivoire where a dramatic scale-up in number of facilities was observed.

4.4.3 Overview of levels of uptake of HIV testing

Levels of reported uptake of HIV testing and collection of results varied widely between countries (Figure 4.1). Uptake was highest among women in Rwanda, at 27.4% in 2005.

The lowest levels of testing were observed in West African countries, Senegal and Guinea in particular. However, not all West African countries had low uptake; for example, Cameroon had the third highest percentage of total persons tested. Overall, reported receipt of results was at a high level and ranged from 75% to 96%. Gender differentials in uptake were observed in many countries; for example, in Zimbabwe, Rwanda, Côte D'Ivoire, Lesotho and Cameroon, women were more likely to have tested and received their results; whereas, in Guinea, uptake of testing and results collection was much higher among men.

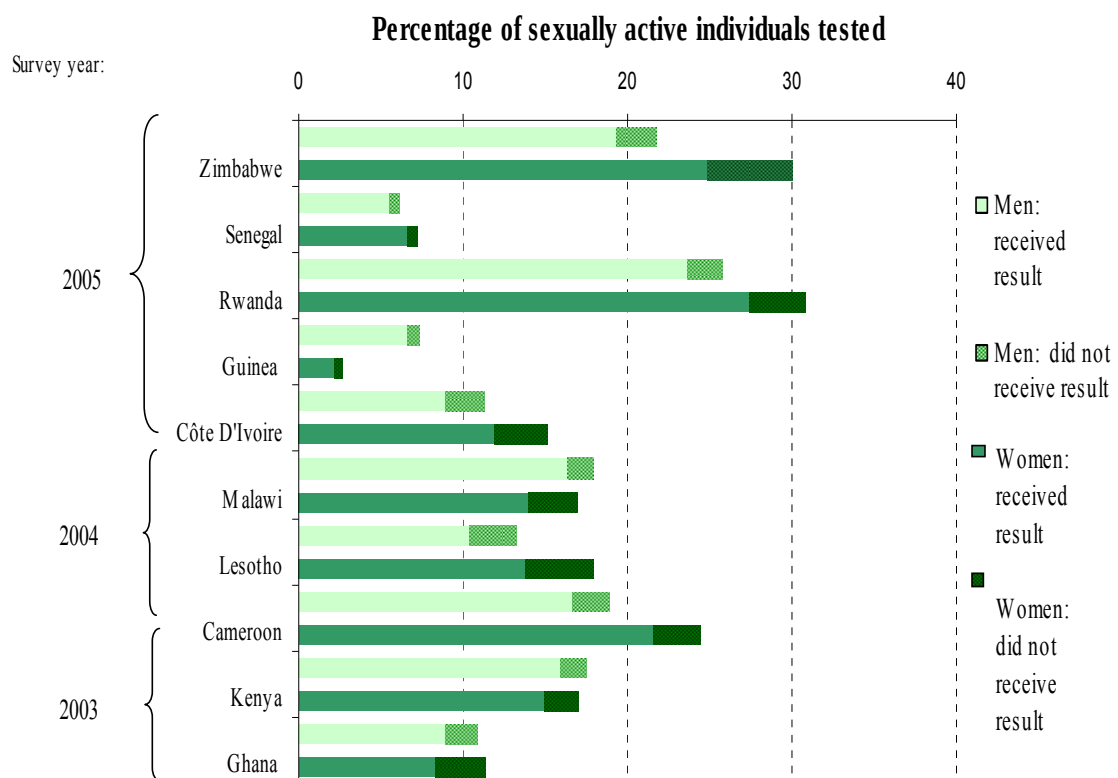


Figure 4.1 Uptake of testing and results collection among men and women in selected countries.

A clear relationship between uptake of testing and HIV prevalence was not observed (Figure 4.2). For example, in 2005, HIV prevalence among women in Guinea was 1.9% and uptake of testing was low at 2.18%, whereas in Rwanda, although HIV prevalence among women was 3.6%, uptake of HIV testing was relatively high at 27.40%. This is in contrast to Zimbabwe, where HIV prevalence among women was 21.2% and uptake of HIV testing was 24.86%. The correlation coefficients for women and men were 0.36 and 0.25, respectively, indicating a very weak positive correlation.

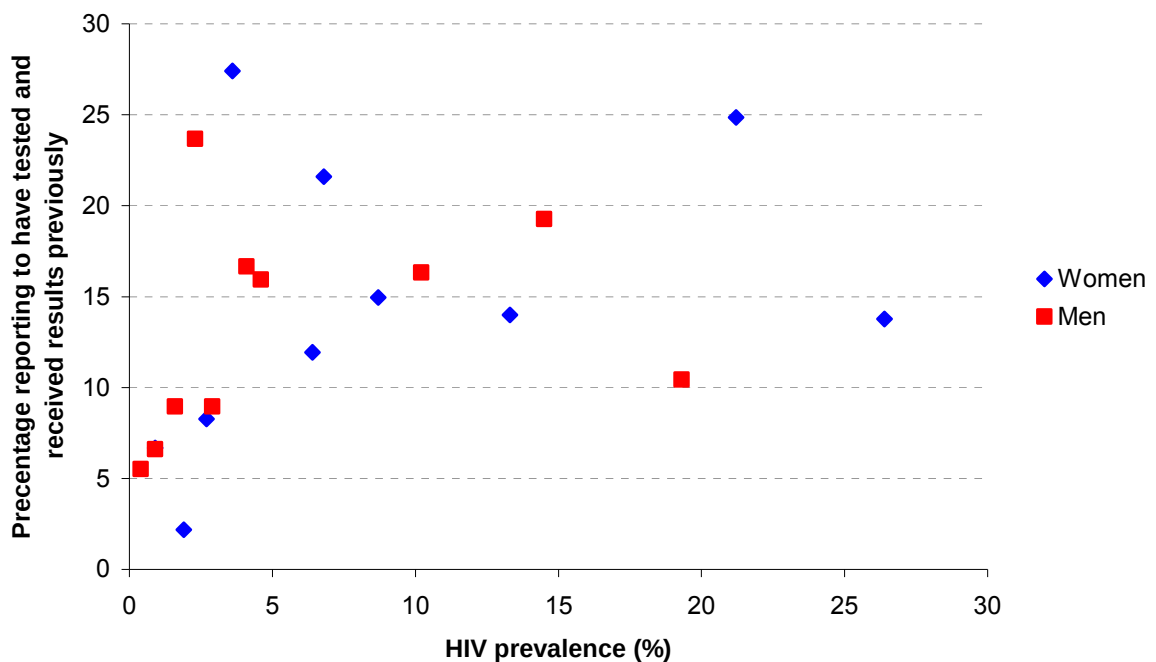


Figure 4.2 Uptake of HIV testing with respect to HIV prevalence among women and men (aged 15-49 years) in selected countries. Each point on this scatter plot represents a national level estimate from the same DHS survey.

4.4.4 Time since testing

Trends in the reported length of time since testing among women were reasonably similar for most countries (figure 4.3). Overall, approximately half of women within each survey who had tested reported to have done so within the last year, with the exception of three west African countries: Ghana, Côte D'Ivoire and Senegal. In all surveys, the majority of

women reported to have tested within the last two years (i.e. <12 months ago or 12-23 months ago), reflecting the recent scale-up of testing services in these countries. However, a considerable proportion reported to have tested two or more years ago, ranging from 21.5% in Lesotho to 45.8% in Ghana.

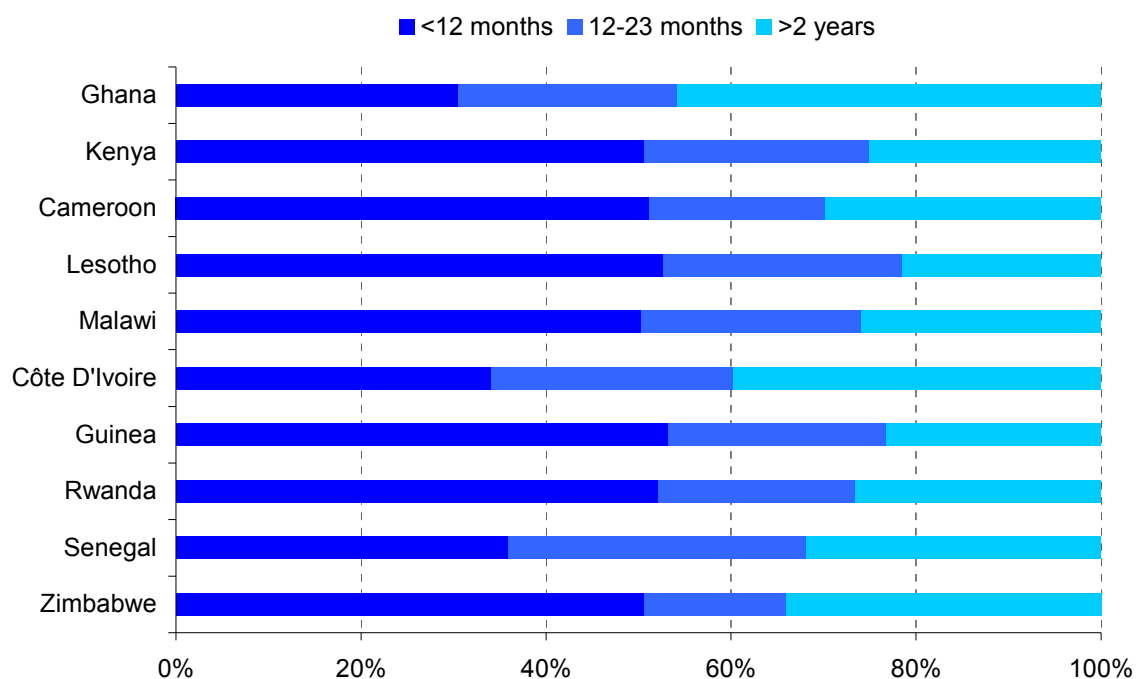


Figure 4.3 Reported length of time since testing among women reporting VCT uptake in selected countries.

Overall, trends in reported time since testing among men were similar to those among women (Figure 4.4). Within each country trends were also similar for men and women. As for women, approximately half of men within each survey who had tested reported to have done so within the last year, again with the exception of Ghana, Côte D'Ivoire and Senegal, as well as Zimbabwe. The proportion of men reporting to have tested two or more years ago ranged from 25.6% in Rwanda to 47.6% in Côte D'Ivoire.

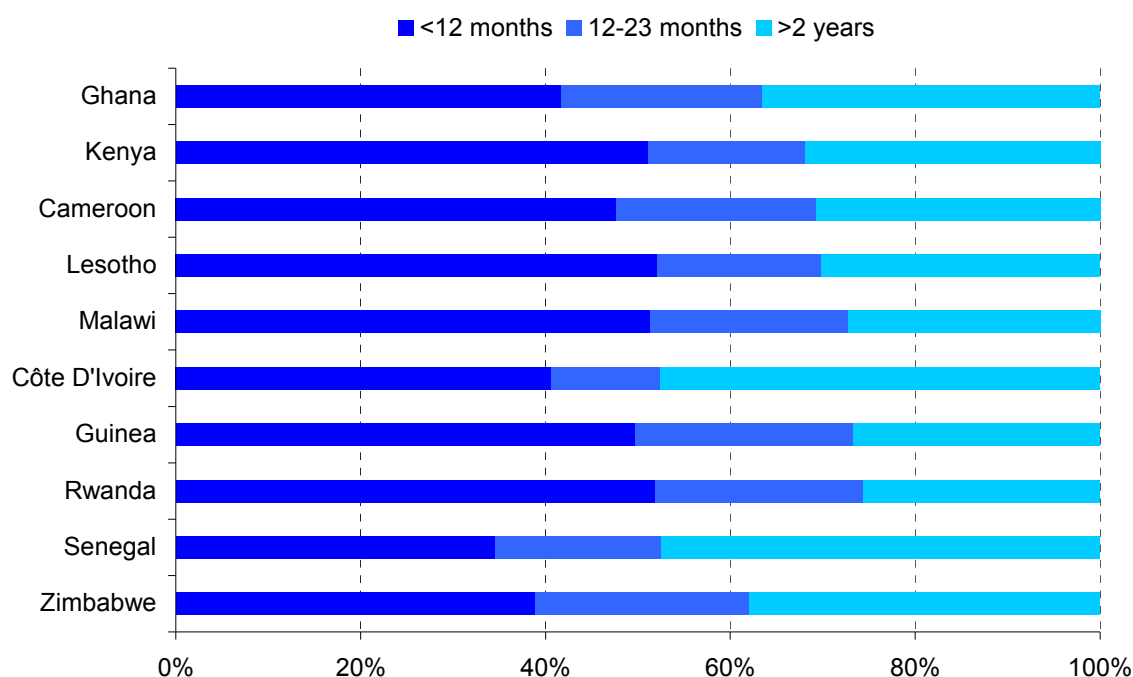


Figure 4.4 Reported length of time since testing among men reporting VCT uptake in selected countries.

In addition, within each survey, the majority of participants who reported not to have tested responded that they would like to be tested, indicating a considerable demand for HIV testing services.

4.4.5 Univariate analysis of characteristics associated with having tested for HIV

Overall, HIV positive individuals are more likely to have tested and received their results than uninfected individuals, with the exception of women in Senegal and men in Guinea (Figure 4.5). However, this association is only statistically significant among men and women in Rwanda, Lesotho and Cameroon, men in Senegal, Côte D'Ivoire and Kenya, and women in Guinea. In countries with relatively low levels of HIV prevalence and low levels of testing, such as those in west Africa, (i.e., Senegal, Guinea and Côte D'Ivoire), there is considerable uncertainty around these odds ratios.

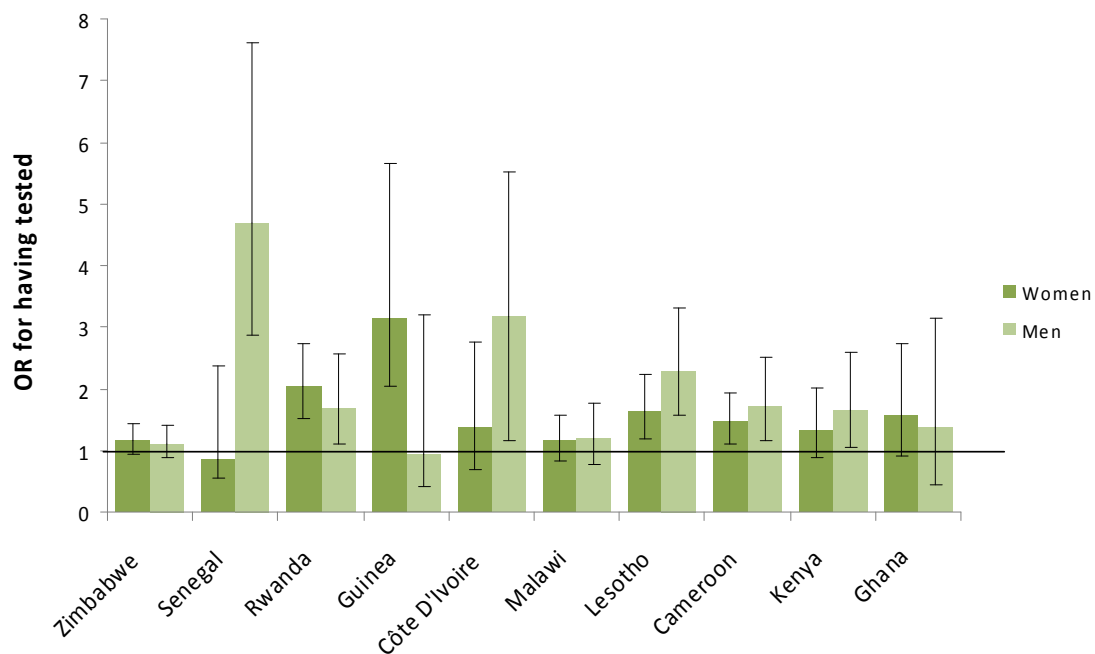


Figure 4.5 Odds ratios for having tested with respect to HIV status, for men and women. HIV uninfected individuals are used as the reference category.

Among women, age was significantly negatively associated with uptake of testing in all surveys, except in Senegal, where uptake was lowest amongst 15 to 24 year olds (Figure 4.6).

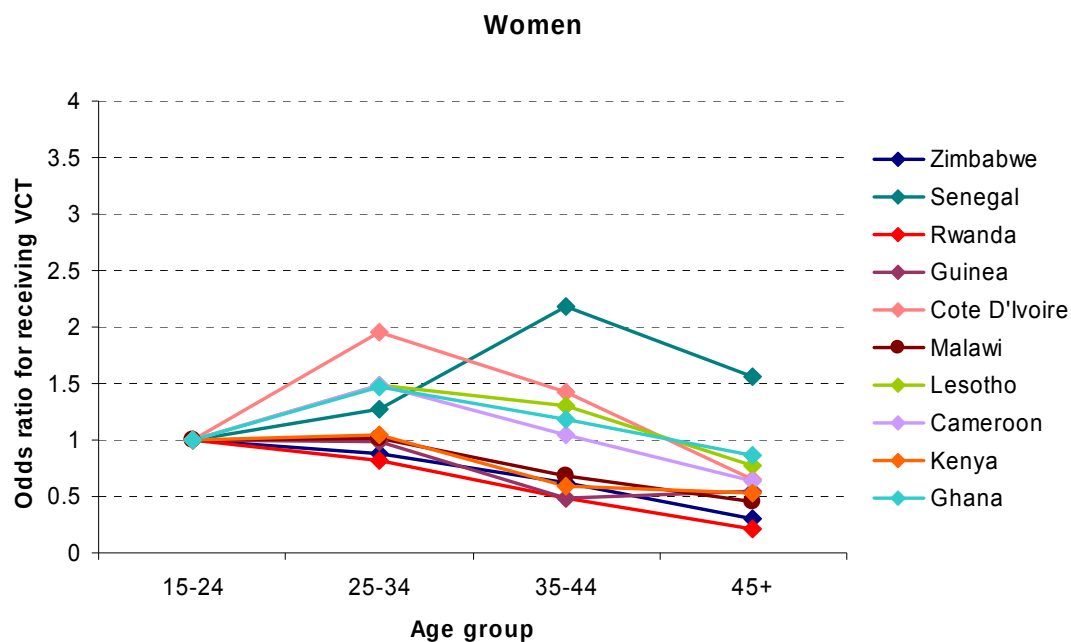


Figure 4.6 Odds ratios for having tested and received results by ten year age group, among women.

Among men, age was also significantly associated with uptake of testing, except in Guinea. The general trend was an increase in uptake from 15-24 up to 25-34, a subsequent plateau or slight decrease, followed by a decline in the oldest age group (Figure 4.7). This trend was most apparent in Lesotho. In general, men seeking testing were older than women seeking testing, across these ten countries.

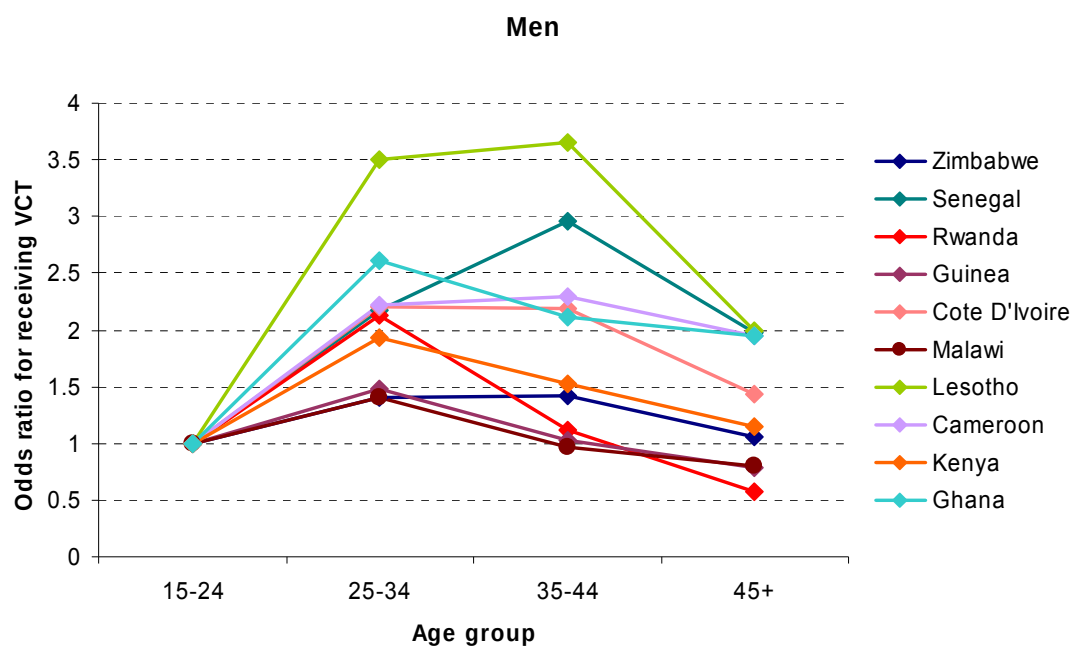


Figure 4.7 Odds ratios for having tested and received results by ten year age group, among men.

The majority of participants lived in rural areas, where uptake was significantly lower relative to those living in urban areas, in all surveys. Among women, the odds ratios for uptake by residence (urban vs. rural) ranged from 1.7 in Lesotho to 7.9 in Guinea (Figure 4.8). Similar trends were observed among men, where uptake in urban areas was between 1.9 and 4.3 times greater than in rural areas, in all countries. The greatest differential with respect to urban or rural residence was observed in Guinea, among both men and women. Uptake was greatest in urban Rwanda at 58.6% and 41.9% among women and men, respectively. In addition to large differentials with regard to place of residence, strong regional differences within countries were also observed (i.e. much heterogeneity within rural areas). For example, large differentials in uptake between rural areas were observed in Kenya with 0.57% of respondents in the North Eastern region reporting to have tested and received their results as compared to 12.45% of those in the Rift Valley region.

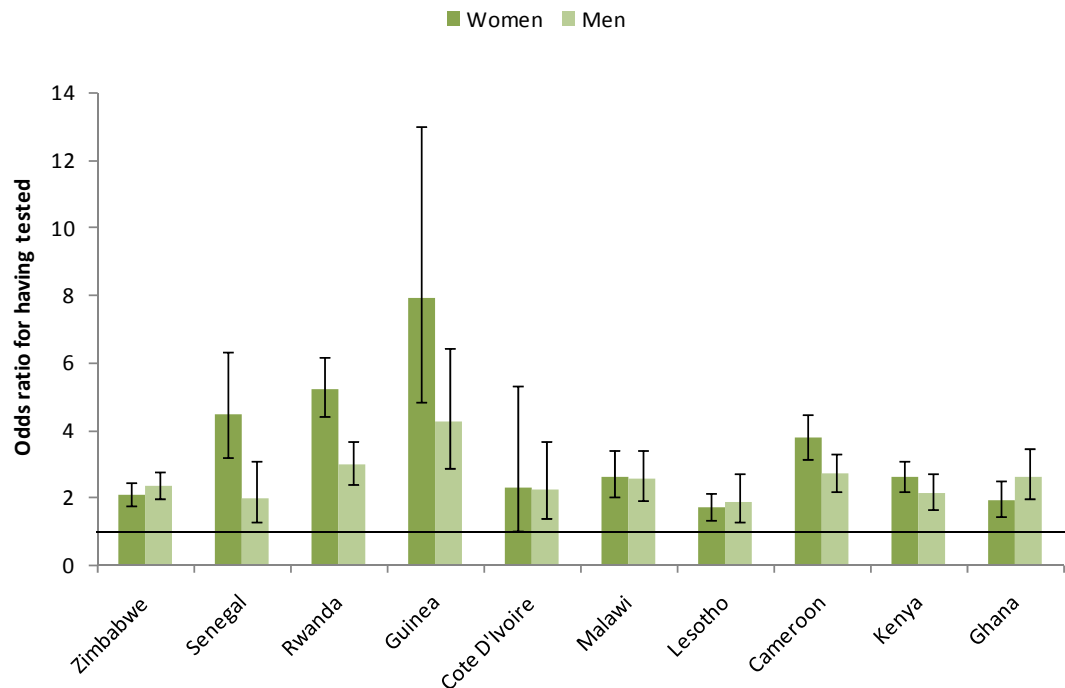


Figure 4.8 Odds ratios for having tested and received results by place of residence, for women and men. Rural is used as the reference category.

Among women, a strong significant positive association between wealth quintile and uptake of testing was observed (Figure 4.9). Those women in the richest quintile were more likely to have tested than those in the poorest quintile (OR range 2.8 – 33.7). However, these differentials were largest in the West African countries which had relatively low testing uptake compared to other sub-Saharan African countries.

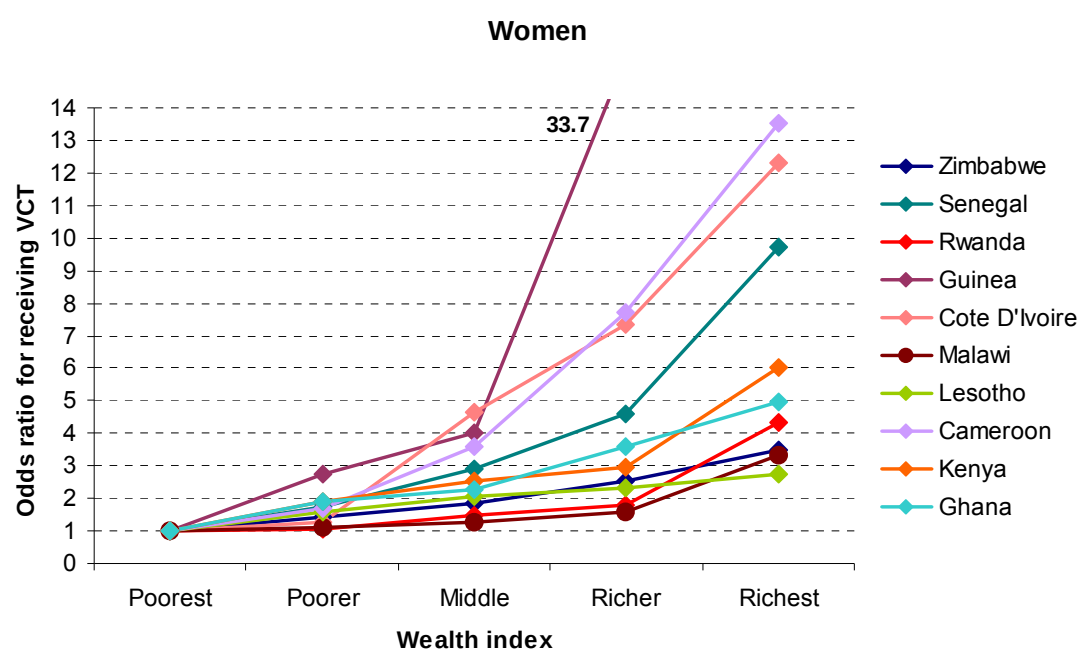


Figure 4.9 Odds ratios for having tested and received results by wealth quintile, for women

A similar trend was observed for men with respect to wealth index. Although statistically significant, the differentials in uptake were not as great as those for women. Uptake was between 3 and 7 times greater among those in the richest quintile as compared to the poorest (Figure 4.10).



Figure 4.10 Odds ratios for having tested and received results by wealth quintile, for men

Across all countries large differentials in uptake with respect to level of education were observed among both men and women, with uptake being greatest among those with higher level education. Overall, with respect to socio-demographic characteristics, the trends observed were remarkably similar across all countries analysed, for both men and women.

Reported uptake of testing and results collection was varied with respect to various indicators of sexual behaviour. However, it was not possible to establish the temporal relationship between the reported behaviour and receiving an HIV test. Those who reported that they did not know someone who has AIDS, or someone who has died of AIDS, were much less likely to report having tested. This trend was consistent across all countries. Uptake of testing and results collection was significantly lower among those expressing stigmatising attitudes towards HIV. This was true across all countries for both men and women.

4.4.6 Multivariate analysis of characteristics associated with having tested for HIV

Table 4.3 shows the adjusted odds ratios for the determinants of uptake of testing and results collection, for women and men in four selected countries. Although univariate analyses found a positive HIV status to be significantly associated with having tested among men and women in Lesotho and Rwanda (Figure 4.5), adjusted analyses showed that being infected was only independently associated with having tested among men and women in Lesotho.

Univariate analyses also indicated age to be a significant determinant of uptake of testing among men and women in each of these four countries. However, this association was no longer significant in multivariate analyses, among women in Lesotho and Senegal and men in Zimbabwe. In general, trends in uptake with respect to age differed for men and women, with uptake being greatest among younger women, but lowest among younger men, except for men in Rwanda. However, divergent trends were observed among men, as the OR for uptake among the oldest age group (45 years and older) as compared to the youngest (15-24 years) ranged from 0.20 for men in Rwanda to 19.53 for men in Senegal.

Increased odds of testing and results collection were consistently observed with increasing level of education for both men and women, in all four countries. Although reporting a third level of education was infrequent, it was strongly associated with increased HIV testing and results collection (OR range: 1.49 – 50.62). Living in an urban area was also associated with increased uptake in all four populations, but only remained significant in adjusted analyses for Rwanda. Similarly, an increasing level of wealth was strongly associated with increased uptake, but this association only remained a significant determinant of uptake in adjusted analyses among men and women in Zimbabwe and in Rwanda.

Generally, there was mixed evidence with respect to marital status and behavioural indicators and testing uptake. There was no evidence to suggest that infrequently reported, but high-risk behaviours, such as paying for sex among men, were

independently associated with uptake of testing. Reporting to have had an STI in the last year was generally associated, but not significantly, with increased uptake.

An awareness of the existence of treatment was independently associated with increased uptake among men and women in all four countries, with the exception of men in Senegal. Those who agreed with stigmatising attitudes, such as people with AIDS should be ashamed, were less likely to have tested, with the exception of women in Zimbabwe. However, this association only remained significant among women in Rwanda. Knowing someone who has, or has died from, AIDS was associated with increased uptake among men and women in all four countries, with the exception of men in Lesotho.

Overall, univariate analyses showed remarkably similar trends across countries and many of these associations persisted at the multivariate level. However, the determinants of uptake independently associated with testing and results collection differed greatly across countries. Level of education and awareness that treatment for HIV exists were consistently independently associated with HIV testing across countries, for both men and women.

Determinants		Zimbabwe		Lesotho	
		Women	Men	Women	Men
		AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
HIV status:	positive vs negative	1.10 (0.86 - 1.40)	1.10 (0.83 - 1.47)	1.50 (1.06 - 2.12)	1.85 (1.19 - 2.87)
Demographic characteristics:					
Age group:	15-24	1	1	1	1
	25-34	0.72 (0.59 - 0.87)	1.52 (1.00 - 2.30) [‡]	1.11 (0.71 - 1.71)	4.27 (1.94 - 9.39)
	35-44	0.52 (0.39 - 0.69)	1.37 (0.83 - 2.26)	0.95 (0.60 - 1.49)	4.27 (1.72 - 10.60)
	45+	0.30 (0.18 - 0.50)	1.42 (0.81 - 2.49)	0.82 (0.43 - 1.57)	3.52 (1.33 - 9.30)
Education:	none	0.88 (0.45 - 1.70)	1.63 (0.37 - 7.07)	0.47 (0.14 - 1.57)	0.66 (0.36 - 1.21)
	primary	1	1	1	1
	secondary	1.61 (1.28 - 2.04)	1.76 (1.24 - 2.50)	0.99 (0.70 - 1.41)	1.80 (1.10 - 2.95)
	higher	4.13 (2.37 - 7.21)	3.16 (1.82 - 5.50)	1.49 (0.50 - 4.38)	2.50 (0.62 - 10.12)
Marital status:	married	1	1	1	1
	never married	0.70 (0.36 - 1.36)	0.73 (0.38 - 1.41)	0.84 (0.44 - 1.61)	0.91 (0.42 - 2.01)
	previously married	0.96 (0.51 - 1.80)	0.22 (0.07 - 0.65)	1.20 (0.64 - 2.27)	1.58 (0.42 - 5.91)
Residence:	urban vs rural	1.19 (0.75 - 1.87)	1.14 (0.75 - 1.73)	1.48 (0.99 - 2.20) [‡]	1.22 (0.70 - 2.14)
Poverty:	richest quintile vs poorest	2.24 (1.29 - 3.90)	2.63 (1.35 - 5.13)	1.41 (0.75 - 2.65)	1.11 (0.47 - 2.63)
Sexual health & behaviour:					
Condom use at last intercourse ^a :	yes vs no	0.86 (0.59 - 1.26)	1.60 (1.14 - 2.25)	1.37 (0.90 - 2.08)	1.81 (1.18 - 2.78)
Extra-marital partners in last year:	yes vs no	1.00 (0.60 - 1.66)	1.16 (0.70 - 1.92)	0.80 (0.48 - 1.33)	0.54 (0.32 - 0.90)
Lifetime partners:					
	Women				
	1	1	1	—	1
	2	0.94 (0.73 - 1.22)	0.71 (0.47 - 1.05)	—	1.23 (0.51 - 2.99)
	>2	0.96 (0.71 - 1.30)	0.64 (0.41 - 0.99)	—	1.51 (0.64 - 3.54)
	Men				
	1	1	1		0.78 (0.30 - 2.05)
	2		0.48 (0.28 - 0.81)		1.28 (0.61 - 2.70)
	>4		0.81 (0.55 - 1.17)		
Ever paid for sex (men only):	yes vs no	—	1.02 (0.48 - 2.14)	—	—
Had an STD in last year:	yes vs no	1.20 (0.77 - 1.87)	1.33 (0.64 - 2.77)	0.97 (0.44 - 2.16)	1.85 (0.65 - 5.28)
Treatment awareness:	yes vs no/unsure	1.84 (1.48 - 2.29)	1.22 (0.92 - 1.62)	1.64 (1.15 - 2.34)	1.64 (1.07 - 2.50)
Expression of stigma & experience of AIDS:					
People with AIDS should be ashamed:					
	agree vs disagree/don't know	1.13 (0.91 - 1.41)	0.96 (0.72 - 1.29)	—	—
AIDS bereavement:	yes vs no	1.08 (0.87 - 1.34)	1.32 (1.05 - 1.65)	2.15 (1.59 - 2.91)	0.95 (0.57 - 1.58)

Determinants	Rwanda		Senegal	
	Women	Men	Women	Men
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
HIV status: positive vs negative	1.18 (0.71 - 1.94)	0.99 (0.54 - 1.82)	0.46 (0.03 - 8.26)	1.45 (0.18 - 11.66)
Demographic characteristics:				
Age group: 15-24	1	1	1	1
25-34	0.61 (0.47 - 0.80)	0.83 (0.56 - 1.23)	0.74 (0.28 - 1.95)	17.91 (1.88 - 170.81)
35-44	0.33 (0.24 - 0.44)	0.35 (0.23 - 0.54)	2.33 (0.95 - 5.69)	22.76 (1.80 - 287.35)
45+	0.13 (0.07 - 0.23)	0.20 (0.13 - 0.32)	1.15 (0.41 - 3.25)	19.53 (1.75 - 217.39)
Education: none	0.81 (0.62 - 1.05)	0.77 (0.56 - 1.06)	0.91 (0.37 - 2.22)	0.89 (0.21 - 3.76)
primary	1	1	1	1
secondary	1.65 (1.15 - 2.36)	1.45 (1.03 - 2.04)	2.21 (1.12 - 4.36)	4.36 (1.13 - 16.80)
higher	7.73 (0.85 - 70.45)	4.47 (1.75 - 11.43)	50.62 (14.35 - 178.60)	9.40 (2.19 - 40.34)
Marital status: married	1	1	1	1
never married	0.66 (0.31 - 1.40)	0.43 (0.20 - 0.95)	0.56 (0.05 - 5.78)	0.92 (0.10 - 8.25)
previously married	0.78 (0.30 - 2.05)	2.35 (0.72 - 7.71)	4.70 (1.95 - 11.34)	
Residence: urban vs rural	3.68 (2.68 - 5.06)	1.77 (1.28 - 2.45)	1.73 (0.71 - 4.20)	1.01 (0.35 - 2.88)
Poverty: richest quintile vs poorest	1.61 (1.09 - 2.37)	1.93 (1.29 - 2.88)	3.24 (0.90 - 11.64)	b
Sexual health & behaviour:				
Condom use at last intercourse: yes vs no	0.92 (0.51 - 1.66)	2.00 (1.05 - 3.78)	2.04 (0.85 - 4.92)	0.58 (0.07 - 4.71)
Extra-marital partners in last year: yes vs no	0.79 (0.42 - 1.49)	0.69 (0.40 - 1.19)	0.93 (0.50 - 1.72)	1.14 (0.34 - 3.91)
Lifetime partners:				
Women 1	1	1	—	—
Men 1			—	—
2	1.06 (0.81 - 1.39)	1.46 (1.08 - 1.98)	—	—
>2	0.84 (0.56 - 1.26)	1.40 (0.98 - 2.00)	—	—
3		1.99 (1.32 - 3.00)		—
4		1.74 (1.16 - 2.60)		—
>4				
Ever paid for sex (men only): yes vs no	—	1.02 (0.65 - 1.61)	—	3.25 (0.35 - 29.95)
Had an STD in last year: yes vs no	1.30 (0.54 - 3.14)	1.86 (0.74 - 4.69)	0.54 (0.12 - 2.40)	c
Treatment awareness: yes vs no/unsure	2.99 (2.06 - 4.35)	1.99 (1.23 - 3.21)	1.73 (0.98 - 3.06) [‡]	0.97 (0.30 - 3.20)
Expression of stigma & experience of AIDS:				
People with AIDS should be ashamed:				
agree vs disagree/don't know	0.75 (0.60 - 0.93)	0.90 (0.70 - 1.16)	0.60 (0.34 - 1.06)	0.59 (0.23 - 1.54)
AIDS bereavement: yes vs no	1.26 (0.93 - 1.71)	1.98 (1.25 - 3.13)	4.01 (1.84 - 8.72)	1.54 (0.57 - 4.21)

Table 4.3 Adjusted odds ratios for hypothesised determinants of uptake of HIV testing for men and women in selected countries.

Footnote: In Lesotho, data on "People with AIDS should be ashamed" were not available for neither men nor women, lifetime partners data were not available for women, and ever paid for sex was not available for men. In Senegal data on lifetime partners were not available for neither men nor women. Bold type indicates significance at the 95% level.

a Condom use refers to last partner, rather than specifically last sex, for men in Lesotho

b AOR = 2.26e+07 due to large differentials with respect to level of wealth and <2% uptake in the reference group (poorest quintile)

c Variable dropped due to small sample size in comparison group (those reporting an STD in last year)

AOR Adjusted odds ratio

‡ Borderline significance

* Indicates significant in univariate analysis ($p < 0.05$)

4.5 Discussion

These analyses provide a cross-sectional illustration of the highly varied levels of uptake of HIV counselling, testing, and results collection in ten African countries, each of which represents a very different epidemiological context in terms of HIV prevalence and access to testing services. Overall, knowledge of serostatus was limited during this period. Despite considerable variations in the percentage of individuals who had tested, from 2% to 27%, trends in reported time since testing were largely similar across countries, for men and for women, indicating that the majority of respondents who have tested have done so within the last two years. Furthermore, despite varying levels of uptake, crude analyses indicated that the socio-demographic profiles of testers (well-educated, wealthier individuals living in urban areas) were remarkably similar across countries. However, for a smaller sub-set of countries, many of these associations did not persist as significant determinants of uptake of testing in adjusted analyses. Despite large differentials in uptake with respect to level of wealth and living in an urban area versus a rural area, multivariate analyses indicate that a secondary or higher level of education and an awareness that treatment exists are the key determinants of uptake of testing, once other possible factors have been taken into account. However, the association between an awareness that treatment exists and uptake of testing may reflect the fact that individuals receive information regarding treatment during pre- and post-test counselling.

The socio-demographic and behavioural-risk profile of individuals who test for HIV has implications for HIV prevention and equitable access to treatment. In terms of prevention, these analyses showed the behavioural profile of those coming forward for testing to be mixed. It is encouraging that testing is not preferentially attracting a “worried-well” low-risk group, but, on the other hand, evidence that some high-risk behaviours, such as transactional sex, are not prompting testing may be of concern. In terms of testing as a means of identifying those in need of treatment, an over-representation of infected individuals is encouraging. However, in terms of equitable access to treatment, the emergence of those with little or no education who live in rural areas in the poorest households, and who are unaware of treatment, as an under-represented group amongst those accessing testing, may also be of concern.

The strongest independent predictor of testing among both sexes is level of education. For example, when compared to those with primary education, women in Senegal who had a third level education had 50 times the adjusted odds of having tested. Education has been found to be a key determinant of the uptake of testing in many other settings. [43, 97, 125, 126, 134, 238]. This finding indicates that there may be a need to increase the awareness of the benefits of counselling and testing in a way that is accessible to those with little or no formal education.

Increased uptake of testing among those living in urban areas, as compared to rural areas, may be due to increased availability of services in urban areas as there is likely to be an urban bias in provision of testing services (i.e. initially setting up sites in urban areas and then gradually extending to rural areas). The finding that uptake increases substantially with increasing level of wealth is surprising, given that HIV counselling and testing services are generally either inexpensive or provided for free. However, in rural areas transport costs may be a barrier to accessing testing services for some individuals. Disagreeing with stigmatising attitudes towards people with HIV was associated with increased odds of testing and results collection, but not significantly so. This provides some evidence to suggest that AIDS-related stigma may be a barrier to testing in these populations.

Due to the cross-sectional nature of the data, a caveat regarding uptake with respect to HIV status is that some individuals may have seroconverted between the time they tested and when the DHS survey, and anonymous testing, was carried out. However, the majority of individuals reported to have tested quite recently (within the last year or two years), which would reduce this misclassification. Moreover, non-response for participation in the DHS HIV testing, among men in particular, may bias these results with respect to HIV status. However, it has recently been shown that non-response did not bias HIV prevalence estimates in six selected DHS surveys, all of which are included in this analysis [243]. With respect to self-reported data regarding the uptake of testing,

one may expect social desirability bias to lead to underreporting of testing among those who have previously tested positive.

In this analysis, it was not possible to test the hypothesis that individuals, if infected, may only seek testing once they are showing symptoms of advanced HIV infection and suspect that they may be infected. However, a population-based study in Rakai, Uganda, has found evidence that counselling and testing is associated with reported illness and potential AIDS-related symptoms among women, but not men [133]. Also, it was also not possible to test the hypothesis that death of one's spouse may prompt an individual to seek testing. Although knowing someone who has, or has died from, AIDS was associated with increased uptake data on the relationship to that person was not available. However, this indicator may be capturing denial of AIDS, rather than experiencing bereavement. For example, in Lesotho, only 28% of women and 29% of men reported knowing someone with, or who had died from, AIDS, despite Lesotho having a high level of HIV prevalence.

A clear relationship between uptake of testing and HIV prevalence at a national level is not apparent. Rwanda with an HIV prevalence of less than 5% had the highest level of uptake overall, whereas Lesotho, with the highest HIV prevalence had a much lower uptake. However, provision of testing services and demand for testing also play an important role in determining the level of uptake of testing [45]. For example, in Kenya, in 2000 there were 3 facilities which provided VCT and 1,100 individuals received VCT, whereas in 2005, there were 680 sites (75% of which were in health care facilities) and 545,000 individuals received VCT [61].

The finding that an awareness of treatment is a predictor of testing is not surprising. However, none of these surveys were carried out in the context of treatment availability, although the timing of some surveys, such as that in Malawi, coincided with the initiation of ART programmes. Lack of treatment is a key impediment to uptake of testing, as in the absence of treatment, knowing that one is infected may be viewed as futile [95].

A key determinant of uptake of testing, not included in these analyses, is availability of and access to testing services. Ideally, the denominator for these analyses would be those who have access to testing services and then analyse who chooses to test. Recent data indicate much heterogeneity in the level of service provision across countries, even when using the comparative measure of number of adults per testing and counselling facility. It is not possible to directly compare the level of uptake of testing and level of service provision for each country, as available data regarding service provision refer to 2007-2008 and the availability of testing services has changed during the period from 2003-2005 to 2007-2008. Furthermore, the scale-up of testing services begun at different times and is likely to have progressed at different speeds in each country. Also, the availability of rapid testing and hence receipt of results within an hour of testing may have influenced uptake of testing. However, data regarding time from testing to receiving test results for those who tested were not available. Future analyses of testing uptake should focus on analysing the extent to which increasing availability of (i) testing services and (ii) ART, influences the profile of those who test.

Current levels of uptake of testing in these countries are certainly higher, as testing services continue to be scaled-up in the context of the shift towards provider initiated opt-out testing and increased access to treatment. Monitoring the socio-demographic and behavioural characteristics of testers will provide useful information for the evaluation of these programmes. This work provides a baseline for monitoring trends in testing and exploring changes in the profile of those who get tested as provision of services increase.

Chapter 5: Trends in self-reported sexual risk behaviour in Manicaland, Zimbabwe

5.1 Aims and organisation of chapter

The aims of this chapter are to describe trends in behaviour in the Manicaland cohort and to assess data quality of age at event reporting. This chapter begins with a brief discussion of measurement of sexual behaviour. The socio-demographic context and epidemiologic context of the study population are described. This is followed by an overview of previous analyses of behavioural data for this population. In Section 5.3 the Manicaland Cohort Study is described in terms of study design and methodology, followed by the data analysis procedure. The results are then presented in two sections. Firstly, data on age at first sex and age at marriage are analysed. The level of inconsistent reporting is quantified and its effect on observed trends is assessed. Reporting biases are identified and the temporal trends in age at first sex and age at marriage are described. The length of time spent single, between first sex and marriage is also described. Secondly, behavioural data for those who have started sex are analysed. In terms of number of sexual partners, indicators referring to different time periods are described in increasing resolution, from partners in the last year, to partners in the last month, to the number of current sexual relationships. Levels of consistent condom use with regular and non-regular partners are also analysed. Finally, a discussion of the main findings is provided in Section 5.5.

5.2 Background

5.2.1 Measuring sexual behaviour

As the HIV/AIDS epidemic in sub-Saharan Africa is primarily heterosexually driven [244, 245], behavioural risk reduction is imperative for HIV/AIDS prevention efforts, especially in the absence of a vaccine [246, 247]. However, a complete view of behaviour is needed when defining behavioural risk. For example, having many sexual partners is not necessarily risky if condoms are always used consistently. Furthermore, an individual's level of risk is often determined by their partner's level of risk and their position within the local sexual partner network [248, 249]. In a high-level generalised epidemic, an individual's risk of infection may be high, although their own behaviour is

inherently low risk. Thus, a nuanced view of sexual behaviour is necessary for analysing and interpreting behavioural data [246, 250].

Since the emergence and spread of HIV, the focus of analyses regarding timing of first sex and marriage has broadened from investigating their role as proximate determinants of fertility to encompass their associations with risk of acquiring HIV [251-253]. Identifying trends in the timing of age at first sex and marriage is essential for evaluating the impact of the investment made in HIV prevention interventions to promote abstinence (by delaying first sex) and to assess the contribution of these changes to any downturn in the epidemic [99, 254-256]. Delays in reported age at sexual debut have coincided with declines in HIV prevalence in Uganda and Zimbabwe [106, 230, 257-259]. Mathematical modelling, however, has indicated that these changes are unlikely to have contributed substantially to reductions in lifetime risk of infection or HIV incidence [260].

In general, the age at which first sex occurs lies within a narrow range, generally the later teenage years [261, 262]. Thus, changes in the median age at first sex of just a year or two are considered epidemiologically significant. However, even modest degrees of social desirability bias, recall bias, digit preference or random mis-reporting could potentially generate spurious trends. For example, social desirability would be expected to bias reports of age at first sex upwards. Slaymaker and Buckner found that declines in reporting of sex before age 15 in Zambia were partially due to a change in reporting bias, when comparing two survey methodologies and accounting for the socio-demographic composition of the survey samples [263].

The relationship between age at marriage and risk of infection has received also attention. Recently, Bongaarts argued that *late* marriage can facilitate the spread of HIV via a long period of premarital sexual activity [264]. However, it is also possible for *early* marriage to pose an increased risk of infection if marriage leads to regular unprotected sex in sero-discordant partnerships [173].

5.2.2 The Manicaland cohort study: background

Socio-demographic context

The Manicaland province in Eastern Zimbabwe is one of ten administrative provinces in Zimbabwe, is predominantly rural, and had a population of 1.5 million in the 2002 census. Recent DHS data indicate that Manicaland has similar education levels to the rest of Zimbabwe (excluding the cities of Harare and Bulawayo which have much higher levels of educational attainment), but is a relatively underdeveloped province in terms of available healthcare and economic wealth (as measured by a households material assets) [265, 266].

The Manicaland project was initially set up in 1993 to investigate the early socio-demographic impacts of the HIV epidemic [267, 268]. This first study was carried out in two sites close to the Mozambiquan border; the Honde Valley in Mutasa district and the Rusitu Valley in Chimanimani district. This study had two components: a socio-demographic and behavioural survey and HIV testing among all women attending ANC over a 15-month period (n=487) and a population-based survey among 1,237 females aged 15-49 years. The population-based sample represented 96% of eligible women identified in a sample containing 95% of all the households in these two communities. HIV prevalence among ANC attendees was 24% in the Honde Valley and 14% in the Rusitu Valley. Following adjustment for differences in age structure among the ANC attendees (younger women were overrepresented), the female population prevalence decreased from 24% to 18% in the Honde Valley and from 14% to 13% in the Rusitu Valley. This study also found increasing levels of mortality and orphanhood, as well as decreasing fertility rates. Overall, this study provided clear evidence for a well-established HIV epidemic in rural Eastern Zimbabwe.

In 1998, HIV prevalence in the Mutasa district of Manicaland was 16.0% and 22.8% among 15-54 year old men and women, respectively [269]. Given this prevalence, it was estimated (using age specific prevalence data and maximum likelihood techniques to calculate cumulative incidence), that an individual entering the sexually-active population had a two in three chance of becoming infected before reaching 55 years of age [269].

This work highlighted the imperative need for effective interventions in this context. As a follow-on from these initial findings, the Manicaland HIV and STI prevention project commenced in 1998. A detailed description of the study design and methodology follows in Section 5.3

Since 1998, the study has provided a detailed documentation of the spread of HIV and the associated demographic impact in the study population. During the first two surveys (1998-2000 and 2001 to 2003), it was estimated that HIV accounted for 61% of adult male and 70% of adult female deaths, and had reduced life expectancy to an estimated 34 years and 38 years, respectively [270]. During the third survey, the proportion of adult deaths attributable to HIV/AIDS had increased to 69% and 74% among men and women, respectively [271]. High levels of HIV associated mortality have led to an increase in prevalence and incidence of orphanhood [272]. The prevalence of orphanhood (all types: maternal, paternal and double) among children aged 0 to 14 years increased from 12.5%, to 19.4%, to 20.8% in the first, second and third surveys, respectively [273]. The HIV epidemic has contributed to a decline in fertility in this population [274]. The average total fertility rate for the study period (1998 – 2005) was 3.46 [275]. However, based on the fertility of uninfected women, the total fertility rate would have been 3.73 in the absence of HIV [275]. Overall, the HIV epidemic has more than doubled the crude death rate, reduced the crude birth rate and hence substantially reduced, although not reversed, population growth [275].

Epidemiological context

Nationally, HIV prevalence in adults (15 - 49 years) is estimated to have peaked at 29% in 1997, to have fallen to 21% by 2004, and decreased further to 16% by 2009 [276]. These trends have been reflected in the Manicaland study population, in which considerable declines in HIV prevalence and incidence have occurred (Figure 5.1).

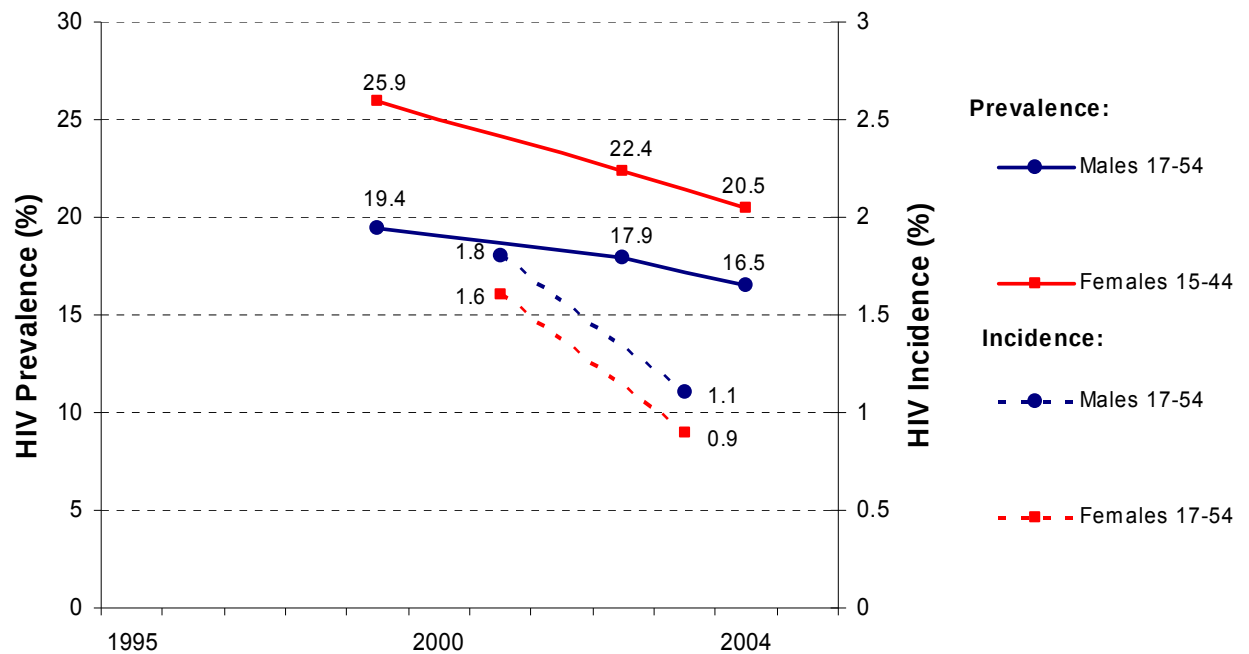


Figure 5.1 HIV prevalence and incidence in Manicaland Zimbabwe, 1998-2005. Source: Professor Simon Gregson.

HIV prevalence declined from 23.0% to 20.5% in the three year inter-survey interval between the first and second surveys [adjusted odds ratio 0.87 95% CI 0.80-0.95] [230]. This decline was greatest among younger ages. In women aged 15 to 24 years HIV prevalence fell by 49% (from 15.9% to 8.0%) [230]. In men aged 17 to 29 years HIV prevalence fell by 23% (from 10.6% to 8.1%) [230]. Gregson *et. al.* explain how such rapid reductions in prevalence are unlikely to be a consequence of the natural dynamics of the HIV epidemic alone (i.e. as a result of saturation of infection and selective AIDS-related mortality within high-risk groups) and demonstrate how these declines in prevalence are associated with reductions in sexual risk behaviour [230]. These behavioural changes are described in the following section regarding behavioural context.

In addition to HIV, the prevalence of cofactor STI's in this population has been measured. A three month survey (February – April) in two districts in 1998 found a high prevalence of Herpes Simplex Virus Type 2 (61.1%), a considerable prevalence of trichomoniasis (9.5%) and low prevalence of chlamydia (2.5%), gonorrhoea (1.8%), syphilis (rapid plasma reagin) (1.4%) and syphilis (Treponema pallidum haemagglutination) (1.2%) [277]. During the first survey, high levels of self-reported STI symptoms were observed, with 25% of men (aged 17-54 years) reporting urethral discharge and 30% of women (aged 15-44 years) reporting vaginal discharge [278]. In addition, significant gender differences in seeking treatment were observed, with 92% of men and 62% of women having sought treatment for their symptoms in the past year [278].

Behavioural context

Levels and trends in sexual risk behaviour in this study population have been well-characterised. In the first survey, patterns of partnership formation were found to be disassortative with respect to age, with young women (17 to 24 years) forming partnerships with men 5 to 10 years older than themselves and almost one quarter forming partnerships with men at least ten years older [279]. This has been associated with increased exposure to HIV infection among these women and is thus a behavioural determinant of the more rapid increase in HIV prevalence in young women as compared to young men [279].

It was also found that among young men (17 to 24 years) a greater proportion of reported sexual partnerships are casual as compared to young women (17 to 24 years) (46% vs. 9%) and more of their regular partnerships are premarital (55% vs. 5%) [279]. The first survey also found reported levels of consistent condom use to be relatively common in casual partnerships but as low as 5% within marital relationships [279]. However, this is a high contraceptive use population, with 52% of married women in the first survey reporting contraceptive use and of these, 96% reported using a modern (mostly hormonal) method [274].

In an effort to identify high-risk sub-groups and places to target prevention activities, it was found that attendance at beer halls was associated with higher levels of risk behaviour, commercial sex in particular [280]. This was reflected by increased risk of HIV infection (odds ratio 1.9, 95% CI 1.6 – 2.3), and experience of STI symptoms (genital sores or discharge) among men attending beer halls [280]. Attending beer halls is relatively common among men in the study population, with 50% of men in the first survey reported having been to a beer hall in the last month [280].

Changes in sexual behaviour have been documented in this population. Early work, in 1994, found that 44% of women reported to have taken some action to prevent acquiring HIV infection. The level of behaviour change was found to be substantial (e.g. 24% of women reported abstinence). Behaviour change was found to be facilitated by an individual's psychosocial status (i.e. knowledge, experience of HIV/AIDS and personal risk perception) but hindered by factors such as low female autonomy, marital status, economic status, male labour migration and alcohol consumption.

Large declines in reported risk behaviour were observed between the first and second surveys [230]. Statistically significant reductions in the reported numbers of new sexual partners in the previous year, sexual partners in the previous month and current sexual partners were observed among men and women. Declines in reported number of casual sex partners were also documented. This trend was most apparent among men, for whom a 49% reduction in the number who reported having casual partners was observed (25.9% versus 13.2%, $P < 0.001$) [230].

The findings summarised above are based on data from the first two surveys. Data from all three surveys are presented in the following section to illustrate trends in selected behavioural indicators.

5.3 Methods

5.3.1 Manicaland cohort study: methodology

Study population and design

The Manicaland HIV/STD Prevention Project is an ongoing longitudinal, population-based open cohort study in the Manicaland province of Eastern Zimbabwe [230, 281]. Participants are recruited from 12 predominantly rural study sites which consist of four subsistence farming areas, two forestry plantations, two coffee and tea estates, two roadside trading areas and two small towns. Each of these 12 communities includes at least one Government or Mission Health Centre. At each survey, local residents are enumerated initially in a household census of all households in each study site. Eligible individuals are then invited to participate in the study. Local community health workers are employed to help identify and locate households and eligible individuals. The baseline survey took place from July 1998 to February 2000 and was carried out in a phased manner (one site at a time). Follow-up surveys were conducted from 2001 to 2003 and from 2003 to 2005.

Initial sample-size calculations for the first survey assumed a HIV prevalence of 20%, a 30% loss to follow-up after two years and 80% power to detect a 40% reduction in HIV incidence, assuming a background incidence of 2% per year [281]. The required sample size was calculated to be 1,000 in each community, based on six pairs of communities. In practice, the sample size was revised to 800 individuals per community and the length of follow-up revised to three years, due to funding constraints and delayed implementation of interventions [281]. However, this also yielded 80% power to detect a 40% reduction in HIV incidence, assuming a proportionate increase in loss to follow-up [281].

Men aged 17 to 54 years and women aged 15 to 44 years who were present in the household for at least four nights in the past month and at the same time one year ago were eligible to participate. Three attempts are made to interview each eligible individual. Only one member of each cohabiting marital union, selected at random, was eligible to participate. At the third survey, extended entry criteria allowed men and women aged 15

to 54 years and both members of a marital union to participate. In the second survey (from site five onwards) and the third survey, in-migrants to the study areas were also invited to participate.

Written informed consent was sought from every individual invited to participate at each survey, as a condition of enrolment. Ethical approval for the study was granted by the Medical Research Council of Zimbabwe (number 02187), the Applied and Qualitative Research Ethics Committee in Oxford (N97.039) and St. Marys Local Research Ethics Committee, London (03.66 R&D 03/SB/004E).

HIV prevention interventions

A community-randomised trial of HIV prevention was conducted in the study sites between the first and second surveys [281]. This intervention included three main components: (i) syndromic management and counselling for STIs, (ii) peer education and free condom distribution targeted to commercial sex workers and their clients and (iii) information, education and communication (IEC) activities, such as AIDS-awareness meetings, at local health centres to encourage safer sexual behaviour. It was intended to also provide income-generating projects for commercial sex workers, but this was not possible due to hyper-inflation and the national economic decline.

This intervention did not reduce overall HIV incidence (intervention vs. control communities, incidence rate ratio 1.27, 95% CI 0.92 – 1.75) [281], although, males who attended programme meetings had lower HIV incidence (incidence rate ratio 0.48, 95% CI 0.24 – 0.98) [281].

At each survey, all participants were offered an information sheet about HIV/AIDS and free VCT. The provision of VCT by the study is described in detail in Chapter 6, Section 6.3.1. At the first survey, all participants were offered their results from a diagnostic test for *Trichomonas vaginalis* and free treatment for *T. vaginalis* and other STI's (syphilis, gonorrhoea, chlamydia and Herpes Simplex Virus Type 2). At the second and third surveys, all participants were offered free treatment for STI's.

Specimen collection and laboratory testing

A finger prick was used to obtain a blood spot for the anonymous HIV serosurvey. Dried blood spots were collected on filter paper and stored at 4°C. A dipstick dot Enzyme Immunoassay (EIA) (ICL-HIV 1 & 2 Dipstick, Thailand) was used to test for HIV antibodies. This test has been evaluated in Zimbabwe, and was shown to have high sensitivity and specificity (both 99.6%) [282]. A plate EIA was used to confirm all positive test results and a 10% sample of negatives. At each survey, there was 100% agreement between the dipstick dot EIA and the plate EIA. When a seroconversion was identified, the participant's blood specimen from the previous survey was re-tested. If this sample tested negative, a plate EIA was used to confirm both samples and verify seroconversion. All laboratory work was carried out at the Biomedical Research and Training Institute (BRTI) laboratory in Harare.

Behaviour data

A structured questionnaire on socio-demographic characteristics and sexual behaviour was used to interview participants. Interviews were led by social science graduates who were familiar with the local language and culture but were not known locally. Interviewers were trained to adopt an informal and non-prejudicial approach, to build up a good rapport with respondents, and to carefully explain the confidentiality procedures. Interviewers were matched for sex with respondents.

An informal confidential voting interview (ICVI) method was used to collect sensitive behavioural data, as a means of reducing social desirability bias [283, 284]. Interviewers explained to participants that by writing their answer, the interviewer would not be aware of the participant's response. Participants placed colour-coded voting slips containing their responses into a locked "voting" box, thus ensuring confidentiality (Figure 5.2). This box was only unlocked and linked to the questionnaire data by data managers at the field site.

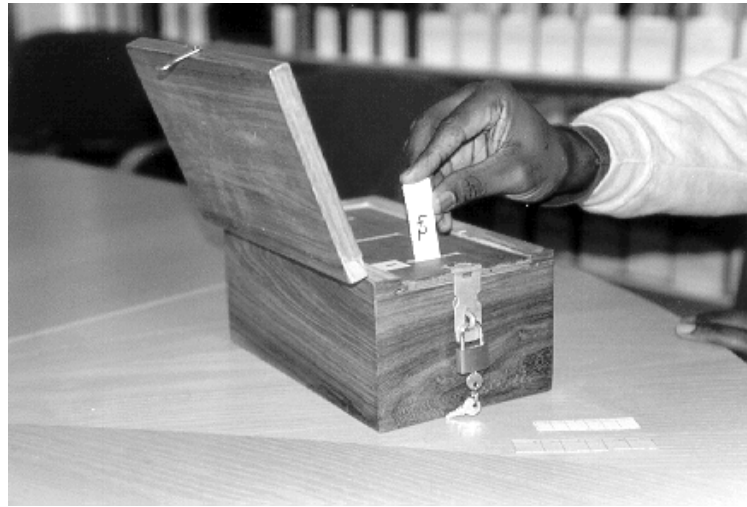


Figure 5.2 Use of the informal confidential voting box method for collecting sexual behaviour data. Source: Gregson *et al.* [284].

In the first survey the ICVI method was used for three-quarters of literate respondents (randomly selected). All illiterate respondents (8%) were interviewed face-to face. At the second and third surveys behavioural data was collected using the same method as in the previous survey and all new literate participants were interviewed using the ICVI method. The ICVI method has been evaluated within the study population and it's use has shown to be associated with increased disclosure of sexual behaviours [283]. All data on age at first sex and age at first marriage were collected using the face-to-face interview method, even when the ICVI method was used to collect subsequent behavioural data in the same interview.

Participants were asked if they had been married or had ever been in a long-term or cohabiting relationship, which for the purposes of this work have been classified together as being 'married'. In the first survey, relationships of six months or longer were defined as long-term, but in the subsequent two surveys, this was changed to be relationships of twelve months or longer. Ever married individuals were asked their age when they first entered such a relationship.

In the section of the questionnaire regarding sexual behaviour, participants were asked initially how old they were when they had sex for the first time. Subsequent questions on sexual behaviour were asked in order of increasing sensitivity. In the first survey, the behavioural section of the questionnaire was skipped if a participant reported that they have never had sex, whereas in the second and third surveys, the full behavioural section of the questionnaire was completed for those reporting to not have had sex (i.e. these participants reported 0 when asked about behavioural indicators such as number of sexual partners). The questions used to define each of the behavioural indicators analysed and their position in the questionnaire are shown in table 5.1.

Behavioural indicator	Position in Questionnaire	Question
Age at marriage	Q251	How old were you when you first entered such a relationship? (asked after Q249: Have you ever been married or in a long-term or cohabiting relationship?)
Age at first sex	Q402	How old were you when you had sex for the first time?
Visited bar/beer hall in the last month	Q242	How many times have you visited a bar or beer-hall in the last month?
New sexual partner in the last year	Q422	How many of these partners were you having sex with for the first time? (asked after Q421: How many different sexual partners have you had in the last 12 months?)
Sexual partner in past month	Q425	How many different partners have you had sex with in the last month?
Multiple concurrent partners	Q424	How many sexual relationships do you consider yourself to be involved in at the moment?
Consistent condom use in last 2 weeks	Q427	How many times have you had sexual intercourse with this partner in the last 2 weeks?
	Q428	On how many of these occasions did you and your partner use condoms throughout?

Table 5.1 Questions used to define behavioural indicators.

Footnote: Questions were asked in a consistent manner over the three surveys. The question numbers presented are from the third survey. Some question numbers have changed from survey to survey due to the addition and removal of questions. The order, however, remains the same.

5.3.2 Data Analysis

Age at first sex and age at marriage

A number of methods have been developed to analyse data on age at first sex (which also apply to age at marriage). The data used are current status (the current age of the individual and whether they have ever had sex) and recall (retrospective reports of age at first sex) [250]. Survival analyses combine the two sources. These techniques can also be adapted to analyse data from successive surveys to assess trends in age at first sex and distinguish underlying trends from reporting errors [285].

Here, survival analysis techniques were employed to analyse timing of first sex, with individuals represented as surviving until first sex. In this scheme, the failure event is starting sex, and follow-up time is censored if individuals had not started sex by the time of their last interview. Censoring is independent (of the probability that sex occurs) since no information on sexual behaviour was obtained prior to recruitment. Kaplan-Meier failure curves were plotted to illustrate the cumulative onset of sexual activity. A Wilcoxon rank-sum test was used to test if median age at first sex was significantly different between two age groups within a birth cohort, for men and for women. This procedure was also followed when analysing trends in age at marriage.

Age at first sex and age at marriage were reported as years in integers, which correspond to age at last birthday at those events. A random proportion of a year was added to each age to capture the distribution of exact ages within a year. Reports of age at first sex and age at marriage were classified according to consistency, to assess the quality of reporting. Four categories were defined to classify reports: (i) consistent, (ii) inconsistent: can be corrected, (iii) inconsistent: can be estimated (iv) unreliable: can't be estimated or corrected (Table 5.2).

Category	Number of age at event reports			Imputed response	
	1	2	3+		
Consistent	Report $\leq$ age at survey	Both reports same AND both reports $\leq$ age at survey	All reports same AND all reports $\leq$ age at survey	Reported age	Reliable
Inconsistent: can be corrected	N/A	Reports differ by 1 year AND both reports $\leq$ age at survey	2 ages reported which differ by 1 year AND both reports $\leq$ age at survey	The older of the 2 ages	
Inconsistent: can be estimated	N/A	1 report $\leq$ age at survey	$\geq 50\%$ of reports same AND these reports $\leq$ age at survey	The most frequent report that is $\leq$ age at survey	
Unreliable: can't be estimated or corrected	Report $>$ age at survey	Reports differ by > 1 year AND both reports $\leq$ age at survey OR Both reports $>$ age at survey	$< 50\%$ of reports same OR $\geq 50\%$ reports same AND reports $>$ age at survey	The mean of all reported ages	Unreliable

Table 5.2 Definitions of reliable and unreliable reporting. Source: Wringe and Cremin *et. al.* [286].

A number of non-mutually exclusive classifications were observed for those individuals with three reports (827/3270) (i.e. when two reports were consistent and the other report differed by one year). In such cases the consistently reported age was used. These criteria were also applied when classifying reports of age at marriage. A detailed description of these classifications, by frequency of reporting, is given by Wringe and Cremin *et. al.* [286].

Temporal trends in sexual behaviour

Analyses on behavioural indicators were restricted to the non-virgin population. Data regarding number of partners were analysed as numeric variables to calculate summary statistics. However, the distributions of number of partners varied substantially, thus these were categorised for comparison and presentation purposes. Defining categorisations was based on a number of considerations which included categorisations used in previous analyses of these data and ensuring statistical power for comparisons. Categorisations were also determined by prior knowledge of behavioural risk and HIV epidemiology in this population.

Consistent condom use was defined by combining data from (i) number of sex acts in the past two weeks and (ii) number of times a condom was used throughout (for sex acts in the past two weeks). Condom use was classified as inconsistent if the number of condoms used was less than the number of sex acts reported.

Behavioural indicators were compared for those lost to follow-up and those followed-up (i) from the first to the second survey and (ii) from the second to the third survey. Chi-squared tests were used to assess the statistical significance of differences in behaviour variables for men and for women, adjusting for age.

5.4 Results

5.4.1 Study participation and participant characteristics

The household participation rates were high at 98%, 94% and 96% in the first, second and third surveys, respectively. The participation rates for the individual interviews were 79% in both the first and the second survey and 83% in the third survey. The rate of follow-up in the closed cohort, with known deaths excluded, was 60.8% from the first to second survey and 62.5% from the second to third survey. This is a highly mobile population [287], and out-migration was the principal reason for loss to follow-up [230]. The rates of participation and loss to follow-up are similar to those from other large-scale population-based African HIV cohort studies [288-291].

The full open-cohort consists of 23517 participants, with 9530, 8210 and 16266 participants in the first, second and third surveys, respectively. Of these 23517 individuals, 16680 were interviewed in only one survey, 3185 were interviewed in two surveys, and 3652 were interviewed in all three. Most of the individuals who were surveyed only once were new entrants at the third survey, for which the eligibility criteria for the study were expanded, as described above.

When restricted to the non-virgin population, the open-cohort consisted of 17874 individuals, with 8273, 6559 and 12533 participants in the first, second and third surveys,

respectively. Of these 17874 individuals, 11931 were interviewed in only one survey, 2395 were interviewed in two surveys, and 3548 were interviewed in all three. The mean length of follow-up time was 4.2 years. An overview of the socio-demographic composition of this sample is presented in Table 5.3.

	Round 1 (1998-2000)		Round 2 (2001-2003)		Round 3 (2003-2005)	
	N	(%)	N	(%)	N	(%)
Sex						
Male	3787	(45.8)	2771	(42.3)	4711	(37.6)
Female	4486	(54.2)	3788	(57.7)	7822	(62.4)
Age						
15 - 19	1326	(16.0)	764	(11.7)	1037	(8.3)
20 - 29	3363	(40.7)	2415	(36.8)	4808	(38.4)
30 - 39	2010	(24.3)	1647	(25.1)	3155	(25.2)
40 +	1574	(19.0)	1733	(26.4)	3533	(28.2)
Marital status						
Single	2321	(28.1)	1334	(20.3)	1833	(14.6)
Married	4715	(57.0)	4227	(64.5)	8465	(67.6)
Previously married	1237	(14.9)	998	(15.2)	2235	(17.8)
Education						
None	306	(3.7)	127	(1.9)	9	(0.1)
Primary	3343	(40.4)	2582	(39.4)	4779	(38.1)
Secondary	4474	(54.1)	3672	(56.0)	7032	(56.1)
Higher	150	(1.8)	68	(1.0)	208	(1.7)
Missing	0	(0.0)	110	(1.7)	505	(4.0)
Total	8273		6559		12533	

Table 5.3 Socio-demographic characteristics of non-virgin study participants, at each survey.

5.4.2 Timing of first sex and marriage

Age at first sex

All respondents were asked what age they were when they first had sex. Over all surveyed individuals, 23.2% (5446/23517) reported never having had sex. Slightly more men than women reported never having had sex (24.3% vs. 22.3%, respectively, χ^2 , $P < 0.001$). Of the individuals who provided a report of age at first sex, 69.3% (12448/17953) only reported in one survey. A small proportion of individuals did not

respond to the question regarding age at first sex (first survey, 63 (0.66%); second survey, 36 (0.44%); third survey, 48 (0.30%)).

Reports were classed as unreliable for 32.1% of women and 52.2% of men who reported age at first sex in at least two surveys (Figure 5.3). Of these unreliable reports, 31.2%, 21.2% and 15.9% of reports differed by 2, 3 and 4 years, respectively. The remaining 31.6% of reports differed by more than 4 years. Similar levels of unreliable reporting were observed among only those who participated in all three surveys. The quality of reporting among those in all three surveys was very similar across birth cohorts, as described by Wringe and Cremin *et. al.* [286].

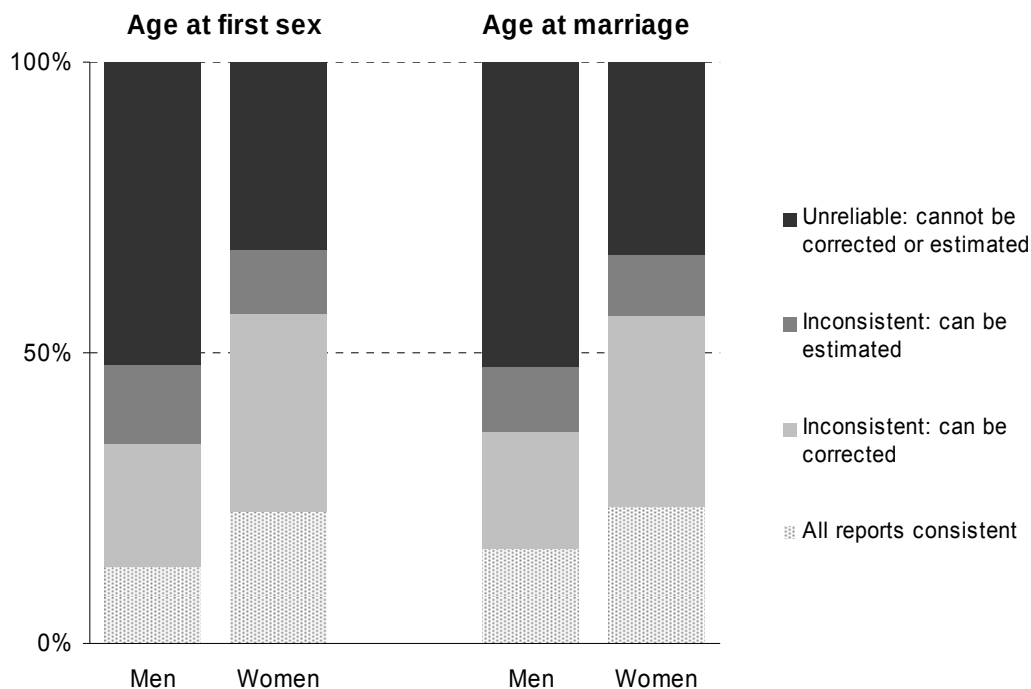


Figure 5.3 The consistency of reporting of age at first sex and age at marriage among men and women aged 15-54 reporting in at least two surveys.

Excluding unreliable reports had little effect on the failure curves when compared to analysing all reports (regardless of consistency) for both men and women. Median age at first sex remained largely unchanged when unreliable reports were excluded (Table 5.4).

Men		Age at first sex				Age at first marriage			
Birth cohort	All data		Reliable data			All data		Reliable data	
	Median	(IQR)	Median	(IQR)		Median	(IQR)	Median	(IQR)
1950-59	20.1	(18.3 - 22.4)	19.9	(18.0 - 22.2)		24.5	(22.0 - 27.0)	24.6	(21.9 - 27.0)
1960-69	19.6	(17.9 - 21.6)	19.5	(17.8 - 21.7)		24.7	(22.0 - 27.4)	25.0	(22.0 - 27.7)
1970-79	19.0	(17.3 - 20.9)	19.0	(17.2 - 20.9)		23.2	(21.2 - 25.2)	23.4	(21.3 - 25.4)
Women									
Birth cohort	All data		Reliable data			All data		Reliable data	
	Median	(IQR)	Median	(IQR)		Median	(IQR)	Median	(IQR)
1950-59	19.0	(17.3 - 20.6)	18.9	(17.2 - 20.5)		19.1	(17.4 - 20.8)	18.9	(17.2 - 20.7)
1960-69	18.7	(17.0 - 20.6)	18.7	(17.0 - 20.6)		18.9	(17.2 - 20.9)	18.8	(17.0 - 20.8)
1970-79	19.0	(17.4 - 20.8)	19.0	(17.5 - 20.8)		19.3	(17.7 - 21.1)	19.3	(17.7 - 21.2)

Table 5.4 Median and IQR for age at first sex and age at marriage, by reliability of data, and birth cohort for men and women. IQR Inter Quartile Range.

Age at first sex is significantly older for men than women (Log-rank test for equality of survivorship functions: $\chi^2 = 110$, $P < 0.001$), (Figure 5.4). Over all surveys, 12.6% of males and 12.0% of females reported experiencing first sex at 15 years or younger.

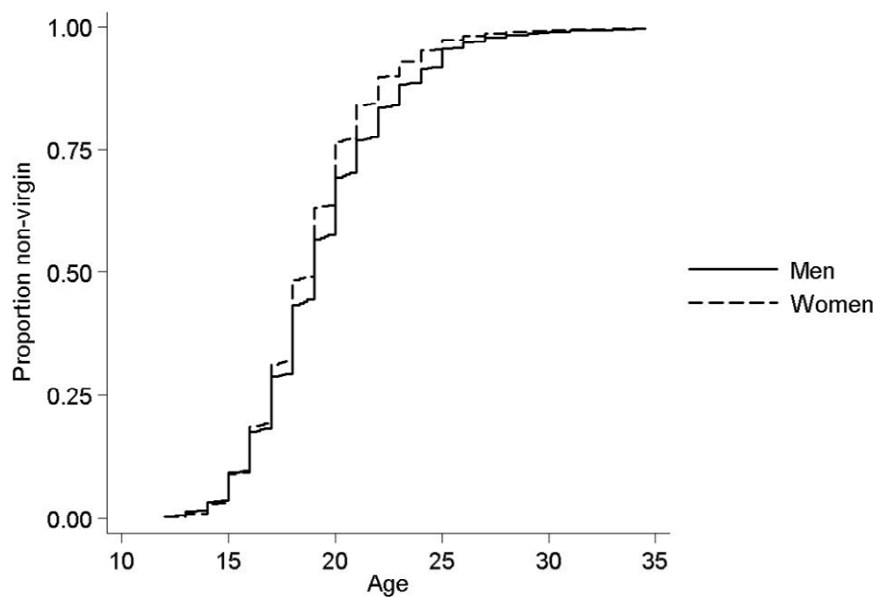


Figure 5.4 Kaplan-Meier failure curve for age at first sex for men and women. Data includes all reports, after corrections and estimations for inconsistent reports have been made.

Comparing medians by birth cohort indicates age at first sex has declined gradually among men, from 20.7 years among those born before 1955 to 19.1 years among those born after 1975, whereas, for women, median age at first sex has remained relatively constant between 19.2 and 19.0 years.

Next, reports from those reporting in at least two surveys were combined and analysed in a life-table format to compare reports by the same individuals as they age. Median age at first sex should remain unchanged as a cohort ages. Among those in older birth cohorts (1965-69 to before 1955), trends in age at first sex remained unchanged as these individuals aged (reading across the table), indicating the absence of reporting biases (Table 5.5). However, among those in younger birth cohorts (1970-74 and after 1975), reported age at first sex increased as they aged. This trend was only statistically significant for those born after 1975.

Age group	Men							Women						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Birth Cohort														
Before 1955						20.0 (22)	20.0 (224)						19.3 (42)	19.0 (436)
1955-59					19.5 (23)	20.0 (257)	20.0 (172)					19.0 (50)	19.0 (667)	18.7 (544)
1960-64				19.0 (48)	19.0 (379)	19.0 (239)					18.3 (65)	18.0 (816)	18.0 (671)	
1965-69			19.3 (45)	19.0 (352)	19.3 (231)					18.0 (69)	18.3 (656)	18.0 (496)		
1970-74		18.8 (68)	19.0 (609)	19.0 (388)					18.0 (62)	18.3 (750)	18.3 (599)			
After 1975	17.0 (415)	18.0 (1047)	18.3 (458)					17.0 (448)	18.0 (1103)	18.6 (586)				

Table 5.5 Median age at first sex and number reporting (N), for men and women reporting in at least two surveys, by five year birth cohort and age group. Bold type indicates differences significant at the 95% level.

Footnote: Reading across follows a birth cohort as they age, reading down allows comparison of an age-group across different time periods and reading diagonally compares age-groups within a fixed period i.e. what a cross-sectional survey would show. Data includes all reports, after corrections and estimations for inconsistent reports have been made. Small sample sizes are indicated in italic, along the leftmost diagonal for men and for women. These are low due to the timing of the surveys in relation to birth cohorts e.g. the majority of individuals in the 1970-74 birth cohort had aged past the 20-24 age group when they were surveyed.

Age at marriage

Across all respondents, 36.9% (8676/23517) reported never having been married. A higher proportion of men than women, had never been married (50.3% vs. 26.8%, χ^2 , $P < 0.001$). Participants who reported to have been ever married or in a long-term relationship were asked at what age they first entered such a relationship. Thus, this question is capturing the participants age at the beginning of a marital or long-term relationship which may not be the age at which the marriage took place. Of these, 43 (0.72%), 45 (0.85%) and 59 (0.55%) did not respond to the question regarding age at marriage in the first, second and third surveys, respectively. Of the individuals who reported an age at marriage, 68% (9874/14508) only reported it in one survey.

Reports were classed as unreliable for 33.2% of women and 52.5% of men who reported age at marriage in at least two surveys (Figure 5.3). Of these unreliable reports, 26.5%, 17.8% and 13.7% of reports differed by 2, 3 and 4 years, respectively. The remaining 41.9% of reports differed by more than 4 years. Excluding unreliable reports when plotting failure curves did not change the overall trends, when compared to trends based on all reports (regardless of consistency). The median age at marriage remained largely unchanged when unreliable reports were excluded (Table 5.4). Men marry at significantly older ages than women (Log-rank test: $\chi^2 = 5647$, $P < 0.001$), (Figure 5.5).

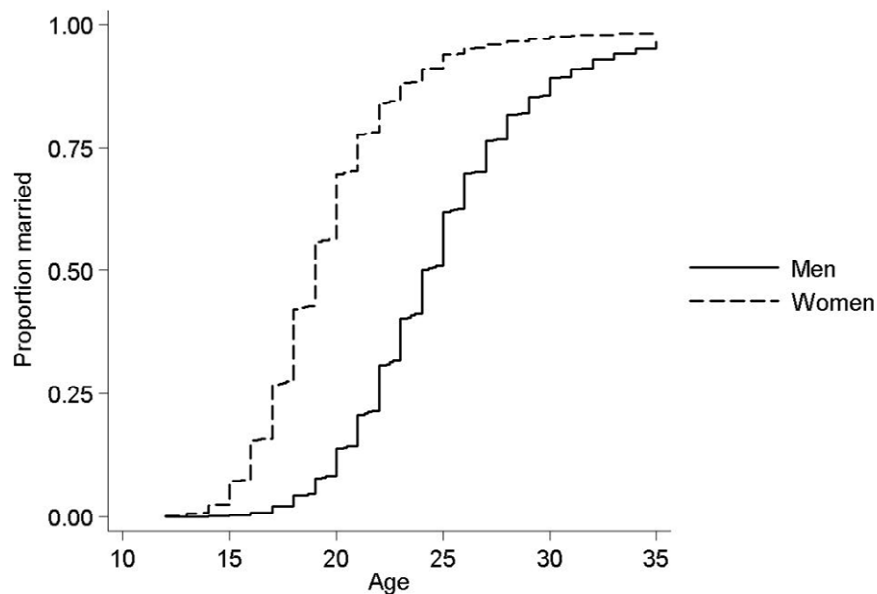


Figure 5.5 Kaplan-Meier failure curve for age at marriage for men and women. Data includes all reports, after corrections and estimations for inconsistent reports have been made.

Comparing median age at marriage across birth cohorts indicates a stable age at marriage among men (approximately 25 years) and women (approximately 19 years). Next, reports from those reporting in at least two surveys were combined and analysed in a life-table format. Men generally reported an increased age at marriage as they aged, in particular those in the youngest birth cohort (reading across the table) (Table 5.6). Women in older birth cohorts (1955-59 and before 1955) reported decreasing ages at marriage as they aged. However, among women in younger birth cohorts (1965-69 to after 1975), reported age at marriage increased, as they aged. This trend was only statistically significant for women born after 1975.

Age group	Men							Women						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Birth cohort														
Before 1955						23.8 (22)	24.0 (219)						19.0 (41)	18.7 (425)
1955-59					21.0 (22)	23.0 (254)	23.0 (168)					19.0 (49)	18.0 (661)	18.0 (541)
1960-64				23.5 (45)	23.0 (364)	23.0 (234)					18.0 (63)	18.0 (803)	18.0 (664)	
1965-69			24.2 (42)	23.7 (324)	23.3 (216)					18.0 (67)	18.7 (645)	18.3 (492)		
1970-74		22.6 (50)	23.0 (441)	23.0 (307)					18.0 (59)	19.0 (710)	18.7 (573)			
After 1975	19.5 (55)	21.0 (313)	22.0 (244)					17.0 (357)	18.0 (963)	18.3 (542)				

Table 5.6 Median age at marriage and number reporting (N), for men and women reporting in at least two surveys, by five year birth cohort and age group. Bold type indicates differences significant at the 95% level.

Footnote: Data includes all reports, after corrections and estimations for inconsistent reports have been made. Small sample sizes are indicated in italic, along the leftmost diagonal for men and for women. These are low due to the timing of the surveys in relation to birth cohorts e.g. the majority of individuals in the 1970-74 birth cohort had aged past the 20-24 age group when they were surveyed.

Time spent single after sexual debut

The average number of person years spent between first sex and marriage has remained constant for men and women (Figure 5.6). The mean duration of time spent single after sexual debut is much longer for men than for women, 4.1 (SD 4.1) years and 0.3 (SD 1.6) years, respectively. Greater proportions of women than men indicated that their first sexual experience was within marriage; 69.8% (6748/9666) and 15.3% (729/4760) of married women and men, respectively, reported age first sex to coincide with age at marriage.

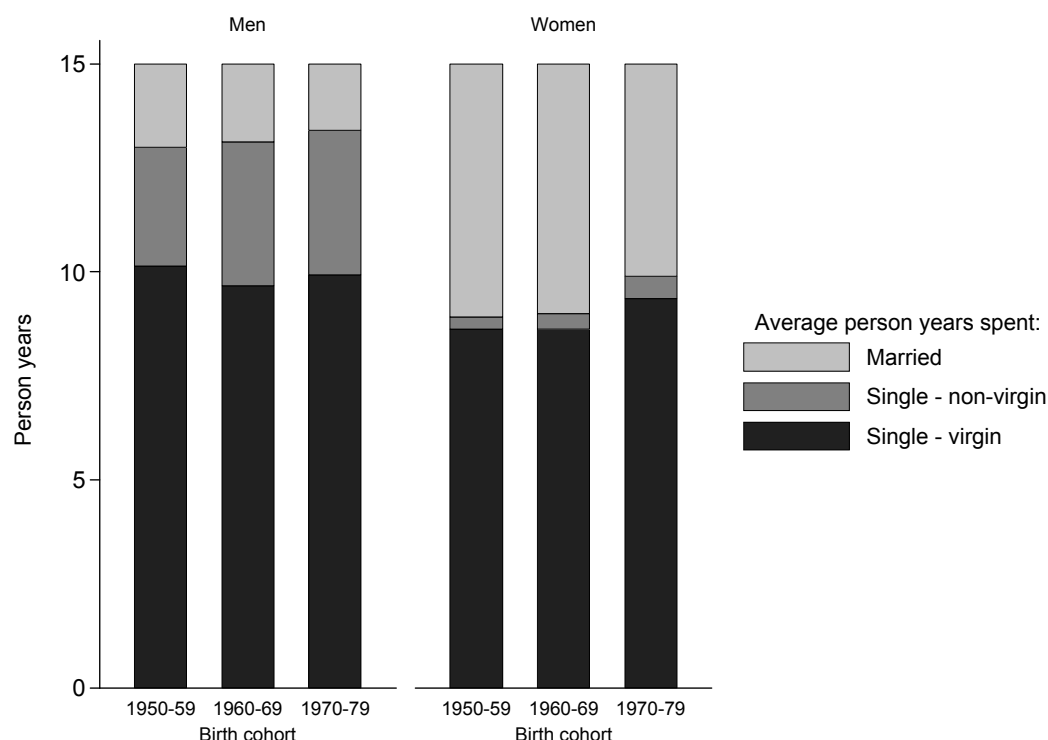


Figure 5.6 Distribution of person years spent as a virgin, sexually active and unmarried and married, between the ages of 10 and 25, for men and women.

5.4.3 Trends in behavioural indicators

This section describes behaviour once an individual has entered the sexually active population. Thus, analyses are restricted to the non-virgin population. The open cohort of non-virgin individuals consisted of 17874 individuals; 7559 men (42%) and 10315 women (58%).

Formation of new partnerships

Within a one year period the majority of individuals, women in particular, do not form new sexual partnerships (Figure 5.7). Overall, men reported forming more new partnerships than women. The reported number of new partnerships decreased from the first survey to the second survey and remained relatively constant from the second survey to the third survey, for both men and women.

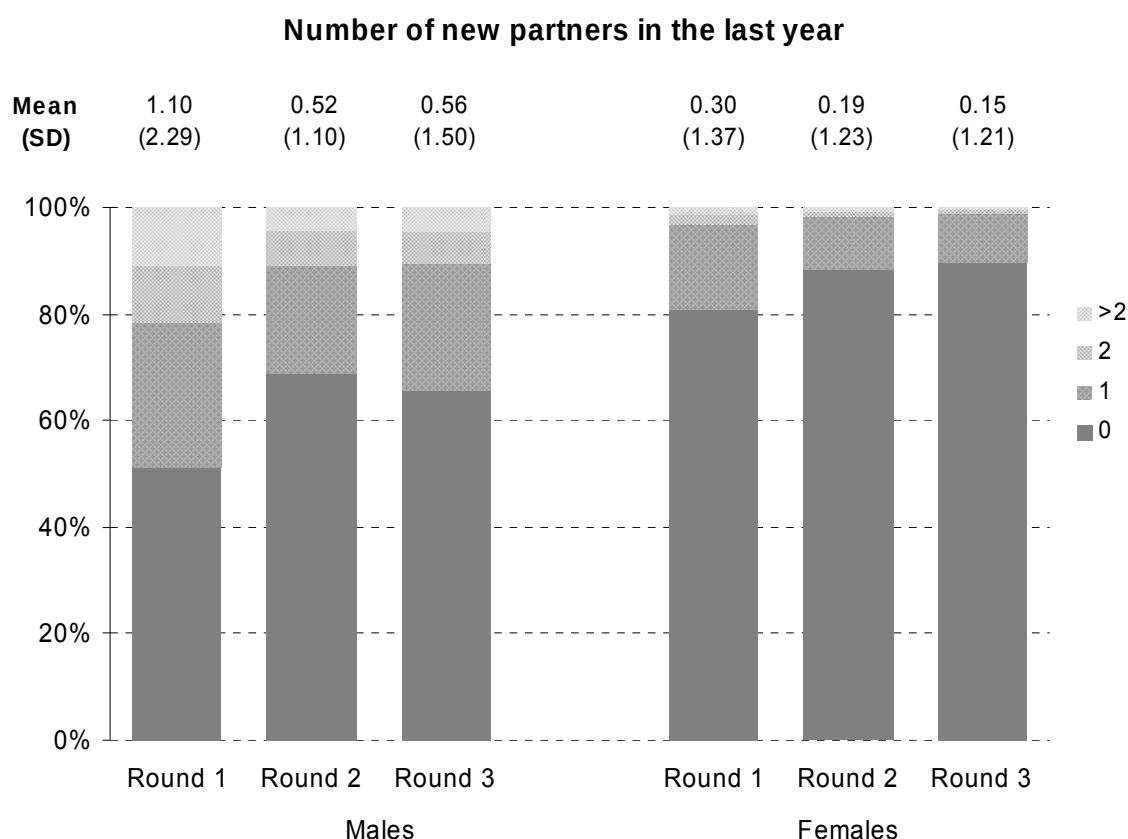


Figure 5.7 Formation of new partnerships in the last year, among sexually active men and women.

Among men, the rate of formation of new partnerships was highest among 20-24 year olds, at each survey. After 24 years of age the proportion of men reporting formation of more than two new partnerships in the last year decreased with increasing age. However, the high rate of new partnership formation (more than two) among 20-24 year old men decreased dramatically between the first and second surveys; from 15.2% to 6.4% to 8.2% in the first, second and third surveys, respectively.

The age-specific trends in partnership formation are somewhat different among women. The proportion of women reporting to form more than two new partnerships in the last year was highest among: 25-29 year olds in the first survey at 3.1%; 30-34 year olds in the second survey at 1.9%; and 20-24 year olds in the third survey at 0.7%. Thus, the age

at peak rates of partnership formation were older than that of men, although the level of partnership formation was lower than that of men and declined substantially over time.

At each survey, single men (i.e. never married) and previously married men (i.e. widowed, divorced or separated) reported the highest rates of new partnership formation. As expected, rates of partnership formation were lower among married men, but were higher among those who were married but living apart compared to those who were married and cohabiting. As for men, the majority of new partnerships were formed by women who were never married or were previously married. Unlike men, however, a higher proportion of married women who cohabited with their husbands reported more than two new partnerships in the last year compared to married women who lived apart from their husbands, at each survey.

Partners in the last month

Unsurprisingly, the majority of participants report having either zero or one sexual partners in the last month (Figure 5.8). Although at each survey a similar proportion of men and women reported no partners in the last month, overall, men report more partners in the last month than women. A decrease in the proportion of participants, men in particular, reporting more than one partner in the last month was observed.

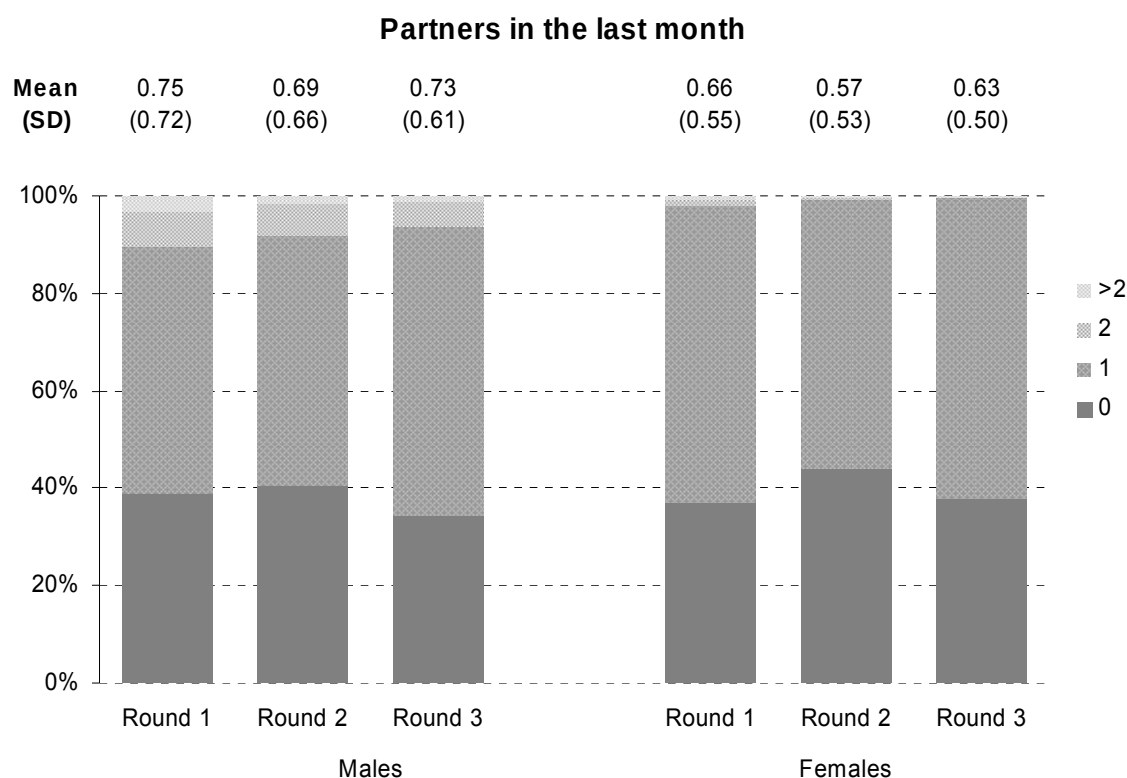


Figure 5.8 Reported number of partners in the last month among sexually active men and women.

In the first survey, the highest number of partners in the last month was reported among 15-19 year old men, with 4.4% reporting more than two partners. By the second survey, 20-24 year old men were reporting the most partners in the last month, with 2.3% reporting more than two. By the third survey, 35-39 year old men were reporting the greatest number of partners in the last month, with 1.9% reporting more than two.

Among women in the first survey, the proportion reporting more than two partners in the last month was constant at about 1% for all those aged 15 – 34. Whereas, in the second survey, the proportion of women reporting more than two partners was highest among those aged 20-24, at 0.8%, and subsequently declined with increasing age. In the third survey, the highest proportion of women reporting more than two partners in the last month was also among those aged 20 – 24, but this proportion had decreased to 0.4%.

With respect to marital status, no consistent trend was observed for partners in the last month among men. In the first survey, the proportion of men reporting more than two partners in the last month was highest among those who were previously married (4.1%). Whereas in the second survey, the highest proportion was among those who were married but lived apart from their spouses (3.4%) and in the third survey those who were never married had the highest proportion reporting more than two partners (1.9%).

Among women, the highest proportion reporting more than two partners in the last month was observed among those who were never married, at 2.5%, 1.2% and 1.4% in the first, second and third surveys respectively.

Multiple partnerships

Overall, the majority of participants reported to be in a single sexual relationship, at the time of each survey (Figure 5.9). There is a strong gender differential in reporting of multiple partners, as observed for the other measures of number of partnerships referring to different pre-survey time periods. Declines in the reported number of concurrent partnerships have occurred between the three surveys. Among men, 18.3%, 10.6% and 9.2% reported multiple (>1) partnerships in the first, second and third surveys, respectively. Among women, 2.3%, 1.1% and 0.51% reported multiple partnerships in the first, second and third surveys, respectively.

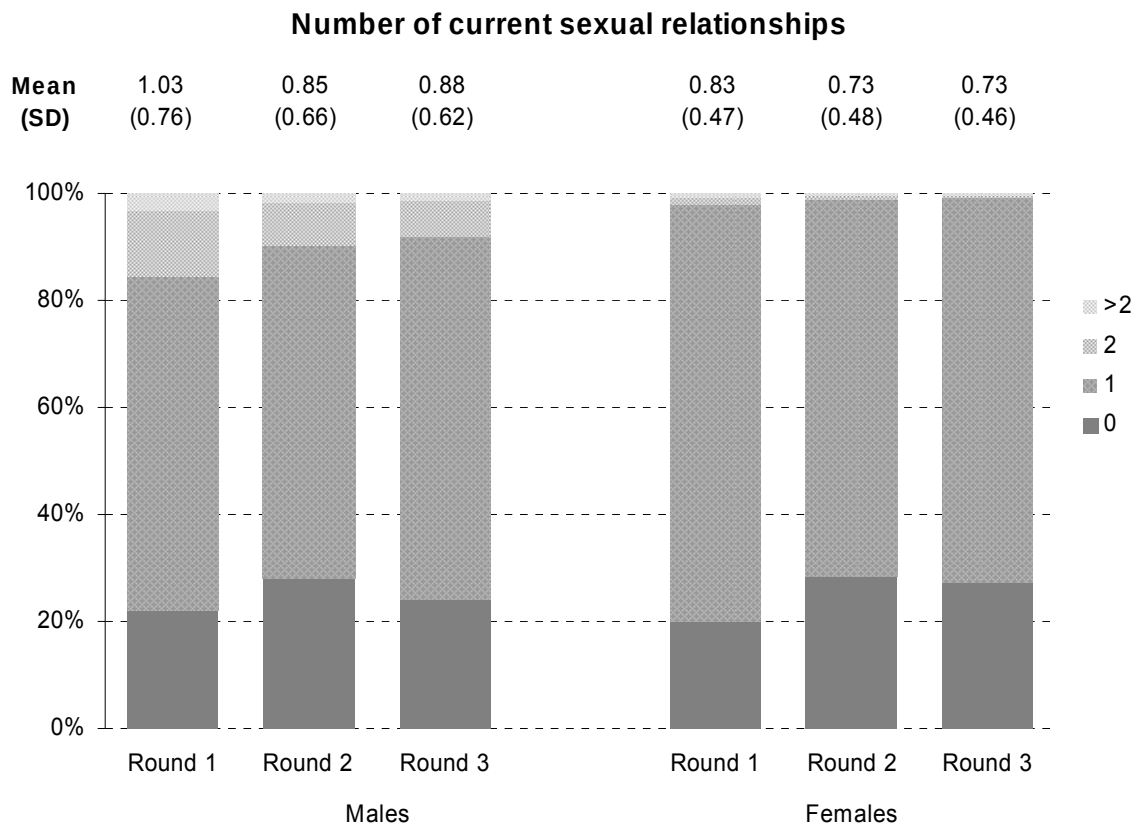


Figure 5.9 Reported number of current sexual relationships, among sexually active men and women.

Among men, decreases in multiple current partnerships were most pronounced among younger men. In the first survey the highest levels of multiple current partnerships were observed among 15-19 year olds, with 10.8% reporting more than two current sexual relationships, whereas this proportion had dropped to 2.8% in the second survey and 3.5% in the third survey. Among women, the highest levels of multiple current partnerships were observed among 15-19 year olds in the first and second surveys, at 1.4% and 1.1%, respectively. By the third survey, the age at highest levels of multiple current partnerships had increased to 25-29 years (0.4%).

Trends in multiple partnerships changed over time with respect to marital status, among men and women. Among men in the first survey, levels of multiple partnerships were highest among never married men, at 10.3%. However, in the second survey, the level of

multiple partnerships was highest among married men who lived apart from their wives, at 4.1%. By the third survey the level of multiple partnerships was highest among never married men, at 4.6%. Among women, levels of multiple partnerships were highest among those who were never married at all three surveys, at 2.5%, 1.2%, and 0.8%, respectively.

Consistent condom use

Consistent condom use with regular partners was low, similar for men and women and did not substantially change over time (Figure 5.10).

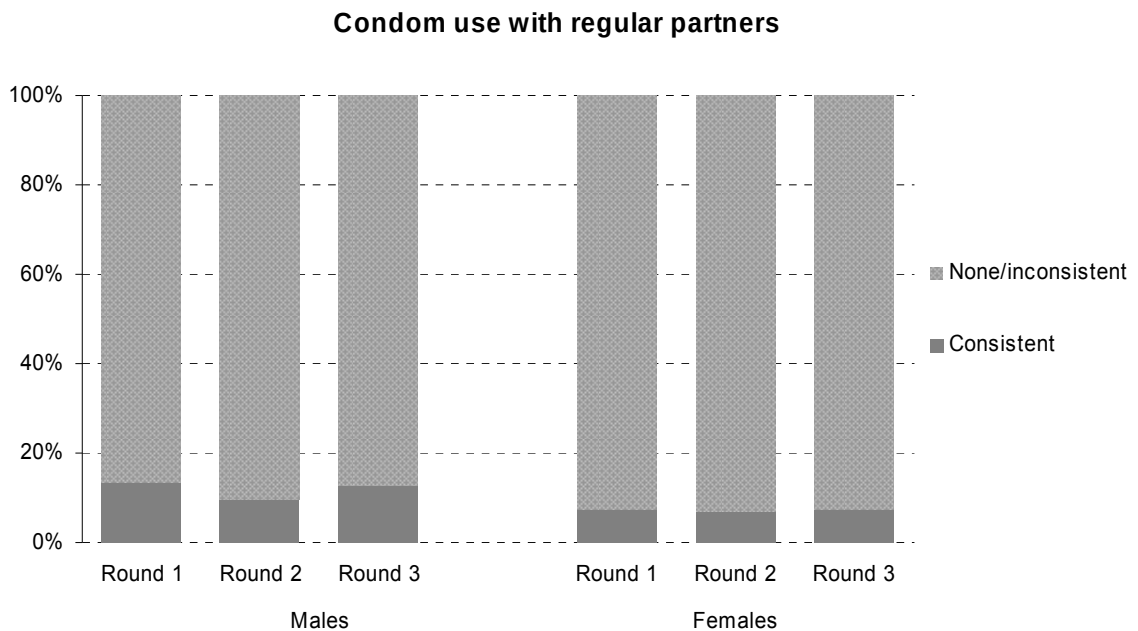


Figure 5.10 Reported condom use with regular partners, among sexually active men and women.

Consistent condom use was relatively high with non-regular partners, men and women reported similar levels and the overall level remained reasonably constant over time (Figure 5.11).

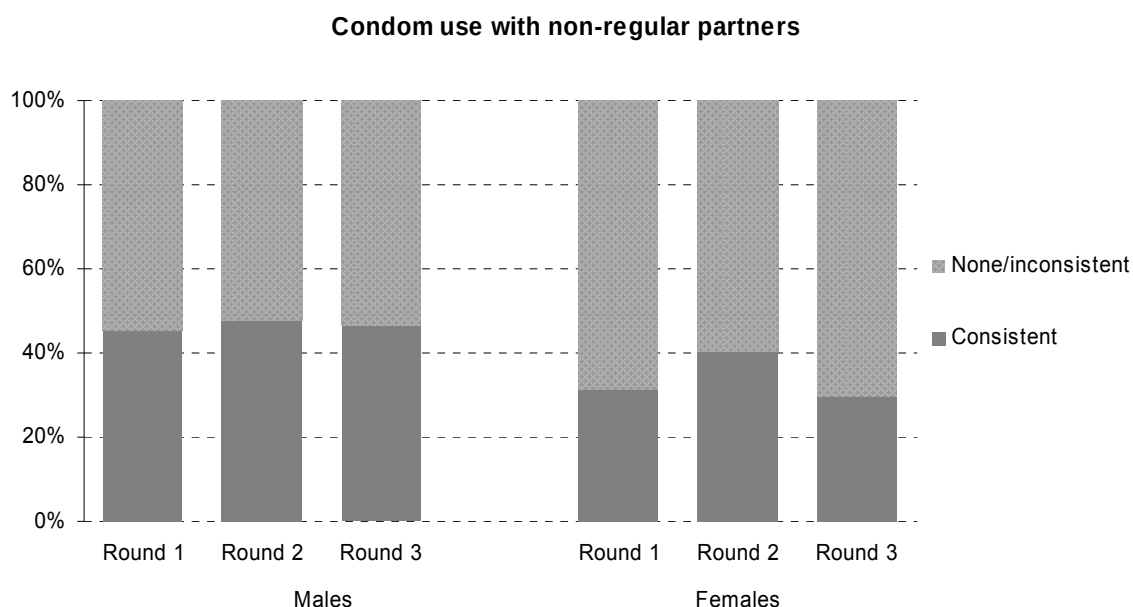


Figure 5.11 Reported condom use with non-regular partners, among sexually active men and women.

Sexual behaviour among those lost to follow-up

First survey to second survey

The characteristics of those lost to follow-up (due to migration, death, refusal or unavailability at the time of the follow-up visit) between the first and second surveys were compared to the characteristics of those who were followed-up from the first to the second survey. The age profile of men and women lost to follow-up was younger than that of those followed-up (Table 5.7). Men lost to follow-up reported higher numbers of new partners in the last year, but were less risky with respect to consistent condom use with regular partners, and did not differ significantly with respect to other behavioural indicators (Table 5.7). Women who were lost to follow-up had lower levels of risk with respect to consistent condom use with regular and non-regular partners (Table 5.7).

Characteristic (at round 1)	Males			Females		
	Lost to follow-up (n = 1704)	Followed-up (n = 2083)	P-value*	Lost to follow-up (n = 1378)	Followed-up (n = 3108)	P-value*
Age (years)						
15-19	18.3	17.8	<0.001	16.7	12.4	<0.001
20-24	32.0	21.8		29.8	15.4	
25-29	19.3	17.3		21.1	16.2	
30-35	11.4	11.4		13.3	13.8	
35-39	5.8	10.5		8.7	17.4	
≥ 40	13.2	21.3		10.4	24.7	
Visits to bar/beer hall in last month						
None	45.4	46.8	0.7328	95.8	95.1	0.5302
Less than once a week	21.0	17.9		2.3	2.7	
Once to twice a week	15.3	15.7		0.7	1.0	
More than twice a week	12.8	12.4		0.5	0.7	
Everyday	5.5	7.1		0.7	0.6	
New partners in past year						
0	50.3	57.6	0.0373	78.0	84.7	0.0599
1	28.7	26.9		19.0	13.5	
2-4	17.7	13.5		2.7	1.5	
5-9	2.1	1.8		0.2	0.1	
≥10	1.1	0.3		0.1	0.2	
Partners in last month						
0 - 1	90.7	89.8	0.7657	98.2	98.7	0.0616
2	6.7	7.9		0.9	1.0	
>2	2.5	2.4		0.9	0.3	
Current partners						
0 - 1	84.7	84.3	0.5590	97.6	98.4	0.0733
2	10.5	11.6		1.4	1.2	
>2	4.9	4.1		1.0	0.4	
Consistent condom use in last 2 weeks						
Regular partners:						
None/inconsistent	82.8	89.1	0.0404	91.0	93.4	0.0486
Consistent	17.2	11.0		9.0	6.6	
Non-regular partners:						
None/inconsistent	51.9	57.6	0.6747	54.4	77.1	0.0116
Consistent	48.1	42.4		45.6	22.9	

Values are given as percentages.

* Chi-squared tests adjusted for age (for behavioural indicators)

Table 5.7 Age profile and behavioural characteristics of non-virgin participants at round 1, by sex, for those lost to follow-up and those followed-up from round 1 to round 2.

Previous work by Mundandi *et. al.* found no difference in sexual behaviour between those lost to follow-up due to migration from the first to the second survey and those followed-up to the second survey, for either sex [292]. It was found that at the first survey future migrants were significantly younger and had higher education levels than those followed-up to the second survey. Unlike this analysis, the analysis by Mundandi *et. al.* included all participants regardless of whether they have had sex or not, and adjusted for

age, education, marital status and location (i.e. area of residence) and focused on loss to follow-up due to migration only (which the majority of loss to follow-up is attributable to).

Second survey to third survey

The characteristics of those lost to follow-up between the second and third surveys were compared to the characteristics of those who were followed-up from the second to the third survey. As for the earlier surveys, the age profile of men and women lost to follow-up between the second and third surveys was younger than that of those followed-up (Table 5.8).

Among men, the distribution of number of new partners in the last year differed by follow-up status; with a greater proportion of those followed-up reporting 5-9 new partners, but a greater proportion of those lost to follow-up reporting 2-4 new partners (Table 5.8). Similarly, among women, the distribution of number of new partners in the last year differed by follow-up status, with those lost to follow-up reporting higher numbers of new partners. However, none of the women lost to follow-up reported having ten or more new partners, as compared to 0.2% of those who were followed-up (Table 5.8). Women who were lost to follow-up also attended bars and beer halls more frequently than those followed-up (Table 5.8).

Characteristic (at round 2)	Males			Females		
	Lost to follow-up (n = 1144)	Followed-up (n = 1627)	P-value*	Lost to follow-up (n = 1115)	Followed-up (n = 2673)	P-value*
Age (years)						
15-19	13.0	13.1	<0.001	15.6	7.9	<0.001
20-24	29.1	19.9		27.4	11.5	
25-29	21.8	17.8		18.1	15.0	
30-35	11.3	11.8		13.2	14.6	
35-39	9.0	10.5		9.7	15.4	
≥ 40	15.8	26.9		16.0	35.6	
Visits to bar/beer hall in last month						
None	51.1	51.3	0.2158	95.3	96.3	0.0096
Less than once a week	20.2	22.1		2.4	2.5	
Once to twice a week	15.2	13.8		1.2	0.5	
More than twice a week	8.6	8.1		0.7	0.4	
Everyday	5.0	4.7		0.4	0.3	
New partners in past year						
0	66.1	74.6	0.0370	83.3	92.4	<0.001
1	23.2	17.2		14.7	6.5	
2-4	10.0	7.2		1.6	0.8	
5-9	0.5	0.9		0.5	0.2	
≥10	0.3	0.2		0.0	0.2	
Partners in last month						
0 - 1	93.0	93.1	0.6433	99.3	99.4	0.7716
2	5.5	5.6		0.5	0.4	
>2	1.6	1.3		0.2	0.2	
Current partners						
0 - 1	90.8	90.8	0.7362	98.8	99.1	0.7261
2	7.3	7.7		0.8	0.6	
>2	1.9	1.5		0.4	0.3	
Consistent condom use in last 2 weeks						
Regular partners:						
None/inconsistent	88.8	91.4	0.6812	91.2	93.8	0.0627
Consistent	11.2	8.6		8.8	6.2	
Non-regular partners:						
None/inconsistent	47.1	55.7	0.3384	56.1	61.8	0.9746
Consistent	52.9	44.3		43.9	38.2	

Values are given as percentages.

* Chi-squared tests adjusted for age (for behavioural indicators)

Table 5.8 Age profile and behavioural characteristics of non-virgin participants at round 2, by sex, for those lost to follow-up and those followed-up from round 2 to round 3.

5.5 Discussion

In this rural Zimbabwean population, women initiate sex and enter marriage at younger ages than men, but spend much less time between first sex and marriage. Comparisons across all surveys, by birth cohorts which span a period of over forty years, indicate median age at first sex has remained constant over time among women but has declined gradually among men. Median age at marriage has remained relatively stable for both men and women. However, tracing birth cohorts between surveys revealed reporting biases. It is possible that some individuals (young people in particular) deliberately report an older age at first sex due to exposure to HIV prevention campaigns promoting delaying age at first sex and abstinence, in addition to the pressure of other social norms. With respect to reported age at first sex, one may expect increasing recall bias as an individual ages.

Including reports of age at first sex and age at marriage identified as unreliable in survival analyses did not alter the results, suggesting that much of the unreliability may be attributable to random misreporting rather than systematic biases such as social desirability bias. This absence of alteration of trends indicates that the observed trends can be interpreted with some confidence, despite the high levels of misreporting. Furthermore, this provides some reassurance when interpreting trends in serial cross-sectional data, such as from DHS, where such inconsistencies cannot be identified. However, consistency of reporting does not always signify accuracy – an individual may consistently report an incorrect age at first sex, a bias which cannot be detected.

Delays in sexual debut among teenage men and women in the first three years of follow-up of this cohort have been reported previously [230]. In this earlier analysis, trends in the percentage of individuals reporting to have had sex, within a small population subgroup who were starting sex at that time (17-19 year old males and 15-17 year old females) were compared. These age restrictions were chosen to analyse an entirely new group of maturing adolescents at each survey, thus focusing on very recent trends. Therefore, these previous findings, using current status data only, are not directly

comparable to the longer-term trends in median age at first sex in the entire population presented here by birth cohorts spanning a period of over forty years.

In Zimbabwe, information on timing of sexual debut has been collected in four DHS surveys since 1988, and median age at first sex has been calculated by province for the most recent three surveys [266, 293-295]. In Manicaland, medians among women aged 25 to 49 years, are relatively constant at; 18.3, 18.2 and 18.4 years in 1994, 1999 and 2005-06, respectively. Among men, aged 25 to 54 years (25 to 49 in the 2005-06 survey), median age at first sex increased from 19.5 in 1994 to 22.0 in 1999, and subsequently decreased to 20.6 in 2005-06. Thus, the medians calculated for women in this study population are a good representation of those in the wider population in the Manicaland province, whereas, for men, the medians calculated for this study population are generally younger. These estimates of median age at first sex are relatively high in comparison to other African countries, such as Kenya, Tanzania, Uganda and Zambia where median age at first sex ranges from 16.4 to 18.1 years [285].

The substantial gender differential in age at marriage observed here is not surprising as women are expected to marry younger than men in Shona society [296]. Women may seek to marry at a relatively young age in order to obtain the security associated with marriage and subsequent motherhood. Men are expected to obtain employment in order to afford bridewealth thus re-enforcing the expectation that they wait until reaching their mid-twenties before marrying. Recall bias may influence quality of reporting of age at marriage, among older individuals in particular. In this society, marriage is a long process and individuals may be unable to distinguish their age when the actual ceremony took place, from that when bridewealth was paid, from when the relationship begun. The biases identified in reporting of age at marriage may also be partially attributable to the change in the definition of a long-term relationship.

A mathematical modelling study, parameterised for this population, has shown that the effect of delaying age at first sex on subsequent risk of HIV infection depends on the length of time spent single (between first sex and marriage) [260]. When sexually active

and unmarried, risk of infection is double that when married, 2% and 1% per person-year at risk, respectively [260]. Thus, the extended duration of time spent sexually active and single among men, and the brief duration of time spent sexually active and single among women observed here, support previous findings in this population that, in general, young men acquire HIV from pre-marital relations (as well as extra-marital relations), whereas for women - who typically spend much less time single - the strongest determinants of infection are their spouse's behaviours [279].

Previous cross-sectional analyses (using the first survey) investigating age at first sex in relation to subsequent risk of HIV infection found that, among both males and females in this population, riskier sexual behaviour was observed among those reporting an early age at first sex (younger than 18) as compared to those who reported an older age of sexual debut [253]. However, for men, an early age at first sex which coincided with age at marriage did not lead to subsequent riskier behaviour, compared to men who initiated sex at an older age. This suggests that, among men, early marriage may be somewhat protective against the riskier effects of early age at first sex. However, the change in age at first sex observed here among men may not translate to additional risk of infection because the average number of years spent single, between first sex and marriage, has remained the same. Thus, the circumstances in which first sex occurs may be more important than the timing.

The behavioural indicators with respect to number of partnerships followed a highly skewed distribution. This is a characteristic observation for behavioural data, with many individuals reporting few sexual partners and few individuals reporting many sexual partners. In addition, data heaping was observed in the tails of these distributions, with increased reports observed for multiples of ten. Analysing data from the first survey of this cohort, Lewis showed that the distribution of lifetime partners among women followed a power law of the form $P(X=x) \propto x^{-\gamma}$, where X represents the number of lifetime partners and γ is the scaling exponent [265]. This suggests that classifying women as either "high activity" or "low activity" is not straightforward, with high activity women falling into the extremes of the distributions of low activity women [265].

A network, such as a sexual network, can be classified as “scale-free” if the distribution of connections (i.e. partnerships) follows a power law. Analysing data from the first survey, Schneeberger *et. al.* calculated the scaling exponent (γ) for lifetime partners to be 3.07 and 2.51 for men and women, respectively [297], and found the distribution of number of lifetime partners to be scale-free. In theory, this eliminates the epidemic threshold, thus allowing the spread of a pathogen of low transmissibility (such as HIV) to be maintained [297].

Large gender differentials in reported numbers of partners were observed, with men reporting greater numbers of sexual partners than women. This may be due to reporting bias, whereby men over-report and women under-report [298]. It may also be due to sampling or participation issues, whereby high activity women are excluded or under-represented. Alternatively, the observed gender differentials may be a combination of both these effects. Inclusion of a single member of a marital union in the first and second surveys is likely to have led to an under-representation of those in long-term relationships.

Issues of validity and reliability are common problems in HIV/AIDS evaluation research [299], as survey data on sexual behaviour can be subject to participation, recall and social desirability bias [300]. There is no “gold standard” with which to validate behavioural data. An additional challenge to collecting reliable behavioural data is participant fatigue. In addition to data quality, care must be taken when interpreting behavioural indicators. Slaymaker outlines how behaviour has many dimensions (e.g. number of partners, relationship to partner, frequency of sex and condom use) and how an individual's risk is determined by the interaction of these different aspects of behaviour and HIV prevalence [250]. For example, individuals reporting one new partner in the last year could have very different levels of risk depending on the explanation; they may be in a long-term partnership and have formed a casual partnership, they may practice serial monogamy, or they may have started their first long-term relationship. Despite these caveats, there is evidence for considerable reductions in reported risk behaviour in this population. In the

following chapter patterns of self-reported behaviour change associated with having received VCT are analysed.

**Chapter 6: Voluntary Counselling and Testing in Manicaland,
Zimbabwe: service provision, uptake and patterns of self-
reported behaviour change associated with receiving VCT**

6.1 Aims and organisation of chapter

The aim of this chapter is to describe the provision and uptake of VCT services in the Manicaland study population and to assess the patterns of behaviour change associated with receiving VCT. Firstly, the provision of counselling and testing services in Zimbabwe is described. The counselling and testing services provided by the study, the behavioural measures used and the data analyses are described in Section 6.3. The results are structured into four main sections: firstly, the participant characteristics are described; secondly, the trends in uptake, reported barriers to testing and reasons for testing, and determinants of uptake of VCT are presented; thirdly, the behavioural outcomes following testing are presented; and finally some qualitative insights from a focus group discussion regarding the uptake of testing are provided. A discussion of the main findings is provided in Section 6.5.

6.2 Background

Knowing and disclosing one's serostatus to facilitate safer sexual behaviour, are promoted as HIV prevention measures [20, 58, 301]. As discussed in Chapter 3, there has been mixed evidence for the efficacy of VCT in promoting safer sexual behaviour in sub-Saharan Africa. The greatest changes observed in studies of the impact of VCT on behaviour were among those testing positive and those in sero-discordant partnerships and little evidence exists for behavioural risk reduction among those found not to be infected [134, 218]. There is concern as to whether the standard of VCT administered in trials can realistically be provided and maintained routinely. Given the importance of longevity of behaviour change and the lack of behavioural risk reduction among the majority of those testing (i.e. HIV negative individuals), the evidence to date for the effectiveness of VCT as a primary HIV prevention measure is relatively weak.

HIV counselling and testing services in Zimbabwe

In Zimbabwe, the National AIDS Council was established in 2000 to coordinate a multi-sector response to the HIV epidemic. However, VCT had first become available in the mid 1990s, with the Matebeland AIDS Council opening the first VCT centre in 1996. Population Services International (PSI), the largest provider of VCT in Zimbabwe,

opened their first socially-marketed “New Start” VCT centre in Harare in 1999 and subsequently established free-standing and integrated centres across Zimbabwe. Since then, New Start has developed into a national network of 20 centres, which are largely located in urban areas, and had tested one million Zimbabweans by the end of 2007 [302, 303]. Thirteen of these centres are integrated into health services infrastructure such as public clinics, hospitals, private health facilities and non-governmental organizations (NGOs). By integrating the New Start network within existing health services, the stigma associated with receiving VCT is reduced. The other seven centres are “free-standing” sites which are operated directly by PSI. Additionally, there are four mobile units which target rural areas. The success of the New Start network in Zimbabwe led to PSI developing VCT programmes in 19 other developing countries [302]. In addition to PSI, a number of other NGO’s, such as Family AIDS Caring Trust (FACT), and faith-based organizations, had also established VCT services by the late 1990s. Since the initiation of the Manicaland HIV/STD Prevention Project, BRTI has been offering mobile counselling and testing services during the study periods.

6.3 Methods

6.3.1 Voluntary counselling and testing services provided by the Manicaland study

All study participants were offered free HIV counselling and testing at each survey, at the stage of the interview before a blood spot was obtained for an anonymous serosurvey. Participants were given a slip which they would use to receive VCT. This service was available at a mobile clinic which was present within the study site at the time the survey was being conducted. Participants receiving VCT from the research programme did so after completing the survey questionnaire. During the baseline and second surveys, VCT clients were asked to return two weeks after testing to receive their results and post-test counselling. At the third survey, rapid testing was introduced and clients received their results and post-test counselling on the same day of testing.

Counselling and testing was provided by trained male and female nurse counsellors. A systemic approach to counselling was used. This is a holistic approach and emphasises

the background of the individual and tailors pre- and post-test counselling accordingly [56]. Participants could attend VCT with their partner if they wished. It was explained to the participants that attending the clinic and discussing the advantages and disadvantages of knowing one's HIV status with a nurse counsellor did not mean that they had to receive their test results. The study participants were also told they could access VCT services provided by the Ministry of Health and NGOs, which became increasingly available in the study areas over time.

For those who participated in the third survey and had previously received VCT, the mean duration of pre- and post-test counselling was 37 and 21 minutes, respectively. Data regarding duration of counselling was not collected in the earlier surveys.

6.3.2 Measures

In the first and second surveys participants were asked "Have you ever had a test for HIV before?". In the third survey this question was changed and participants were asked if they had thought about having an HIV test, to which there were five possible responses, each corresponding to Prochaska's stages of change model (discussed in chapters 2 and 3) [176]: (i) No (pre-contemplation); (ii) Yes: but not done anything (contemplation); (iii) Yes: and found out how to get one (preparation); (iv) Yes: and planning to have a test (planning); and (v) Had a test (action).

The behavioural indicators that were analysed have been described in Chapter 5. These included the number of times the participant had visited a bar/beer hall in the previous month (which is known to be associated with risky sexual behaviour [280]), whether the participant had a sexual partner in the last month, the number of new partners in the last year and whether the participant had multiple concurrent partnerships (self-defined). Consistent condom use (i.e. condoms used in all acts of intercourse over the most recent two week period) with regular (i.e. partnerships of greater than one year's duration) and non-regular partners was also analysed. Reported number of lifetime sexual partners was not included in this analysis as it is a cumulative measure.

6.3.3 Data analyses

All analyses considered the non-virgin population who had an unambiguous anonymous dipstick HIV test result. Participants who reported having been tested for HIV and having received their results were defined as having received VCT. Unfortunately, in the first survey, receipt of results was not established.

An indicator based on time since last test and collection of results was created which captured whether or not an individual had previous experience of VCT at each survey (Table 6.1). Reports given by respondents in the second survey were used to identify those who had received VCT previous to the second survey (i.e. at the first survey and between the first and second survey). Reports given by respondents in the third survey were used to identify those who had received VCT previous to the third survey (i.e. at the second survey and between the second and third survey).

	Round 1	Round 2	Round 3
Tested r1-r2	0	1	1
Tested r2-r3	0	0	1
Didn't test	0	0	0

Table 6.1 Coding of VCT indicator to capture testing status at each round

In analyzing the relationship between sexual behaviour and VCT, comparing behaviour before and after receiving VCT was of primary interest. Most reported behaviours refer to the month previous to the survey, so only those receiving VCT before that month are defined as having received VCT. However, number of new partners in the last year relates to a longer pre-survey period, so to avoid misclassification of exposure, for this variable, only those who tested over 12 months previously are defined as having received VCT.

To analyse the impact of VCT on behaviour the sample was restricted to the closed cohort (i.e. those individuals who participated in all three surveys, N=3548). In the closed cohort there were 1254 men (35.3%) and 2294 women (64.7%). At baseline, the median

age among men and women who remained in the cohort was 29 and 34 years, respectively.

For each behavioural indicator, the difference in reported behaviour between successive rounds was used to define the outcome variable in order to analyse behaviour *change*, rather than behaviour, as the outcome. Thus, the distribution of the outcome was continuous and centred around zero. Data from the first round was subtracted from second round data to calculate the change in behaviour from the first to the second round. Equally, data from the second round was subtracted from third round data to calculate behaviour change from the second to third round. Thus, negative values indicate a decrease in risk, zero represents no change and positive values represent an increase in risk.

Next, the dataset was reshaped from wide to long format, so that for each individual there was three records (i.e. one per study round). Linear regression models with robust standard errors were fitted to investigate the reported behaviours in the study, including VCT as a variable in the model. Models adjusting for age (5 year categories) and marital status were fitted. Marital status was dropped from the model if inclusion did not significantly improve the fit of the model ($P < 0.05$, likelihood ratio test). In effect, these models assess behaviour change over time, comparing those who received VCT to those who did not receive VCT, stratified by sex and HIV status.

Given that consistent condom use is a dichotomous variable coded as either none/inconsistent or consistent, the value for change in condom use can take three values: -1 (an increase in condom use), 0 (no change) or 1 (a decrease in condom use). Thus, ordinal logistic regression was used to analyse the impact of VCT on consistent condom use. Ordinal logistic regression is an extension of logistic regression and can be used when the outcome is ordered categorical [304].

Although many individuals reported having a non-regular partner, much fewer reported having a non-regular partner in two successive surveys. Thus, the sample size regarding

change in consistent condom use with non-regular partners was small (n=46), and was too small to stratify the analysis by sex and HIV status. Therefore, data was analysed for change in condom use with regular partners only.

For those who tested, HIV status at the time of receiving VCT was used for stratification. This stratification was performed to examine whether those who received a positive test result changed their behaviour more than those with similar initial risks who did not receive VCT. However, changes in behaviour among those who received VCT and were negative at the time of testing are also of interest. If those who seroconverted subsequent to VCT were included as positive in this analysis, the results would be biased for those testing negative to only those who remain negative. Therefore, those who seroconverted following VCT were considered as HIV negative in the analysis, as this was their serostatus when they received VCT. Those who did not test and who seroconverted during follow-up were categorized as positive in the analysis. This assumption applied to 169 individuals (119 seroconversions among non-testers between baseline and the second survey and 50 between the second and third surveys). A sensitivity analysis showed that overall findings were unchanged when these individuals were assumed to be negative in the analysis.

6.4 Results

6.4.1 Uptake of VCT

Provision, awareness and uptake of counselling and testing services

The proportion of participants wishing to know their status was high and increased from 76.0% at the first survey to 87.5% at the second survey (this question was not asked in the third survey). In the third survey (from site 7 onwards), participants were asked about the availability of VCT services. The majority (52.4%) did not know where VCT was available, 36.3% were certain of the availability of a VCT service and the remaining 7.8% were unsure. When asked about distance to the nearest VCT centre in the third survey, 16.5% reported that they have never heard of VCT.

The reported uptake of testing, counselling and collection of results at each survey is shown in Figure 6.1. The high desire to know serostatus reported in the first and second surveys was not translated into actual uptake and completion of VCT. In the second survey, 18% (1216/6559) of participants reported having had a previous HIV test. However, of these, only 56% (680/1216) reported collecting their test results. In the third survey, 10% (1248/12 533) of participants reported having tested. Of these, 86% (1079/1248) received their results. Overall, 8.6% (1079/12 533) of participants in the third survey were defined as having *previously* received VCT. Individuals who only received VCT from the research programme at the third survey are not defined as having received VCT for analysis purposes, as they received VCT after completing the survey questionnaire.

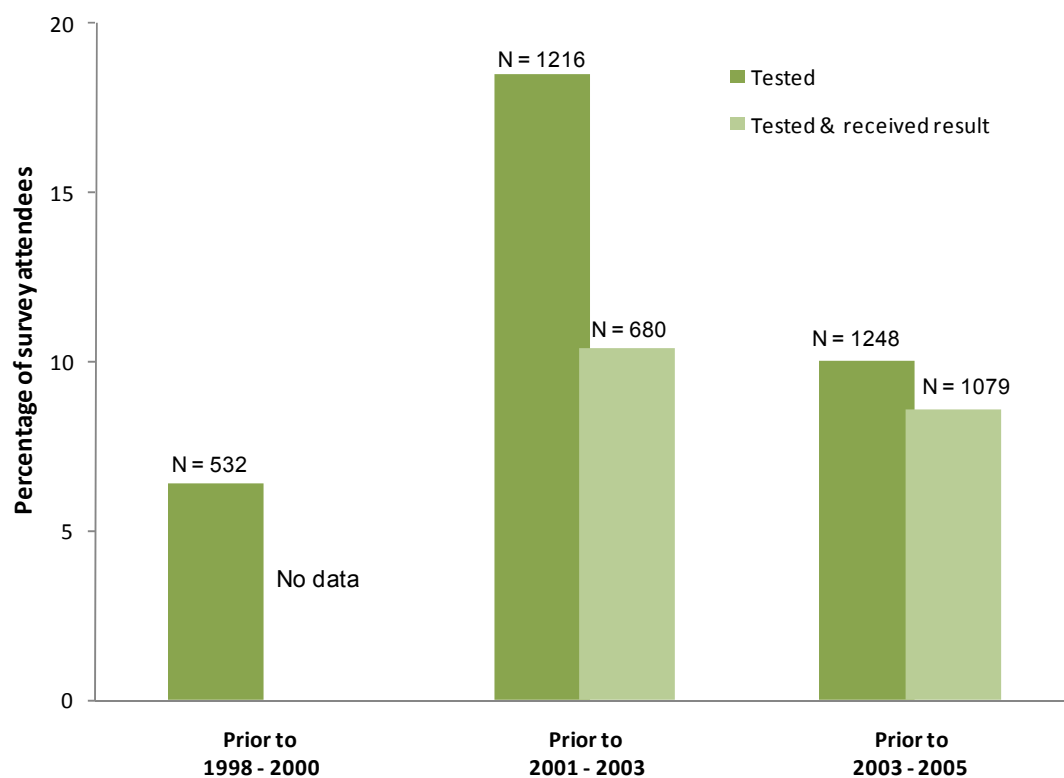


Figure 6.1 Previous uptake of testing and results collection reported by individuals at each survey. In earlier surveys (1998-2000 and 2001-2003) those who reported to have tested may include those who were tested for medical purposes but did not receive their results.

In terms of Prochaska's stages of change model relatively few participants were in the contemplation and planning stages, however, a much larger proportion reported to having thought about going for an HIV test, but had not done anything about it (Figure 6.2). Nonetheless, approximately half of participants (50.11% overall) reported that they have not thought about having an HIV test. Although a greater proportion of women had completed VCT, these findings were similar for both men and women and also for infected and uninfected individuals. These trends in the stages leading to the uptake did not vary by age group (data not shown).

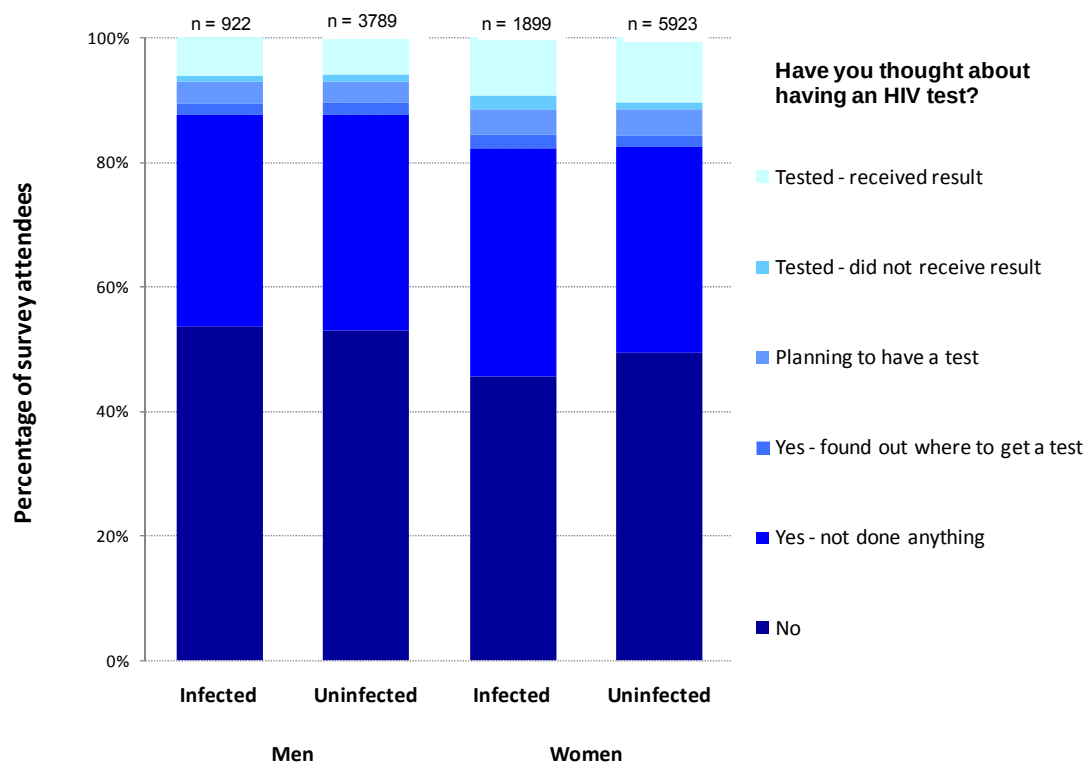


Figure 6.2 The stages leading to the uptake and completion of VCT at the third survey, by sex and HIV status.

Service provision varied between the study communities (Figure 6.3). In the two small towns the majority of participants who had tested had done so at a government hospital or clinic. A similar proportion of participants reported testing with BRTI (i.e. with the

study) and PSI, 18.5% and 18.7% respectively. However, the majority of those who tested with the study lived in the more rural areas i.e. the subsistence farming areas and the tea, coffee and forestry estates. The majority of those who received testing from FACT were resident in towns and roadside trading areas.

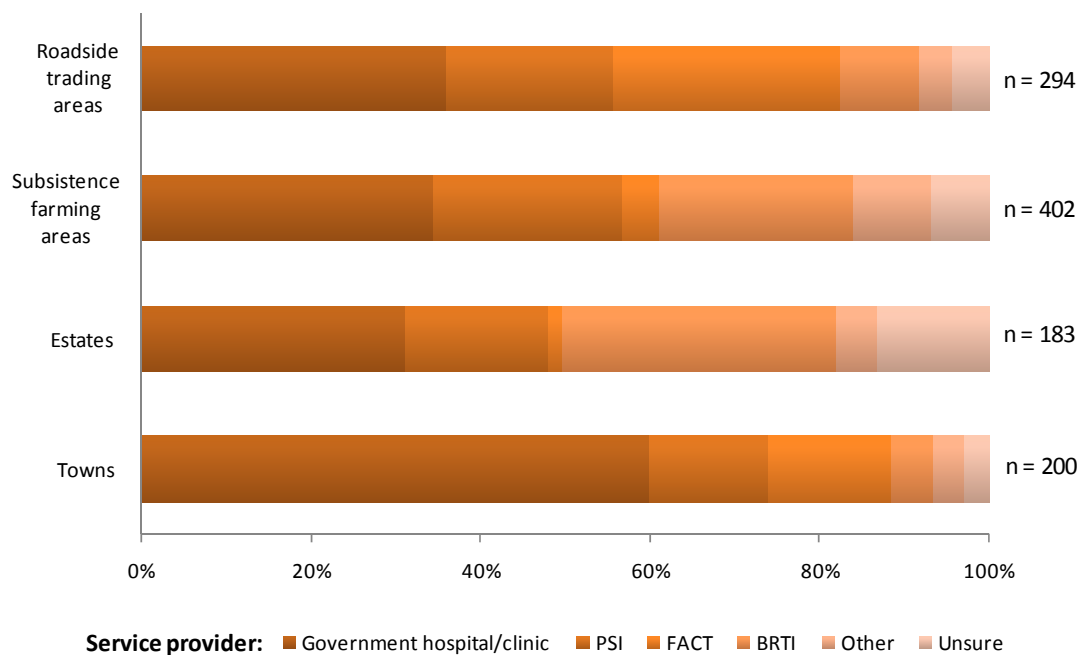


Figure 6.3 Distribution of providers of counselling and testing services in the study communities at the third survey, as reported by those who tested.

At the third survey, the mean distance travelled to receive VCT was 4.6 kilometres (standard deviation 17.3). Participants were asked how much they had to pay for their HIV test (from site 7 onwards). The majority (86%) reported that the counselling and testing they received was free.

Reported reasons for and deterrents from testing

In the first and third surveys all participants were asked, hypothetically, what their reasons for going to receive counselling and testing would be. In the second survey only those who reported to have received a HIV test were asked what their reason for testing was. A list of reasons for testing was provided. Those reasons not listed were specified and then categorised as “other”. At each survey the most commonly reported reason that

people would test was “general concern”, with much fewer participants identifying specific circumstances, such as planning for the future (Figure 6.4). “Wanted reassurance not infected”, which was added at the second survey, was the second most frequent reason for testing in the second and third surveys. Apart from this, the trends in reasons for testing were similar across the three surveys.

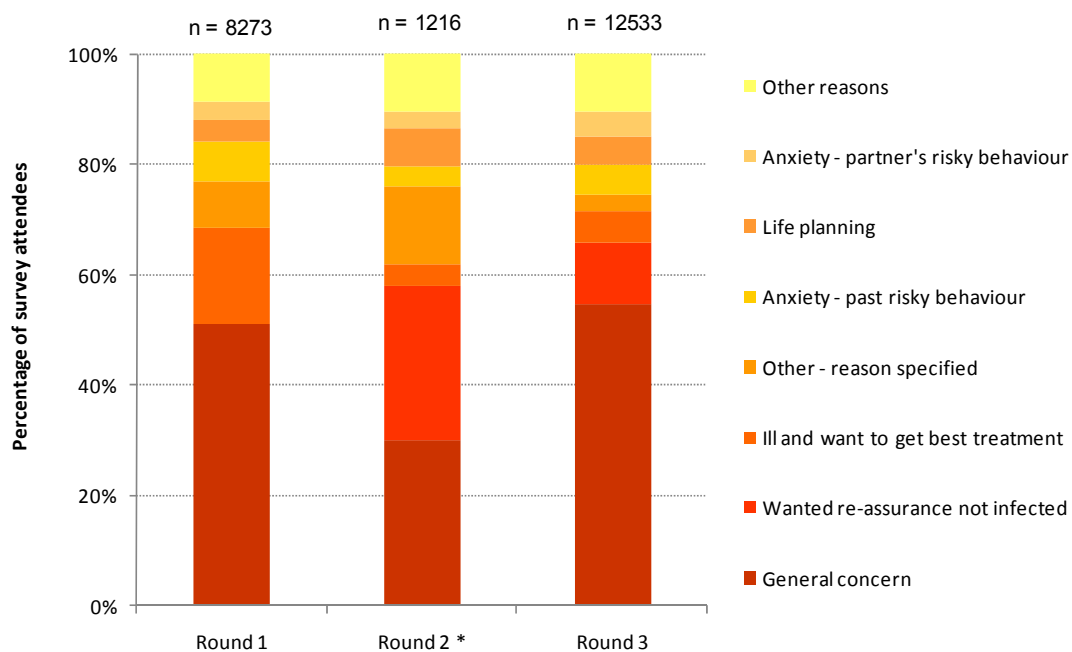


Figure 6.4 Reported reasons for testing at each survey.

* Round 2 illustrates the reasons for testing only among those who actually tested. The response: Wanted re-assurance not infected was added at the second survey. The category “other reasons” includes reasons which were listed but infrequently reported: anxiety regarding other risks; contemplating marriage; avoid infecting partner(s); anxiety regarding ill or deceased partner; contemplating having a child; prevent mother to child transmission; anxiety regarding ill or deceased child; anxiety regarding past blood transfusions or medical injections; doctor or nurse suggested it; partner tested HIV positive; and for an insurance policy.

At each survey participants were asked, hypothetically, what factors would deter them from testing and a list of possible responses was given. A comparison of deterrents across surveys is not strictly appropriate as new deterrents were added at the second and third surveys. However, as with the reasons for testing, general responses such as “psychological effects” were most commonly reported rather than specific deterrents such as partnership dissolution (if in a stable relationship) (Figure 6.5).

Somewhat surprisingly, at each survey a considerable proportion of participants did not find their main concern on the list of suggested responses. An examination of a sample of 120 questionnaires from the third survey revealed that when these individuals specified their concerns the majority said that they had no reason for *not* testing.

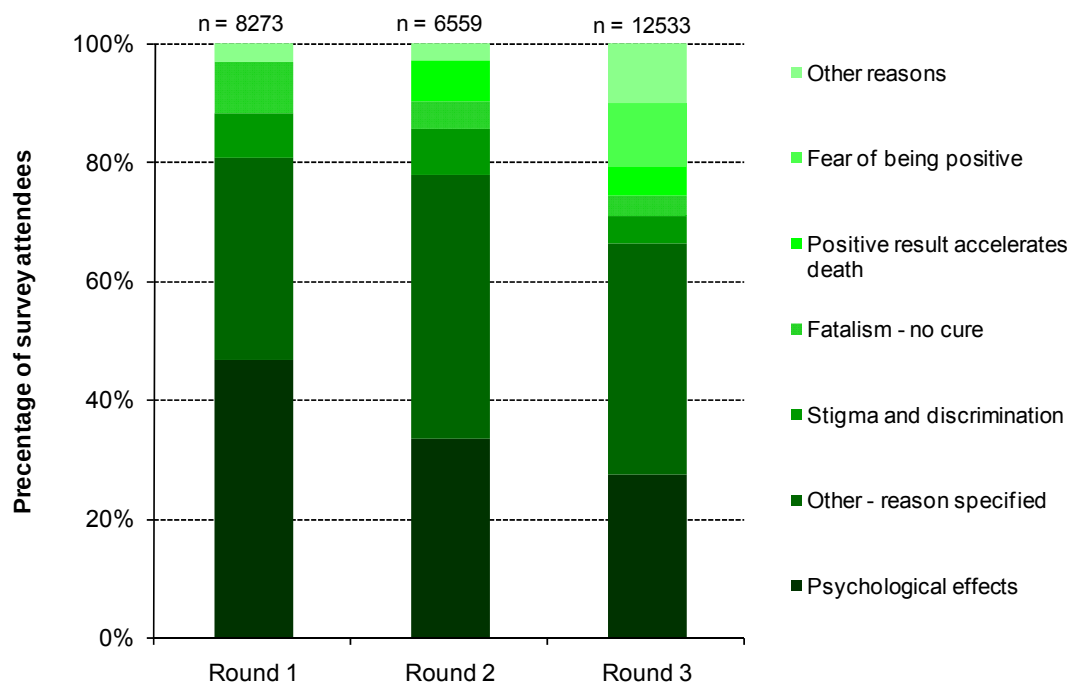


Figure 6.5 Reported deterrents from testing at each survey.

The response “Positive result accelerates death” was added at the second survey and “fear of being positive” was added at the third survey. The category “other reasons” includes reasons which were listed but infrequently reported: partnership breakdown (divorce/separation); job loss; and a number of responses which were only included during the third survey: could not face friends or family; fear of violence; harm to partner; lack of confidentiality and too expensive.

Socio-demographic and behavioural determinants of uptake of VCT

At the second survey, 12% of men and 10% of women in the study population had tested and received their results. The associations between demographic and sexual behaviour variables and uptake of HIV testing among those in the second survey are shown in table 6.2.

Among both men and women, there was a strong positive association between age and uptake of VCT. Large differentials with respect to socio-economic site-type were observed, with uptake of VCT being particularly low in roadside trading centres among men, but not among women. Among men, uptake of VCT was highest among those who were married or previously married (i.e. separated or divorced), whereas among women uptake was highest among those who were widowed.

A relatively high uptake of VCT among the small proportion of men and women who had a higher level education was observed. However, this association was only statistically significant among women. With respect to recent health, there was little difference in VCT uptake among men, whereas women who reported to be seriously ill were twice as likely to have tested than those reporting to be in good health.

Regarding HIV status, infected individuals are more likely to have received VCT than uninfected individuals. However, this association was only statistically significant among women. With respect to sexual risk behaviour, uptake of VCT was lowest among women reporting multiple lifetime partners, partners in the last three years, partners in the last year and current partners, whereas the opposite was generally true for men.

Among women, adjusted analyses found increasing age, a positive HIV status, living in a subsistence farming area or a roadside trading centre, and a higher education to be the key determinants of uptake of VCT. Among men, increasing age and area of residence were found to be the key determinants of uptake, following adjusted analyses.

	Males						Females					
	%	N	OR	(95% CI)	AOR	(95% CI)	%	N	OR	(95% CI)	AOR	(95% CI)
Age												
17-19	3%	199	1		1.18†	**** (1.08-1.28)	5%	266	1		1.08†	** (1.01-1.18)
20-24	10%	608	3.39	*** (1.44-7.98)			10%	612	1.99	** (1.09-3.62)		
25-29	11%	549	3.79	** (1.61-8.95)			9%	605	1.76	* (0.96-3.23)		
30-34	12%	346	4.56	**** (1.90-10.9)			9%	570	1.69	* (0.92-3.12)		
35-39	14%	256	5.43	**** (2.24-13.1)			10%	483	2.03	** (1.09-3.75)		
40-44	15%	216	5.8	**** (2.37-14.2)			11%	501	2.17	* (1.18-3.99)		
45 and older	18%	416	6.84	**** (2.92-16.0)			12%	632	2.38	* (1.32-4.31)		
HIV status												
Negative	12%	2015	1				9%	2661	1		1	
Positive	13%	575	1.14	(0.87-1.41)			12%	1008	1.33	*** (1.08-1.72)	1.63	**** (1.25-2.12)
Socio-economic site-type												
Town	11%	479	1				6%	495	1		1	
Estate	13%	1105	1.21	(0.86-1.69)			8%	1010	1.38	(0.89-2.14)		
Subsistence farming	14%	630	1.27	* (0.88-1.83)			11%	1353	2.02	*** (1.34-3.04)	1.56	*** (1.18-2.26)
Roadside trading centre	4%	303	0.36	** (0.19-0.67)	0.29	*** (0.15-0.56)	11%	735	2.07	*** (1.34-3.21)	1.52	*** (1.14-2.26)
Marital status												
Never married	8%	842	1				7%	232	1			
Widowed	8%	36	1.05	(0.31-3.51)			14%	419	1.99	** (1.12-3.51)		
Divorced	15%	73	2.05	** (1.03-4.08)			8%	291	1.13	(0.48-1.59)		
Separated	17%	35	2.39	* (0.96-5.96)			8%	136	1.11	(0.48-2.05)		
Married	14%	1604	1.84	**** (1.38-2.46)			9%	2591	1.32	(0.77-2.08)		
Education												
Primary/None	13%	784	1				9%	1849	1			
Secondary	11%	1728	0.89	(0.69-1.15)			10%	1717	1.09	(0.87-1.36)		
Higher	18%	49	1.56	(0.73-3.31)			32%	19	4.50	*** (1.69-11.99)		
Knowledge index (per 10 points / 100)			1.01	(0.96-1.13)					1.18	*** (1.09-1.28)	1.17	*** (1.05-1.24)
Recent health												
Good health	13%	1803	1				10%	2647	1			
Recurring sickness	15%	181	1.18	(0.78-1.81)			10%	430	0.98	(0.69-1.31)		
Serious illness	13%	91	0.98	(0.52-1.83)			20%	66	2.13	** (1.14-3.96)		
Visited bar or beer hall												
No	11%	1279	1				10%	3521	1			
Yes	13%	1311	1.16	(0.91-1.51)			7%	148	0.66	(0.34-1.26)		
Thinks spouse has other partners												
No	12%	2275	1				10%	2307	1			
Yes/Don't know	13%	314	1.09	(0.79-1.56)			10%	1355	1.04	(0.83-1.30)		
Age at first sex			1.01	(1.00-1.02)					0.97	* (0.95-1.00)		

Lifetime total partners									
one	9%	471	1			10%	2360	1	
many	13%	2120	1.42	**	(1.01-1.99)	9%	1302	0.92	(0.73-1.16)
Lifetime regular partners									
none	7%	442	1			14%	70	1	
one	13%	994	1.99	****	(1.32-3.02)	10%	2556	0.66	(0.33-1.31)
many	13%	1155	2.08	****	(1.38-3.13)	9%	1036	0.58	(0.29-1.17)
Lifetime non-regular partners									
none	9%	600	1			10%	2920	1	
one	11%	422	1.24		(0.82-1.87)	11%	402	1.12	(0.86-1.67)
many	13%	1569	1.55	***	(1.13-2.12)	7%	340	0.74	(0.48-1.13)
Different regular partners in last 3 years									
none	8%	713	1			13%	650	1	
one	13%	1286	1.79	****	(1.30-2.45)	9%	2766	0.71	*** (0.54-0.92)
many	14%	592	1.89	****	(1.32-2.70)	7%	246	0.51	** (0.29-0.89)
Different non-regular partners in last 3 years									
none	12%	1343	1			10%	3274	1	
one	9%	471	0.71	*	(0.50-1.01)	10%	245	1.04	(0.68-1.60)
many	13%	777	1.11		(0.85-1.44)	6%	143	0.54	* (0.26-1.12)
Different partners in last month									
none	9%	962	1			11%	1521	1	
one	13%	1408	1.49	***	(1.14-1.95)	9%	2107	0.85	(0.68-1.06)
many	15%	221	1.72	**	(1.12-2.65)	12%	34	1.13	(0.39-3.26)
Different partners in last 12 months									
none	8%	484	1			11%	1202	1	
one	13%	1428	1.57	**	(1.09-2.24)	9%	2324	0.83	(0.66-1.04)
many	13%	679	1.57	**	(1.06-2.32)	5%	136	0.44	** (0.20-0.96)
Current sexual relationships									
none	8%	617	1			10%	953	1	
one	13%	1685	1.60	***	(1.16-2.20)	9%	2666	0.91	(0.72-1.17)
many	13%	289	1.71	**	(1.10-2.65)	9%	43	0.90	(0.31-2.56)
Condom use in regular partnerships in last 2 weeks									
None/inconsistent	13%	1299	1			10%	2065	1	
Consistent	56%	135	0.86		(0.50-1.48)	10%	136	0.99	(0.58-1.82)
Condom use in nonregular partnerships in last 2 weeks									
None/inconsistent	15%	223	1			7%	117	1	
Consistent	16%	86	1.05		(0.53-2.07)	8%	39	1.12	(0.28- 4.46)

* p<0.1, ** p<0.05, *** p<0.01, **** p<0.001

† Included as a continuous variable

Table 6.2 Associations between demographic and sexual behaviour variables and uptake of HIV testing, 2001-2003. Source: Sherr *et. al.* [125].

At the third survey, 6% of men and 10% of women in the study population had tested and received their results. The associations between demographic and sexual behaviour variables and uptake of HIV testing among those in the third survey are shown in table 6.3.

For both men and women, age was strongly positively associated with knowing one's status in univariate analyses. Overall, large differentials in uptake of VCT with respect to community were observed; from 2.9% in the Eastern Highlands tea estates, a remote area, to 17.3% in Nyabadza, a roadside trading area, reflecting differences in access to VCT services. Women who had tested were more likely to be married or have been previously married (i.e. widowed or separated). In particular, widows were five times more likely to have tested, compared to women who had never been married. As for women, men who had tested were more likely to be married, separated or divorced. Men who reported to be seriously ill were twice as likely to have tested compared to those who reported to be healthy. Higher education was associated with significantly increased uptake of VCT among men, but not women.

As was observed at the second survey, those who were infected, both men and women, were more likely to have received VCT. However, this association was not statistically significant. In terms of risk behaviour, women who tested tended to report low risk behaviour, whereas the opposite was true for men. With respect to behaviours such as concurrent sexual relationships and having many partners in the last month, those most at risk of infection are not going for VCT.

Among women, adjusted analyses found marital status and area of residence to determine uptake of VCT. Among men, however, education level and poor health were found to be the key determinants of uptake, following adjusted analyses.

	Males						Females					
	%	N	OR	(95% CI)	AOR	(95% CI)	%	N	OR	(95% CI)	AOR	(95% CI)
Age												
15-19	1%	1930	1		1.00 †	(0.99 - 1.02)	4%	2158	1		0.99 †	(0.98 - 1.00)
20-24	7%	1306	9.79	*** (5.65 - 16.97)			9%	1735	2.41	*** (1.84 - 3.16)		
25-29	6%	902	8.29	*** (4.66 - 14.76)			9%	1413	2.34	*** (1.76 - 3.10)		
30-34	7%	790	10.12	*** (5.70 - 17.96)			10%	1148	2.60	*** (1.95 - 3.48)		
35-39	7%	530	9.03	*** (4.89 - 16.66)			10%	870	2.75	*** (2.02 - 3.73)		
40-44	6%	442	7.65	*** (4.00 - 14.64)			11%	919	2.84	*** (2.10 - 3.84)		
45 and older	7%	781	9.11	*** (5.10 - 16.28)			12%	1496	3.15	*** (2.41 - 4.12)		
HIV status												
Negative	5%	5703	1				8%	7911	1			
Positive	6%	1022	1.18	(0.88 - 1.58)			10%	1892	1.17	* (0.98 - 1.39)		
Socio-economic site-type												
Town	5%	1239	1				11%	1416	1		1	
Estate	5%	2149	0.92	(0.67 - 1.27)			4%	2681	0.34	*** (0.27 - 0.44)	0.31	*** (0.24 - 0.41)
Subsistence farming	6%	2175	1.10	(0.80 - 1.50)			9%	3785	0.76	** (0.62 - 0.93)	0.72	** (0.58 - 0.89)
Roadside trading centre	4%	1166	0.82	(0.56 - 1.20)			13%	1924	1.14	(0.92 - 1.41)	1.16	(0.92 - 1.45)
Marital status												
Never married	3%	3284	1				3%	2380	1		1	
Widowed	4%	100	1.45	(0.52 - 4.01)			14%	961	5.02	*** (3.75 - 6.70)	2.03	*** (1.32 - 3.13)
Divorced	8%	188	3.01	*** (1.71 - 5.30)			9%	782	2.80	*** (1.20 - 3.93)	1.28	(0.82 - 2.02)
Separated	6%	48	2.31	(0.71 - 7.58)			7%	196	2.30	** (1.28 - 4.15)	1.21	(0.62 - 2.35)
Married	7%	3109	2.64	*** (2.06 - 3.39)			10%	5487	3.31	*** (2.60 - 4.23)	1.35	(0.92 - 2.00)
Education												
Primary/None	4%	1616	1		1		9%	3672	1			
Secondary	5%	4816	1.19	(0.90 - 1.57)	1.44	** (1.03 - 2.01)	9%	5611	0.99	(0.85 - 1.15)		
Higher	18%	181	4.97	*** (3.15 - 7.81)	2.72	*** (1.50 - 4.92)	11%	76	1.22	(0.58 - 2.57)		
Recent health												
Good health	7%	2790	1		1		10%	4742	1			
Recurring sickness	7%	191	1.08	(0.61 - 1.89)	1.14	(0.64 - 2.00)	12%	604	1.25	* (0.96 - 1.63)		
Serious illness	13%	113	2.08	** (1.19 - 3.66)	2.22	** (1.26 - 3.92)	9%	140	0.87	(0.48 - 1.58)		

Visited bar or beer hall									
No	4%	4299	1			9%	9498	1	
Yes	6%	2426	1.44	***	(1.15 - 1.79)	7%	302	0.75	(0.47 - 1.18)
Thinks spouse has other partners									
No	7%	3239	1			11%	5146	1	
Yes/Don't know	6%	170	0.92		(0.49 - 1.72)	10%	2092	0.91	(0.77 - 1.07)
Age at first sex			1.04	**	(1.01 - 1.08)			1.04	** (1.01 - 1.07) 1.02 † * (0.99 - 1.05)
Lifetime total partners									
one	6%	917	1			11%	5277	1	1
many	7%	3956	1.14		(0.84 - 1.55)	8%	2407	0.69	*** (0.58 - 0.82) 0.81 * (0.64 - 1.04)
Lifetime regular partners									
none	4%	1201	1			10%	347	1	
one	7%	2293	1.68	**	(1.22 - 2.31)	11%	5905	1.17	(0.81 - 1.69)
many	7%	1439	1.63	**	(1.16 - 2.30)	8%	1507	0.81	(0.54 - 1.21)
Lifetime non-regular partners									
none	7%	848	1			11%	6049	1	1
one	6%	870	0.82		(0.55 - 1.20)	10%	1016	0.95	(0.77 - 1.19) 1.18 (0.88 - 1.58)
many	6%	3212	0.91		(0.67 - 1.22)	6%	684	0.49	*** (0.35 - 0.68) 0.60 ** (0.40 - 0.91)
Different partners in last month									
none	6%	1666	1			11%	2909	1	
one	7%	2951	1.03		(0.80 - 1.31)	10%	4808	0.86	** (0.74 - 1.00)
many	4%	314	0.58	*	(0.31 - 1.06)	3%	37	0.22	(0.03 - 1.61)
Current sexual relationships									
none	5%	1185	1			11%	2133	1	
one	7%	3305	1.37	**	(1.03 - 1.83)	10%	5583	0.84	** (0.71 - 0.98)
many	4%	444	0.77		(0.45 - 1.31)	5%	41	0.39	(0.09 - 1.65)
Condom use in regular partnerships in last 2 weeks									
None/inconsistent	7%	2468	1			9%	3786	1	
Consistent	5%	330	0.72		(0.42 - 1.20)	12%	278	1.31	(0.89 - 1.92)
Condom use in nonregular partnerships in last 2 weeks									
None/inconsistent	3%	90	1			5%	75	1	
Consistent	6%	68	1.81		(0.39 - 8.38)	13%	15	2.73	(0.45 - 16.48)

* p<0.1, ** p<0.05, *** p<0.01, **** p<0.001

† Included as a continuous variable

Table 6.3 Associations between demographic and sexual behaviour variables and uptake of HIV testing, 2003-2005. Source: Cremin, MSc thesis.

6.4.2 Outcomes following counselling and testing

Disclosure of serostatus

In the third survey those who reported to have tested were asked about disclosure. Of those who had previously received VCT, 23.8% (257/1079) reported to have tested together with a spouse or prospective spouse. Those who reported that they did not receive counselling and testing with a spouse or prospective spouse were asked about disclosure (N=719). Participants were not asked about disclosure to casual sex-partners.

Overall, the rate of disclosure among those who report having a spouse or regular partner (N=640) was similar among men and women (80.4% vs. 84.2%, $p=0.272$) and significantly higher among uninfected individuals than infected individuals (84.6% vs. 76.9%, $p=0.050$). Rates of disclosure for married individuals stratified by gender and HIV infection status are shown in table 6.4.

	Women		Men	
	Positive (N=79) %	Negative (N=408) %	Positive (N=29) %	Negative (N=124) %
Disclosed test result:				
Yes	74.7	86.0	82.8	79.8
No	25.3	14.0	17.2	20.2
Total	100	100	100	100

Table 6.4 Level of disclosure of HIV test results among married individuals at the third survey, stratified by gender and HIV status.

Among men, an increase in the level of disclosure was observed with increasing age: from 56.8% among 15-24 year olds, to 86.4% among 25-34 year olds, 81.8% among 35-44 year olds and 100% among those older than 44 years. No clear relationship between age and disclosure was observed among women, with disclosure being greatest among 25-34 year olds (at 89.2%) and lowest among those aged 35-44 (at 77.5%).

Those who reported to have received a positive test result (N=128), were asked who they disclosed to, with 35.9% disclosing to their spouse or regular partner, 19.5% to a family member, 12.5% to someone else and 32.0% did not disclose to anybody. Of those self-reported positives who did disclose (N=87), 72.4% reported that response they received was supportive.

Of those who tested and had a spouse or regular partner, 2.57% (25/974) reported that they separated from their partner after receiving the test results. Surprisingly, of those who separated (N=25), 19 had received a negative test result, suggesting that the test result was unlikely to be the only reason for separation.

VCT and subsequent sexual behaviour

As discussed in Chapter 5, there have been declines in reported risk behaviours, among both men and women, during the study period. Against this background of considerable declines in risk behaviour, including reductions in casual sex [230], no significant additional behavioural risk reduction associated with VCT was observed among either HIV positive or negative men (Table 6.5).

Women who received a negative test result increased their frequency of bar attendance and their number of partners in the last month relative to negative women who did not test. However, for both indicators the magnitude of these effects are small and are driven by modest changes in behaviour among a small number of individuals (Table 6.5).

With respect to bar attendance, the majority of negative women reported that they had not visited a bar or beer hall in the last month - 96.1%, 96.2% and 98.0% in the first, second and third rounds, respectively. The majority (94.6%) of negative women did not change their behaviour over the three rounds. The mean change among negative women who had not tested was a reduction of 0.096 visits, whereas, the mean change among negative women who had tested was an increase of 0.007 visits (a very small change driven by an increase among a small number of women (<10)).

The vast majority of negative women reported having zero or one partners in the last month – 99.6%, 99.8% and 100% in the first, second and third rounds, respectively. The majority (69.8%) of negative women did not change their reported number of partners in the last month over the three rounds. The mean change among negative women who had not tested was a reduction of 0.027 partners, whereas, the mean change among negative women who had tested was an increase of 0.038 partners (a very small effect driven by an increase among a small number of women).

	HIV positive			
	Males		Females	
	Coefficient	95% CI	Coefficient	95% CI
Visited bar/beer hall in the last month	1.32	(-0.83, 3.47)	0.11	(-0.14, 0.37)
New sexual partner in past year ^a	-0.01	(-0.24, 0.23)	-0.03	(-0.23, 0.17)
Sexual partner in past month	0.01	(-0.19, 0.22)	0.05	(-0.06, 0.16)
Multiple concurrent partners	0.11	(-0.04, 0.27)	0.004	(-0.08, 0.09)

	HIV negative			
	Males		Females	
	Coefficient	95% CI	Coefficient	95% CI
Visited bar/beer hall in the last month	-0.08	(-1.06, 0.90)	0.10 *	(0.01, 0.20)
New sexual partner in past year ^a	0.09	(-0.06, 0.23)	0.02	(-0.01, 0.06)
Sexual partner in past month	0.03	(-0.06, 0.12)	0.07 *	(0.01, 0.13)
Multiple concurrent partners	0.08	(-0.03, 0.18)	0.02	(-0.02, 0.07)

^a Those who had tested within the year before the survey were categorized as not tested when defining the indicator for having received VCT.

* P < 0.05

Table 6.5 Sexual behaviour change following VCT, from linear models predicting change in behaviour. A coefficient of zero indicates no change.

Footnote: All models were adjusted for age, however marital status was only adjusted for if inclusion significantly improved the fit of the model. The following models adjusted for marital status: multiple concurrent partners – men and women, positive and negative; partners in the last month – negative men, positive and negative women; and new partners in the last year – negative men and negative women.

No significant change in consistent condom use in the last two weeks with a regular partner associated with having received VCT was observed among neither men nor women (Table 6.6).

	Odds ratio	Std. Err	95% CI
HIV positive:			
Males	0.79	0.48	(0.24 - 2.58)
Females	0.54	0.26	(0.21 - 1.39)
HIV negative:			
Males	0.83	0.35	(0.36 - 1.91)
Females	1.00	0.33	(0.52 - 1.92)

Std. Err: Standard error

* P < 0.05

Table 6.6 Change in consistent condom use in the last two weeks with a regular partner associated with having received VCT.

An analysis of the impact of VCT on HIV incidence is not presented due to a low number of seroconversions between the second and third surveys and, as a result, large uncertainty in the estimate of incidence exists among those who had received VCT.

6.4.3 Qualitative insights from a focus group discussion

A focus group discussion was carried out to gain insight into some of the issues relating to the uptake of counselling and testing services and the behavioural impact following testing. This focus group discussion was carried out in January 2009 at Hauna growth point (one of the study sites) by one of the study's nurse counsellors. A small group of individuals from households (randomly selected) in the community were invited to join. Five men and three women participated, none of whom had tested previously. An outline of open-ended questions was used in order to guide the discussion.

The participants had a good understanding of the purpose of VCT and what it involves. Family planning was cited, by two of the women, as one of the reasons for testing. The main barriers to testing raised by the participants were: fear of marital breakdown (in particular for sero-discordant couples); emotional stress; apprehension regarding the cost

of treatment and lack of confidentiality. One woman outlined how knowing her status would be futile if she was faithful to an unfaithful husband who infected her:

“..maybe I would have been faithful, and the husband promiscuous, so if I hear that I now have the disease, one might say it’s better to die than be seen ill or suffering when I wouldn’t have been responsible for bringing the virus.”

It was noted by the participants that going for testing with one’s partner would be best as going alone would not be helpful because they would continue having sex with their partner whose serostatus would be unknown. One woman hypothetically outlined the difficulty of testing alone and the risk of marital breakdown as a barrier to testing:

“Yes, it [testing] breaks a marriage, that’s why it results in other people not getting tested. I might be willing and have decided to go for testing and my husband will be unwilling, then I decide to go for a test and discover that I’m positive and my husband will be the only partner I would have slept with, and he will be thinking he is negative, so it’s not easy to disclose my status to him because in his mind he also believes I’m also his first wife. So it results in dissolution of marriages, that’s why many people we do not get tested.”

This issue was raised later in the discussion by another participant:

“It is not easy to test negative whilst you don’t know about your husband’s status, because I will not feel comfortable when I have sex with him, thinking probably he is going to infect me today.”

Conversely, another participant expressed that it was better for a woman to get tested alone, as if she was infected she could hide her ART card with the nurses and not disclose to her partner. However, there was a misunderstanding regarding the efficacy of treatment, with this woman saying that despite being on treatment the virus would continue to multiply if you continued to have unprotected sex.

One man described how one's perception of their own serostatus may influence their decision to test:

"...you know you are healthy and you may never had developed abscesses or other signs and symptoms related to HIV, so these occur and through your past history you might be sure you now have the disease, so it's meaningless to get tested."

Despite citing more barriers to testing than positive aspects, overall they agreed that the advantages of knowing one's HIV status outweighed the disadvantages.

The participants were reluctant to discuss changing sexual behaviour following counselling and testing, saying that maybe some people will and some people won't. When asked about condom use, it was noted that it is uncommon within a marital union and that it is difficult to begin using condoms, unless both partners have gone for counselling.

6.5 Discussion

As a scale-up in provision of VCT services and access to treatment in sub-Saharan Africa is underway, it is important to monitor the uptake of VCT and its impact on sexual behaviour. In this rural Zimbabwean population, the uptake of VCT services is increasing gradually, but remains low compared with some other countries with generalized HIV epidemics [305]. In Zimbabwe, there have been widespread reductions in risk behaviour over the study period [230]. The analysis compared behaviour change among those who tested to those who didn't to distinguish behavioural changes associated with receiving VCT from background reductions in risk. It was found that receiving VCT did not influence subsequent sexual behaviour, regardless of sex and serostatus, with the exception of very slightly increased bar attendance and reported number of partners in the last month among women testing negative.

The findings that at the most recent survey, approximately 90% of respondents were unaware of their HIV status and half (50.1%) reported that they have not even thought about having an HIV test are of concern, given that the HIV prevalence in this population

at this time was 16.5% among men (17-54 years) and 20.5% among women (15-44 years). Previous community surveys in Zimbabwe have found that 50-70% of adults believed themselves to be infected despite the fact that most were not [60]. The consequences of such a combination of perception and reality, in the context of high HIV prevalence and scarce available treatment, may result in low motivation for attending VCT. Learning one's HIV status is likely to be a daunting proposition in a country in which up to one in five adults (aged 14 – 49) are infected, an estimated 3,000 people die each week from AIDS-associated illnesses, and there is very limited treatment. Furthermore, when VCT is still uncommon the psychological and social barriers to its use may be substantial.

One possible explanation for the unusual trend in receipt of test results is that the question regarding HIV testing at the second survey may have been misinterpreted. At the second survey, participants were asked “Have you ever had a test for HIV before?” It was explained that they did not need to know the result. It is possible that participants may have confused the blood taken for the anonymous serosurvey, which they did not receive results for, as a HIV test as a component of VCT. However, at the third survey, the question was re-phrased and participants were asked “Have you thought about having an HIV test?” to which there was a choice of five responses.

Although the uptake of counselling and testing in the Manicaland cohort is low, the level of disclosure following testing is relatively high, is broadly representative of the level of disclosure found in a recent national DHS survey (2005-2006), and is consistent with reported disclosure rates among women in other developing countries [306]. Although marital breakdown was discussed as one of the main deterrents of uptake of testing and disclosure in the focus group discussion, this is not supported by the data, as the reported frequency of separation subsequent to disclosure in Manicaland is low (2.5%), unlike in other settings in developing countries [306]. Whilst the focus group discussion provides some interesting insights regarding the uptake of testing, the findings cannot be over-interpreted given that it is a single discussion among just eight people.

Previous analyses regarding behavioural change associated with receiving VCT in this study population used data from two surveys and different statistical methods, and found greater reductions in risk behaviours among individuals testing positive - but increased risk among individuals testing negative - than in the general (i.e. untested) population [125]. The differences in findings between this analysis and previous work may reflect changes occurring over time in the context, nature (including quality), profile of testers, and effect of VCT, as well as the differences in the statistical methods used. Unlike in the earlier analysis, account was taken here of the magnitude of change in particular behavioural variables, using behaviour change as the outcome. Furthermore, the current analysis is stratified by HIV infection status, whereas the earlier report was based on separate comparisons between positive and negative individuals who took up VCT and all individuals (i.e. positive and negative individuals combined) who had not received VCT.

Increases in risk following receipt of a negative test result have been reported elsewhere. A recent study among commercial sex workers in Senegal found that previous HIV testing was inversely associated with consistent condom use with regular partners. In addition, women who reported that they tested negative were over 80% less likely to always use condoms with their regular partner (adjusted prevalence ratio = 0.17 , 95% CI: 0.08 – 0.36) as compared to women who had not tested [307]. Studies in developed countries, among homosexual men in particular, have found evidence for increased risk behaviour following a negative test result [308, 309]. Sherr et. al. outline how receipt of a negative test result may be interpreted as “permission for risk” or enhancing a belief of being “impervious to risk”, in particular following a risk exposure [125].

The potential for VCT to have the unintended effect of increasing risk behaviour is of concern and is something which should be addressed when planning for VCT service provision. Avoiding unintended consequences of VCT highlights the importance of good quality post-test counselling which emphasises the importance of the practice of safe sex, even following a negative HIV test result.

As discussed in Chapter 3, evaluating the evidence for the impact of VCT on sexual behaviour is difficult because studies are diverse with respect to design, outcome measures, statistical analyses and comparison groups, participant characteristics and service provision. The lack of behavioural impact following VCT reported here is in contrast to the findings from the VCT Efficacy Study Group's multi-centre RCT [310]. However, this study reports reductions in formation of new partnerships, whereas the outcome of interest in the RCT was unprotected intercourse. In addition, these findings are in contrast to the conclusions of two previous meta-analyses (one in developed settings and the other in developing settings) which concluded that VCT can be effective for risk reduction among those testing positive [69, 200]. However, these findings are consistent with those of Matovu *et al.*, who report no difference in number of sexual partners among acceptors and non-acceptors of VCT, and no significant change in risk during follow-up among those who accepted or refused VCT, in Rakai, Uganda [134]. However, as noted in Chapter 3, almost half of participants (50.9% of VCT acceptors and 41.2% of non-acceptors) had previously received home-based VCT from the Rakai program.

Previous studies of VCT services in Zimbabwe have achieved higher levels of uptake than was observed in the current study in contexts such as ANC [311], workplace VCT programmes [138], and mobile same day testing [128]. The profile of testers and the effect of VCT are likely to differ according to the method of VCT provided and the specific context in which it is offered, so it is uncertain to what extent these results can be generalised beyond the particular study setting i.e. rural Eastern Zimbabwe [231, 312, 313]. The effect of the introduction of rapid testing on the uptake of counselling and testing remains to be seen in the forthcoming data from the fourth survey. Furthermore, the current study was undertaken in the pre-ART era. The expansion of VCT services, provision of treatment, and the switch to provider-initiated VCT will likely have important implications for the demand for VCT and its effect on sexual behaviour. Lack of treatment has almost certainly been a barrier to uptake of VCT in this population, as

the majority (83%) of participants at the third survey reported that they would test if cheap treatment was available.

One of the limitations of these analyses is that these data do not capture short-lived changes in behaviours measured over the short-term, such as consistent condom use and concurrency. Thus, if an individual reduced their risk immediately after VCT, but this risk reduction was not maintained until the subsequent study survey, this change would not be identified. Mathematical modelling studies of the population-level impact of VCT have found that a critical determinant of the preventive benefits of VCT is the duration of changes in behaviour [237]. If high risk sexual behaviour is reduced following VCT, but these reductions are not maintained, the epidemiological impact of the intervention will be greatly reduced. Furthermore, slight changes in behaviour among negative individuals can result in substantial impact at the population level, as the majority of the population will be uninfected.

VCT can present an opportunity for encouraging sexual behaviour change, which is essential if the transmission of HIV is to be abated and the provision of ART is to be sustainable. Provision and uptake of testing is increasing as efforts to find infected individuals to start therapy intensify. But, for VCT to be a successful prevention intervention, it must lead to sustained risk reduction among both infected and uninfected individuals. Thus, research is required as to how counselling can best be provided to facilitate behaviour change. Furthermore, the importance of adopting and maintaining reductions in risk behaviour must be emphasized through high-quality counselling.

Chapter 7: Discussion

7.1 Aims and organisation of chapter

Detailed discussions of the topics covered in this thesis have been presented at the end of each relevant chapter. The aim of this chapter is to provide an overview of this thesis as a whole. It draws together the main findings of each chapter, outlines the limitations of the analyses presented and considers the future direction of this research.

7.2 Summary of main findings

Given the self-selection of individuals who come forward for counselling and testing, the determinants of uptake of testing are of importance. Additionally, the role of testing for prevention has to date been uncertain. Thus, the effectiveness of receiving counselling and testing for behavioural risk reduction is central to this thesis.

For these reasons, a theoretical framework was developed for the determinants of uptake of testing and the behavioural outcomes following testing. This framework was subsequently used to guide the statistical analyses within this thesis. In terms of outcomes following testing, the focus is on behavioural change. Thus, a review of studies assessing the impact of counselling and testing on sexual behaviour was carried out. This review found evidence regarding the efficacy of VCT for behavioural risk reduction to be mixed. The largest changes in behaviour have been observed among those in sero-discordant partnerships and among individuals testing positive, while little evidence exists for risk reduction following receipt of a negative result.

Patterns of uptake of testing among sexually active adults was compared using data from ten DHS from the period 2003 to 2005 in sub-Saharan Africa. Across these ten countries, knowledge of serostatus was lowest among women in Guinea, at 2%, and highest among women in Rwanda, at 27%. Despite varied levels of testing, univariate analysis indicate the socio-demographic profile of testers to be remarkably similar across countries, with those who are younger, well-educated, relatively wealthy and living in urban areas to be more likely to have tested. Overall, infected individuals are more likely to have tested and received their results than uninfected individuals, with the exception of those in Senegal and Guinea. Adjusted analyses indicate that a secondary or higher level of education and

an awareness that treatment exists are the key determinants of uptake of testing, once other characteristics have been taken into account.

To understand the impact of counselling and testing on sexual behaviour, trends in sexual behaviour must first be described. Hence, the overall trends in sexual behaviour in the Manicaland study population were analysed. Overall, there have been declines in reported risk behaviour during the study period, in particular between the first and second surveys. As has been previously reported [265], substantial gender differentials in reporting of number of sexual partners were found.

The impact of VCT on subsequent sexual behaviour in the Manicaland cohort was analysed. Uptake of VCT in the Manicaland cohort was low, with 8.6% of participants in the third survey reporting to have previously received counselling and testing. While almost half of participants reported that they have not thought about having an HIV test, when asked, the majority reported that they would like to know their serostatus. Although uptake of testing was low, disclosure of serostatus following testing was relatively high, at over 80%. In the context of considerable declines in risk behaviour in the study population overall, no significant additional behavioural risk reductions associated with having received VCT were observed among neither men nor women, regardless of serostatus. Conversely, slightly increased bar attendance and new partners in the last month was found among some women testing negative.

7.3 Limitations

The limitations of the analyses presented in this thesis fall into three broad categories, that of data deficiency, data quality and analytical issues. Although DHS data are ideal for cross-country comparative analyses, the cross-sectional nature of these data meant that it was only possible to use this data to analyse the uptake of testing and not the impact of VCT on subsequent sexual behaviour also. However, large-scale behavioural surveys which follow-up individuals over the long-term are logistically challenging and expensive to conduct. This highlights the value of data from longitudinal cohort studies in

addressing questions such as those regarding the effectiveness of VCT for behavioural risk reduction.

It was not possible to test certain aspects of the theoretical framework. Data regarding the availability and type of testing service provision, as well as the level of treatment availability, were not available to be included in the cross-country comparative analyses of uptake. Also, data on certain individual-level measures were not collected by the DHS, general health status for example. Thus, the hypothesis that ill health may act as a motivation to receive counselling and testing could not be tested.

There are many issues surrounding the quality and reliability of sexual behaviour data, which have been well documented. For example, social-desirability bias and recall bias can lead to under-reporting and inconsistent reporting. However, an informal confidential voting method was used when collecting sexual behaviour data in the Manicaland cohort to minimise social-desirability bias. Furthermore, although high levels of inconsistent reporting of age at first sex and age at marriage were identified, this did not introduce bias to the observed trends in these indicators.

In terms of analytical issues, low uptake of VCT within the Manicaland cohort meant that there was insufficient sample-size to analyse incidence of HIV as an outcome following VCT. However, there may be sufficient statistical power to analyse the impact of VCT on subsequent incidence using a forthcoming survey data collected from 2006 to 2008.

7.4 Public health implications

The profile of individuals who test for HIV, in terms of socio-demographic characteristics, has implications for equitable access to treatment. In terms of testing as a means of identifying those in need of treatment, an over-representation of infected individuals, as described in chapter 4 (figure 4.2), is encouraging. In addition, uptake of testing was found to be higher among women than among men in many of the countries analysed, perhaps reflecting pregnant women receiving testing through ANC and PMTCT

services. The increasing provision of testing through PMTCT programmes (largely attributable to the expansion of provider-initiated opt-out testing in health care settings and the use of rapid testing with same day results) implies increasing access to treatment among women. Indeed, recent data regarding treatment provision show that women are slightly advantaged compared with men. In 35 countries in sub-Saharan Africa (those with disaggregated data), 64% of adults receiving ART were women, while women represent 60% of adults in need of ART [17]. Thus, effort is required to promote testing among men in order to avoid a “gender-gap” in access to treatment, whereby women have more access.

In terms of equitable access to treatment, the under-representation of those with little or no education who live in rural areas in the poorest households, and who are unaware of treatment, amongst those accessing testing, is concerning. Thus, testing services need to be targeted to these groups and outreach services should continue to be used to provide services in rural areas where access to testing is low.

The relationship between access to treatment and type of treatment provided is not clear. However, in low and middle-income countries, the most common first-line treatment regimens among adults are: stavudine + lamivudine + nevirapine (45%), followed by zidovudine + lamivudine + efavirenz (18%), zidovudine + lamivudine + nevirapine (17%), stavudine + lamivudine + efavirenz (11%) and tenofovir-based regimens (8%) [17].

In the Manicaland cohort it was found that neither individuals testing positive nor individuals testing negative reduced their risk behaviour relative to untested positive and negative individuals, respectively. While these findings regarding the impact of VCT on subsequent sexual behaviour do not support VCT as an effective preventive strategy, this does not negate the need to expand access to VCT services. However, expansion should be carried out concomitantly with evaluation of testing services in order to determine (i) how to gain preventive benefit from VCT and (ii) how VCT can be improved so as to

maximise its behavioural impact. In terms of service provision, emphasis must be placed on providing high quality risk reduction counselling.

A challenge in analysing the impact of VCT on sexual behaviour is that factors determining uptake may confound the impact of VCT. In settings where VCT has been shown to reduce risk behaviour, individuals coming forward for VCT may have already committed to behaviour change. It is not clear how increasing the provision of VCT services will increase demand and therefore increase uptake of VCT. Furthermore, it is not clear if, and how, the behavioural profile of those coming forward for VCT will change as provision of services increase. When uptake is low and knowing one's HIV status is uncommon an average VCT client may differ substantially (in terms of their level of risk and intention to reduce their risk) from an average VCT client when uptake is high and knowledge of one's HIV status is a social norm. Importantly, the uncertainty of how supply of VCT influences demand for VCT limits the extent to which conclusions about the impact of VCT on sexual behaviour can be generalised and extrapolated.

7.5 Future direction

The field of research related to HIV testing and the context of HIV testing itself is changing. Rapid testing and oral swabs mean that testing can be done quickly and painlessly. Newer more convenient approaches to service provision, such as home-based testing is making testing more accessible and convenient. Large increases in provision of services and new policy regarding provider-initiated opt-out testing are leading to increased uptake. Importantly, the availability of treatment is removing a major barrier to testing and is also playing an increasingly important role in prevention.

However, tension can arise between individual-level benefit and population-level benefit regarding HIV testing. Although there are benefits to knowing one's HIV status, the decision to test is not an easy one, as there are also many psychological barriers and potential negative outcomes as a HIV diagnosis cannot simply be reduced to its medical content, as discussed in chapter two. However, the public health importance of HIV counselling and testing is great, given the central role of testing for treatment and

potentially for prevention of HIV. This tension between what is best for an individual and what is best for a population is a recurring theme in public health and has been widely discussed, particularly with regard to vaccination uptake. In the absence of treatment there is a conflict between what is best for the individual and what is best for the population and for public health. However, as treatment becomes increasingly available this conflict is reduced, even removed. It is rare to override an individual's right in the interest of public health, (one example is the WHO recommendation for obligatory vaccination during the smallpox eradication campaign), but HIV testing is not a situation where this should occur. HIV testing without informed consent and confidentiality is a violation of human rights and should be discouraged.

Confidentiality is one of the key guiding principles of expanded counselling and testing services [26, 27]. A perceived lack of confidentiality is often reported as a deterrent from counselling and testing [90, 92, 174, 314-316]. For example, rumours may spread about counsellors in certain clinics not maintaining confidentiality of test results, and this discourages others from seeking counselling and testing. A lack of anonymity may also be an issue in rural areas where the counsellor is local and knows many of those from the surrounding area who attend a health facility to receive VCT. Qualitative work in rural Malawi found that respondents expressed a preference for counsellors who are not local or known in the area [161]. In addition, confidentiality is essential for maintaining trust between the client and the counsellor, which can facilitate an open discussion for behavioural risk reduction. For these reasons, the importance of confidentiality and privacy must be emphasised when training those who provide counselling and testing.

Despite much variability in the published literature regarding the impact of VCT on behaviour, it is apparent that VCT can and does motivate behaviour change. However, it is equally apparent that VCT does not always lead to reductions in risk behaviour, as evidenced by the findings from the Manicaland cohort presented in chapter 6. It is clear that there are many factors which influence the potential effectiveness of VCT for behavioural change. Potential influencing factors can be broadly categorised as those

surrounding the service provision and quality of counselling and those relating to the individual.

Firstly, the availability of well-trained staff to provide good quality counselling is of importance. The provision of follow-up counselling may be important for continued support and encouragement, if required. The nature, amount and quality of the counselling itself is important as poor quality counselling may hinder the effectiveness of VCT for behavioural change. However, VCT services with the Manicaland cohort was provided by trained nurse counsellors and so the lack of impact is unlikely to be a consequence of the standard of counselling provided.

Secondly, it is necessary for the individual to have the intention and motivation to adopt safe behaviour. However, an individual's sexual behaviour may not be intrinsically "risky". For example, in Lesotho, an estimated 35% and 62% of incident infections in 2008 occurred among people who reported a single sexual partner in the last year [317]. Thus, an individual's partner also needs to be willing to adopt safe behaviour. This underscores the importance of couple counselling and testing for facilitating behaviour change.

Thirdly, there are a number of psychological factors which may influence behaviour change, such as an individual's perception of their own risk of infection and vulnerability, as well as the balance between the anticipated positive and negative outcomes of preventive behaviours, such as condom use, as outlined in chapter 3. Weinhardt *et. al.* argue that research explicitly guided by theories of behaviour change is required to understand and enhance the effectiveness of VCT for reducing risk behaviour [200].

Although counselling and testing services are essential for treatment provision, their role in prevention is still debated. In a call for a shift in prevention priorities, Potts *et. al.* questioned the efficacy of VCT, among other "established" prevention measures (i.e. condom promotion and distribution and treatment of other STIs) [318]. However, this proved to be controversial. UNAIDS responded to note that with respect to VCT, it has

been proven to reduce risk behaviour among those testing positive [319]. Given that there is some evidence for VCT to be a strategy which can promote risk reduction, attention should now be focused on addressing how VCT services can be improved to maximise behavioural impact.

The importance of HIV testing, in terms of positive prevention (i.e. prevention for positive individuals), has recently been emphasized [320]. It has been proposed that HIV negative partners in sero-discordant couples are likely to be the largest risk group for infection in sub-Saharan Africa [320]. Hence, partner counselling and testing needs to be promoted in order to reduce transmission.

To date, research regarding the impact of VCT has focused on the level of the individual or couple, and the social impact in terms of decreasing denial, increasing support, increasing acceptance of condoms etc, of VCT has not been investigated. At a community level, increasing levels of uptake of HIV counselling and testing may have important social impact through individuals knowing and disclosing their serostatus, thus paving the way for changes in social norms (moving away from silence and stigma surrounding HIV and moving towards improved social support) regarding HIV/AIDS [185]. A large RCT of community mobilisation, mobile HIV testing, same-day results and post-test support, known as Project Accept, was begun in 2004 to investigate, among other outcomes, the community-level impact of a counselling and testing intervention [321]. This trial is being carried out in forty-eight communities in Zimbabwe, South Africa, Tanzania and Thailand. The first year of the study saw a four fold increase in uptake of counselling and testing in the intervention versus the control communities that received clinic-based standard VCT [322]. The results regarding impact on individual behaviour change, on community outcomes and, most importantly, on HIV incidence, are expected in June 2011.

The recent expansion of treatment programmes in sub-Saharan Africa have raised the question: what is the impact of receiving treatment on behaviour? There are some encouraging early findings. The first study to address this question was among a cohort of

882 infected individuals attending an organisation called The AIDS Support Organisation in Uganda [11]. Baseline data was collected within two weeks of initiating treatment and follow-up data was collected five to seven months after initiating treatment. Overall, there was a 70% reduction in reported risky sex, which was defined as inconsistent or no condom use with a negative partner or a partner whose HIV status is unknown [11]. When reductions in viral load were also taken into consideration, it was estimated that there was a 98% reduction in risk of HIV transmission to partners of negative and unknown status (from 45.7 per 1000 person years at baseline to 0.9 per 1000 person years at follow-up) [11]. Importantly, concerns regarding reductions in viral load being offset by increases in risky behaviour were not confirmed by this study. On the contrary, this study provides compelling evidence for integrated prevention and treatment programs to reduce HIV transmission.

There has recently been increasing interest in the use of ART for prevention, i.e. “treatment prevention” [323-326]. Grannich *et. al.* proposed that annually testing all individuals over the age of fifteen years for HIV and providing immediate treatment for those found to be infected (irrespective of CD4+ cell count) could lead to the elimination of HIV (defined as an incidence of less than 0.1%) within a decade, based on an analysis using mathematical modelling [327]. This “test and treat” strategy would require increased funding, constant access to testing supplies and first and second line drugs, high levels of treatment adherence and careful programme monitoring. The advantages of this approach are that it would simplify clinical management (i.e. no CD4+ counts and viral load measurements), it may reduce high mortality due to late diagnosis [328], it may also reduce stigma and it could be cost-saving over the long-term [327]. However, this strategy poses many challenges. Implementation of a test and treat strategy would be expensive and would be intensive in terms of the human resources required. There are serious concerns surrounding evolution of drug resistance, adverse side-effects of ART and the long-term sustainability of ART provision. There are also human rights concerns regarding protection of voluntariness and individual rights as well as the ethics of utilitarianism versus individualism [329].

Given the provocative nature of a claim to “eliminate” HIV, this proposed new direction for the field of HIV prevention, and counselling and testing, has stimulated much debate. In addition to the programmatic, clinical, behavioural, financial, social and ethical barriers to implementation noted by Granich *et. al.* [327], a number of specific criticisms of the model and general cautions regarding a test and treat strategy have been raised by others. Many of the modelling assumptions and parameter values have been questioned, including unrealistic behavioural assumptions [330-332], an unrealistically short epidemic doubling time [330], a highly optimistic assumption regarding reductions in infectiousness [332], and the assumption that second-line therapy is immediately available upon failure of first-line therapy [332]. It is noted that the model would be highly sensitive to drop-out rates, infectivity while on treatment and the coverage of testing [330, 333]. It is also argued that the model underestimates the role of acute transmission [330, 334], and does not adequately account for concurrency [331]. More generally, it has also been highlighted that the long-term toxic effects and the relative benefits and risks of treatment for people with CD4+ cell counts above 350 per μL are unknown [334, 335]. Furthermore, Garnett and Baggaley note that although dramatic reductions in incidence could be achieved, real elimination of HIV is unlikely, as not all individuals will be tested and treated, and if these unscreened individuals have high risks of acquisition and transmission of HIV they will maintain infection within the population [336].

In response, Grannich *et. al.* acknowledged these concerns, emphasised that more research is needed, but affirmed that, in theory, it is possible to substantially reduce HIV transmission using their proposed strategy of universal testing with immediate treatment [337]. In a follow-up editorial regarding the test and treat debate, De Cock *et. al.* propose: “how to use ART for the greatest simultaneous therapeutic and prevention benefit“, to be the most pressing question in HIV research presently [338].

Interestingly, the issues raised regarding a test and treat strategy, as outlined above, have been concerned with the technicalities of model specification and issues surrounding treatment, while the testing aspect of this strategy has received very little attention. There

are many barriers to the uptake of HIV counselling and testing, such as stigma, as outlined in Chapter 2. Even if opt-out testing is being implemented, this relies on individuals attending health centres. Thus, large outreach testing programmes will need to be provided in order to achieve “universal” voluntary counselling and testing. Furthermore, the logistics of providing *annual* testing to an entire adult population are formidable. Universal coverage of HIV testing has not yet been achieved in wealthy countries committed to HIV prevention [332, 334]. However, the recent rapid increases in testing and treatment provision in sub-Saharan Africa demonstrate that logistical barriers can be overcome, given adequate financial resources and political will. Furthermore, the test and treat strategy is now being implemented in the Bronx in New York city and in Washington DC, to investigate if it is feasible [339].

Although the work presented in this thesis does not show behavioural risk reduction following counselling and testing, there is some evidence from other settings, albeit limited, for risk reduction associated with receiving counselling and testing. Thus, the potential role for testing as a prevention measure (through behavioural risk reduction) should not be completely overshadowed by the role of testing to identify infected individuals in order to provide treatment.

7.6 Recommendations regarding improved implementation of counselling and testing for HIV

The move towards provider-initiated counselling and the introduction of rapid tests are important developments which have meant that HIV testing is being offered routinely and more conveniently. However, there are a number of ways in which the implementation of counselling and testing can be improved.

Firstly, counselling and testing should be more actively promoted. Mass media campaigns have been shown to be effective for increasing uptake of HIV counselling and testing [340]. For example, in Kenya, a linear increase in testing sites and an exponential increase in client utilization was observed nationally from 2001 to 2005 and this increase in VCT utilization over and above the increase in service provision has been attributed to

a mass media campaign promoting VCT carried out during this period [341]. Media campaigns should be used to increase awareness of the benefits of knowing one's HIV status and to promote testing as being socially acceptable. Social marketing has also been shown to be successful for promoting VCT and should be continued [303]. Greater involvement of people living with HIV/AIDS in promoting VCT and providing awareness may be important for providing a more "relevant" service [9]. Over the long-term, there should be continued effort to overcome social barriers to HIV counselling and testing, such as stigma, discrimination and gender inequalities.

Secondly, counselling and testing should continue to be scaled-up in a broad-range of settings, as although uptake is increasing, knowledge of serostatus is unsatisfactorily low in many places. In addition, new approaches to the provision of counselling and testing, such as home-based testing and mobile testing should be implemented in more settings, as many people do not use formal health services. Community-based counselling services should be expanded, particularly in rural areas. Monitoring and evaluation of provider-initiated counselling and testing programs and adequate training of staff is required to avoid potential coercion of patients and insure that informed consent is obtained.

Thirdly, there is a need to ensure sufficient capacity of health care workers to deliver quality counselling. The principles for effective prevention counselling include: tailored counselling to deal with an individual's personal risk rather than predetermined counselling messages, use of open-ended questions, a personalised risk assessment, acknowledging and supporting positive efforts already made, clarifying misunderstandings, the use of explicit non-technical language and developing a feasible and achievable risk reduction plan [342]. Furthermore, there must be supervision and support for counsellors, to help them remain motivated and cope with emotional burnout. In addition, monitoring the quality and content of counselling would be useful [9].

Fourthly, improved supply chain management is important to avoid problems such as stock-outs of test kits. Quality control of testing is important to ensure that all individuals receive the correct test result. This is becoming increasingly important as testing is

expanded and can be improved by training and re-training those providing counselling and testing as necessary.

Fifthly, in addition to post-test counselling, those testing positive should receive referral for care, support and treatment, if available. Where possible, providers of testing and counselling should address factors which may make completing referral difficult (e.g. lack of transportation).

7.7 Concluding remarks

AIDS has been described as “... potentially the greatest natural tragedy in human history” [343]. As the HIV/AIDS epidemic matures, and efforts to achieve universal access to testing and treatment continue, it is to be anticipated that counselling and testing services will be increasingly available. To achieve a significant public health impact, counselling and testing must attain a high coverage of the sexually active population, lead to sustained risk reduction among both infected and uninfected individuals and lead to timely initiation of treatment for infected individuals. The mitigation of the HIV/AIDS epidemic depends on the success of strategies to prevent new infections and to treat currently infected individuals. HIV counselling and testing can serve both goals.

**Appendix A: Multivariate analysis of characteristics associated
with having tested for HIV in Guinea, Côte D'Ivoire, Malawi,
Cameroon, Kenya and Ghana (supplement to chapter 4)**

Determinants	Guinea		Cote D'Ivoire	
	Women	Men	Women	Men
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
HIV status: positive vs negative	2.69 (0.43 - 16.98)	0.70 (0.15 - 3.25)	1.10 (0.42 - 2.86)	3.47 (1.36 - 8.86)
Demographic characteristics:				
Age group: 15-24	1	1	1	1
25-34	0.56 (0.09 - 3.26)	1.91 (0.98 - 3.73) [‡]	1.06 (0.67 - 1.66)	2.17 (1.23 - 3.84)
35-44	0.26 (0.01 - 5.33)	1.24 (0.56 - 2.76)	1.00 (0.52 - 1.93)	2.08 (0.82 - 5.27)
45+	4.09 (0.33 - 50.98)	1.00 (0.40 - 2.49)	0.25 (0.04 - 1.58)	1.45 (0.54 - 3.89)
Education: none	0.20 (0.01 - 4.26)	0.71 (0.37 - 1.38)	0.86 (0.42 - 1.77)	0.72 (0.29 - 1.82)
primary	1	1	1	1
secondary	5.30 (0.97 - 29.07) [‡]	1.16 (0.58 - 2.33)	1.31 (0.69 - 2.49)	1.13 (0.54 - 2.38)
higher	36.43 (5.10 - 260.47)	1.50 (0.59 - 3.81)	2.55 (0.79 - 8.17)	5.58 (2.55 - 12.22)
Marital status: married	1	1	1	1
never married	4.10 (0.38 - 44.43)	0.48 (0.23 - 0.98)	0.27 (0.15 - 0.50)	0.72 (0.36 - 1.45)
previously married	§§	0.75 (0.07 - 8.01)	0.15 (0.03 - 0.74)	§§
Residence: urban vs rural	0.05 (0.01 - 0.26)	1.30 (0.56 - 3.02)	1.11 (0.44 - 2.79)	1.66 (0.87 - 3.14)
Poverty: richest quintile vs poorest	§	1.55 (0.45 - 5.31)	5.54 (1.43 - 21.42)	2.11 (0.78 - 5.74)
Sexual health & behaviour:				
Condom use at last intercourse: yes vs no	2.50 (0.85 - 7.38)	1.46 (0.82 - 2.58)	1.44 (0.81 - 2.54)	0.75 (0.44 - 1.28)
Extra-marital partners in last year: yes vs no	0.19 (0.01 - 2.58)	1.34 (0.73 - 2.47)	1.32 (0.78 - 2.23)	1.30 (0.62 - 2.72)
Lifetime partners:				
Women	Men			
1	1	1	1	1
2	2	0.30 (0.35 - 2.54)	0.23 (0.08 - 0.65)	0.84 (0.18 - 3.90)
>2	3	2.17 (0.64 - 7.42)	0.72 (0.41 - 1.28)	1.37 (0.34 - 5.52)
	4	2.09 (0.50 - 8.73)		0.99 (0.23 - 4.24)
	>4	2.74 (0.68 - 10.97)		1.09 (0.33 - 3.59)
Ever paid for sex (men only): yes vs no	—	0.78 (0.10 - 6.16)	—	—
Had an STD in last year: yes vs no	1.24 (0.24 - 6.36)	1.06 (0.41 - 2.74)	0.26 (0.07 - 1.03)	2.51 (1.02 - 6.18)
Treatment awareness: yes vs no/unsure	3.44 (0.89 - 13.35)	3.36 (2.00 - 5.65)	—	—
Expression of stigma & experience of AIDS:				
People with AIDS should be ashamed:				
agree vs disagree/don't know	0.33 (0.11 - 1.02) [‡]	0.25 (0.08 - 0.75)	0.85 (0.44 - 1.67)	0.74 (0.38 - 1.42)
AIDS bereavement: yes vs no	3.29 (1.16 - 9.34)	1.02 (0.53 - 1.96)	3.28 (1.93 - 5.59)	0.97 (0.50 - 1.89)

Note: In Cote D'Ivoire, data on treatment awareness were not available for neither men nor women, and ever paid for sex was not available for men.

Bold type indicates differences significant at the 95% level

[‡] Borderline significance

§ AOR = 1.54e+08 due to large differentials with respect to level of wealth and <0.5% uptake in the reference group (poorest quintile)

§§ Variable/category dropped due to small sample size in comparison group

AOR Adjusted odds ratio

Table A.1 Adjusted odds ratios for hypothesised determinants of uptake of HIV testing for men and women in Guinea and Côte D'Ivoire.

Determinants	Malawi		Cameroon	
	Women	Men	Women	Men
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
HIV status: positive vs negative	0.98 (0.65 - 1.49)	0.88 (0.52 - 1.49)	1.03 (0.72 - 1.46)	1.13 (0.75 - 1.70)
Demographic characteristics:				
Age group: 15-24	1	1	1	1
25-34	1.43 (0.94 - 2.16)	1.40 (0.85 - 2.29)	1.40 (1.11 - 1.76)	2.94 (2.20 - 3.93)
35-44	1.17 (0.74 - 1.85)	1.07 (0.60 - 1.89)	0.92 (0.70 - 1.21)	3.15 (2.21 - 4.50)
45+	0.88 (0.43 - 1.81)	1.31 (0.67 - 2.55)	1.03 (0.67 - 1.58)	3.86 (2.67 - 5.58)
Education: none	0.48 (0.30 - 0.78)	0.64 (0.31 - 1.32)	0.20 (0.12 - 0.35)	0.56 (0.35 - 0.91)
primary	1	1	1	1
secondary	2.66 (1.77 - 3.97)	1.49 (1.00 - 2.21)	1.78 (1.42 - 2.23)	1.83 (1.42 - 2.34)
higher	1.61 (0.45 - 5.78)	3.64 (1.68 - 7.86)	3.23 (1.93 - 5.58)	3.96 (2.72 - 5.75)
Marital status: married	1	1	1	1
never married	0.45 (0.13 - 1.52)	1.16 (0.57 - 2.37)	0.47 (0.34 - 0.66)	0.89 (0.66 - 1.19)
previously married	0.47 (0.17 - 1.33)	0.89 (0.26 - 3.08)	0.91 (0.48 - 1.71)	0.76 (0.54 - 1.07)
Residence: urban vs rural	0.98 (0.63 - 1.51)	1.27 (0.82 - 1.96)	1.16 (0.89 - 1.51)	1.06 (0.80 - 1.40)
Poverty: richest quintile vs poorest	1.35 (0.71 - 2.58)	1.68 (0.89 - 3.16)	4.23 (2.56 - 7.02)	3.99 (2.35 - 6.79)
Sexual health & behaviour:				
Condom use at last intercourse: yes vs no	1.31 (0.68 - 2.51)	1.94 (1.28 - 2.95)	0.98 (0.76 - 1.27)	1.29 (1.00 - 1.64)
Extra-marital partners in last year: yes vs no	2.67 (1.02 - 6.99)	1.07 (0.58 - 1.97)	1.01 (0.79 - 1.30)	1.24 (0.95 - 1.61)
Lifetime partners:				
Women				
1	—	—	—	—
2	—	—	—	—
>2	—	—	—	—
Men				
1	—	—	—	—
2	—	—	—	—
>2	—	—	—	—
Ever paid for sex (men only): yes vs no	—	0.78 (0.53 - 1.14)	—	—
Had an STD in last year: yes vs no	6.14 (2.27 - 16.56)	0.46 (0.08 - 2.55)	0.84 (0.55 - 1.28)	1.29 (0.85 - 1.96)
Treatment awareness: yes vs no/unsure	2.63 (1.80 - 3.84)	1.16 (0.82 - 1.63)	—	—
Expression of stigma & experience of AIDS:				
People with AIDS should be ashamed:				
agree vs disagree/don't know	—	—	—	—
AIDS bereavement: yes vs no	1.06 (0.76 - 1.48)	0.59 (0.38 - 0.92)	1.49 (1.24 - 1.78)	1.52 (1.24 - 1.85)

Note: In Malawi, data on lifetime partners and "People with AIDS should be ashamed" were not available for neither men nor women. In Cameroon data on lifetime partners, awareness of treatment and "People with AIDS should be ashamed" were not available for neither men nor women, and ever paid for sex was not available for men.

Bold type indicates differences significant at the 95% level

‡ Bordeline significance

AOR Adjusted odds ratio

Table A.2 Adjusted odds ratios for hypothesised determinants of uptake of HIV testing for men and women in Malawi and Cameroon.

Determinants	Kenya		Ghana	
	Women	Men	Women	Men
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
HIV status: positive vs negative	1.17 (0.72 - 1.92)	1.39 (0.87 - 2.23)	1.61 (0.86 - 2.99)	0.97 (0.26 - 3.69)
Demographic characteristics:				
Age group: 15-24	1	1	1	1
25-34	0.68 (0.49 - 0.94)	1.35 (0.82 - 2.23)	1.48 (0.97 - 2.23)	3.14 (1.71 - 5.79)
35-44	0.42 (0.29 - 0.62)	1.04 (0.58 - 1.85)	1.28 (0.84 - 1.97)	2.43 (1.21 - 4.85)
45+	0.58 (0.31 - 1.09)	0.78 (0.42 - 1.43)	1.03 (0.56 - 1.90)	2.01 (0.94 - 4.27)
Education: none	0.61 (0.32 - 1.17)	0.62 (0.28 - 1.40)	0.53 (0.33 - 0.85)	0.42 (0.21 - 0.81)
primary	1	1	1	1
secondary	1.81 (1.31 - 2.48)	1.16 (0.84 - 1.62)	1.78 (1.23 - 2.58)	0.84 (0.53 - 1.34)
higher	2.51 (1.53 - 4.13)	1.94 (1.33 - 2.82)	1.98 (0.91 - 4.31)	1.06 (0.52 - 2.17)
Marital status: married	1	1	1	1
never married	0.46 (0.24 - 0.90)	0.51 (0.26 - 0.99)	0.49 (0.26 - 0.94)	1.43 (0.81 - 2.53)
previously married	1.09 (0.36 - 3.26)	1.82 (0.69 - 4.81)	0.52 (0.21 - 1.27)	0.92 (0.25 - 3.44)
Residence: urban vs rural	1.14 (0.76 - 1.72)	1.28 (0.83 - 1.97)	1.08 (0.69 - 1.68)	1.04 (0.67 - 1.62)
Poverty: richest quintile vs poorest	3.37 (1.89 - 6.02)	1.30 (0.69 - 2.45)	2.09 (1.09 - 4.00)	3.32 (1.71 - 6.42)
Sexual health & behaviour:				
Condom use at last intercourse: yes vs no	1.58 (0.96 - 2.61)	1.18 (0.74 - 1.87)	1.43 (0.86 - 2.38)	0.93 (0.59 - 1.47)
Extra-marital partners in last year: yes vs no	1.07 (0.59 - 1.95)	1.05 (0.68 - 1.63)	1.13 (0.65 - 1.98)	0.70 (0.45 - 1.08)
Lifetime partners:				
Women				
1	—	—	—	—
2	—	—	—	—
>2	—	—	—	—
Men				
1	—	—	—	—
2	—	—	—	—
>2	—	—	—	—
Ever paid for sex (men only): yes vs no	—	—	—	—
Had an STD in last year: yes vs no	0.42 (0.12 - 1.47)	0.48 (0.15 - 1.60)	1.19 (0.52 - 2.71)	0.53 (0.12 - 2.36)
Treatment awareness: yes vs no/unsure	—	—	—	—
Expression of stigma & experience of AIDS:				
People with AIDS should be ashamed:				
agree vs disagree/don't know	—	—	—	—
AIDS bereavement: yes vs no	1.93 (1.27 - 2.91)	2.52 (1.60 - 3.97)	1.63 (1.24 - 2.15)	2.19 (1.61 - 2.97)

Note: In Kenya, data on lifetime partners, treatment awareness and "People with AIDS should be ashamed" were not available for neither men nor women, and ever paid for sex was not available for men.

In Ghana, data on lifetime partners, treatment awareness and "People with AIDS should be ashamed" were not available for neither men nor women, and ever paid for sex was not available for men.

Bold type indicates differences significant at the 95% level

‡ Bordeline significance

AOR Adjusted odds ratio

Table A.3 Adjusted odds ratios for hypothesised determinants of uptake of HIV testing for men and women in Kenya and Ghana.

Appendix B: Measuring trends in age at first sex and age at marriage in Manicaland, Zimbabwe (published manuscript)

Measuring trends in age at first sex and age at marriage in Manicaland, Zimbabwe

I Cremin,¹ P Mushati,² T Hallett,¹ Z Mupambireyi,² C Nyamukapa,² G P Garnett,¹ S Gregson^{1,2}

¹ Department of Infectious Disease Epidemiology, Imperial College London, UK;

² Biomedical Research and Training Institute, Harare, Zimbabwe

Correspondence to: Ms I Cremin, Department of Infectious Disease Epidemiology, Imperial College London, St Mary's Campus, Norfolk Place, London W2 1PG, UK; ide.cremin05@imperial.ac.uk

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ABSTRACT

Objective: To identify reporting biases and to determine the influence of inconsistent reporting on observed trends in the timing of age at first sex and age at marriage.

Methods: Longitudinal data from three rounds of a population-based cohort in eastern Zimbabwe were analysed. Reports of age at first sex and age at marriage from 6837 individuals attending multiple rounds were classified according to consistency. Survival analysis was used to identify trends in the timing of first sex and marriage.

Results: In this population, women initiate sex and enter marriage at younger ages than men but spend much less time between first sex and marriage. Among those surveyed between 1998 and 2005, median ages at first sex and first marriage were 18.5 years and 21.4 years for men and 18.2 years and 18.5 years, respectively, for women aged 15–54 years. High levels of reports of both age at first sex and age at marriage among those attending multiple surveys were found to be unreliable. Excluding reports identified as unreliable from these analyses did not alter the observed trends in either age at first sex or age at marriage. Tracing birth cohorts as they aged revealed reporting biases, particularly among the youngest cohorts. Comparisons by birth cohorts, which span a period of >40 years, indicate that median age at first sex has remained constant over time for women but has declined gradually for men.

Conclusions: Although many reports of age at first sex and age at marriage were found to be unreliable, inclusion of such reports did not result in artificial generation or suppression of trends.

In the era of the HIV pandemic, the focus of analyses regarding timing of first sex and marriage has broadened from investigating their role as proximate determinants of fertility to encompass their associations with risk of acquiring HIV.^{1–3} Identifying trends in the timing of age at first sex and marriage is essential for evaluating the impact of the investment made in HIV prevention interventions to promote abstinence (by delaying first sex), and to assess the contribution of these changes to any downturn in the epidemic.^{4–7} Delays in reported age at sexual debut have coincided with declines in the prevalence of HIV in Uganda and Zimbabwe.^{8–12} Mathematical modelling, however, has indicated that these changes are unlikely to have contributed substantially to reductions in lifetime risk of infection or HIV incidence.¹³

The relationship between age at marriage and risk of infection has received attention. Recently, Bongaarts argued that late marriage can facilitate

the spread of HIV via a long period of premarital sexual activity.¹⁴ However, it is also possible for early marriage to pose an increased risk of infection if marriage leads to regular unprotected sex in serodiscordant partnerships.¹⁵

In general, the age at which first sex occurs lies within the later teenage years.^{16,17} Thus, changes in the median age at first sex of just a year or two are considered epidemiologically significant. However, even modest degrees of social desirability bias, recall bias, digit preference or random misreporting could potentially generate spurious trends. For example, social desirability would be expected to bias reports of age at first sex upwards. Slaymaker and Buckner found that declines in reporting of sex before age 15 in Zambia were partially due to a change in reporting bias, when comparing two survey methodologies and accounting for the sociodemographic composition of the survey samples.¹⁸ The Manicaland cohort study in Zimbabwe, which asked individuals about the timing of first sex and marriage in three survey rounds spanning a period of 8 years, presents an opportunity to monitor trends in age at first sex and marriage as well as to gauge the consistency of reporting which may inform on the accuracy and reliability of these data.

The objectives of this paper are to (1) quantify the level of inconsistent reporting and its influence on observed trends; (2) identify reporting biases; (3) describe the overall trends in age at first sex and age at marriage; and (4) describe the length of time spent single (between first sex and marriage) in this population.

METHODS

Study design

The Manicaland HIV/STD Prevention Project is a population-based open cohort study in the Manicaland province of eastern Zimbabwe. The study design and procedures have been outlined in detail previously.¹² Briefly, participants were recruited from 12 predominantly rural study sites which consisted of 4 subsistence farming areas, 2 small towns, 2 roadside trading areas and 4 forestry, coffee and tea estates. Local residents were enumerated initially in a household census. Eligible individuals (those present in a local household for at least four nights in the past month and at the same time one year ago) were then invited to participate in the study. This baseline survey took place in a phased manner from July 1998 to February 2000. This survey was repeated as a first follow-up from 2001 to 2003 and second follow-up from 2003 to 2005.



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Men aged 17–54 years and women aged 15–44 years were recruited with only one member of each cohabiting marital union selected at random to participate. At the second follow-up survey, extended entry criteria allowed men and women aged 15–54 years and both members of a marital union to participate. In the second survey (from site five onwards) and the third survey, migrants into the study areas were invited to participate.

Behaviour data

Participants were interviewed using a structured questionnaire on sociodemographic characteristics and sexual behaviour. Interviews were led by social science graduates who were familiar with the local language and culture but were not known locally. Interviewers were trained to adopt an informal and non-prejudicial approach and to build up a good rapport with respondents. Interviewers were matched for sex with respondents. An informal confidential voting interview (ICVI) method was used to collect sensitive behavioural data as a means of reducing social desirability bias.¹⁹ Participants placed slips containing their responses into a “voting” box, thus ensuring confidentiality. All data on age at first sex and age at first marriage were collected using the face-to-face interview method, even when the ICVI method was used to collect subsequent behavioural data in the same interview.

Participants were asked if they had been married or were in a long-term or cohabiting relationship, which we classify together as being “married”. In the first round of the survey, relationships of ≥ 6 months were defined as long-term, but in the subsequent two rounds this was changed to be relationships of ≥ 12 months. Ever married individuals were asked their age when they first entered such a relationship. In the section on sexual behaviour, participants were asked initially how old they were when they had sex for the first time. Subsequent questions on sexual behaviour were asked in order of increasing sensitivity.

Analysis of data

A number of methods have been developed to analyse data on age at first sex (which also apply to age at marriage). The data used are current status (the current age of the individual and whether they have ever had sex) and recall (retrospective reports of age at first sex).²⁰ Survival analyses combine the two sources. These techniques can also be adapted to analyse data from successive surveys to assess trends in age at first sex and distinguish underlying trends from reporting errors.²¹

Survival analysis techniques were employed to analyse timing of first sex, with individuals represented as surviving until first

sex. In this scheme the failure event is starting sex and follow-up time is censored if individuals had not started sex by the time of their last interview. Censoring is independent (of the probability that sex occurs), since no information on sexual behaviour was obtained prior to recruitment. Kaplan-Meier failure curves were plotted to illustrate the cumulative onset of sexual activity. This procedure was also followed when analysing trends in age at marriage.

Age at first sex and age at marriage were reported as years in integers, which correspond to age at last birthday at those events. A random proportion of a year was added to each age to capture the distribution of exact ages within a year. Reports of age at first sex and age at marriage were classified according to consistency to assess the quality of reporting. Four categories were defined to classify reports: (1) consistent; (2) inconsistent: can be corrected; (3) inconsistent: can be estimated; and (4) unreliable: cannot be estimated or corrected (table 1).

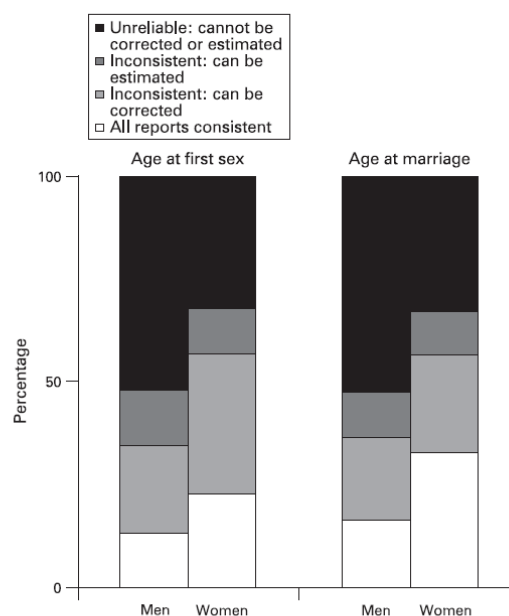


Figure 1 Consistency of reporting age at first sex and age at marriage among men and women aged 15–54 years who reported in at least two surveys.

Table 1 Definitions of reliable and unreliable reporting

Category	Number of age-at-event reports			Imputed response	
	1	2	3		
Consistent	Report $\leq$ age at survey	Both reports same AND both reports $\leq$ age at survey	All reports same AND all reports $\leq$ age at survey	Reported age	Reliable
Inconsistent: can be corrected	N/A	Reports differ by 1 year AND both reports $\leq$ age at survey	2 ages reported which differ by 1 year AND both reports $\leq$ age at survey	Older of the 2 ages	
Inconsistent: can be estimated	N/A	1 report $\leq$ age at survey	$\geq 50\%$ of reports same AND these reports $\leq$ age at survey	Most frequent report that is $\leq$ age at survey	
Unreliable: cannot be estimated or corrected	Report $>$ age at survey	Reports differ by > 1 year AND both reports $\leq$ age at survey OR both reports $>$ age at survey	$< 50\%$ of reports same OR $\geq 50\%$ reports same AND reports $>$ age at survey	Mean of all reported ages	Unreliable

Table 2 Median and IQR for age at first sex and age at marriage by reliability of data and birth cohort for men and women

Birth cohort	Age at first sex		Age at first marriage	
	All data	Reliable data	All data	Reliable data
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
Men				
1950–9	20.1 (18.3–22.4)	19.9 (18.0–22.2)	24.5 (22.0–27.0)	24.6 (21.9–27.0)
1960–9	19.6 (17.9–21.6)	19.5 (17.8–21.7)	24.7 (22.0–27.4)	25.0 (22.0–27.7)
1970–9	19.0 (17.3–20.9)	19.0 (17.2–20.9)	23.2 (21.2–25.2)	23.4 (21.3–25.4)
Women				
1950–9	19.0 (17.3–20.6)	18.9 (17.2–20.5)	19.1 (17.4–20.8)	18.9 (17.2–20.7)
1960–9	18.7 (17.0–20.6)	18.7 (17.0–20.6)	18.9 (17.2–20.9)	18.8 (17.0–20.8)
1970–9	19.0 (17.4–20.8)	19.0 (17.5–20.8)	19.3 (17.7–21.1)	19.3 (17.7–21.2)

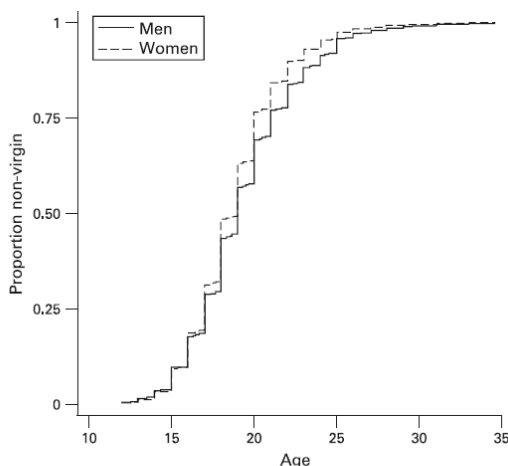
IQR, interquartile range.

A number of non-mutually exclusive classifications were observed for those individuals with three reports (827/3270)—that is, when two reports were consistent and the other report differed by 1 year. In such cases the consistently reported age was used. These criteria were also applied when classifying reports of age at marriage. A detailed description of these classifications, by frequency of reporting, is given by Wringe *et al.*²²

All analyses were carried out using Stata Version 10 (Stata Corp, College Station, Texas, USA).

RESULTS

The numbers of participants at the first, second and third surveys were 9530, 8210 and 16 266, respectively. In total, 23 517 individuals were interviewed in at least one survey, of which 16 680 were interviewed in only one survey, 3185 were interviewed in two surveys and 3652 were interviewed in all three. Most individuals who were surveyed only once were new entrants at the third survey round in which the eligibility criteria for the study were expanded, as described above.

**Figure 2** Kaplan-Meier failure curve for age at first sex for men and women. Data include all reports after corrections and estimations for inconsistent reports.

Age at first sex

All respondents were asked what age they were when they first had sex. Of all the surveyed individuals, 23.2% (5446/23 517) reported never having had sex. Slightly more men than women reported never having had sex (24.3% vs 22.3%, χ^2 test, $p < 0.001$). Of the individuals who provided a report of age at first sex, 69.3% (12 448/17 953) only reported in one round. A small proportion of individuals did not respond to the question regarding age at first sex (63 (0.66%) in round 1, 36 (0.44%) in round 2 and 48 (0.30%) in round 3).

Reports were classed as unreliable for 32.1% of women and 52.2% of men who reported age at first sex in at least two surveys (fig 1). Of these unreliable reports, 31.2%, 21.2% and 15.9% of reports differed by 2, 3 and 4 years, respectively. The remaining 31.6% of reports differed by >4 years. Similar levels of unreliable reporting were observed among only those who participated in all three surveys. The quality of reporting among those in all three surveys was very similar across birth cohorts, as described by Wringe *et al.*²² Excluding unreliable reports had little effect on the failure curves compared with analysing all reports (regardless of consistency) for both men and women. Median age at first sex remained largely unchanged when unreliable reports were excluded (table 2).

Age at first sex was significantly higher for men than for women (log-rank test for equality of survivorship functions: $\chi^2 = 110$, $p < 0.001$; fig 2). Over all the surveys, 12.6% of men and 12.0% of women reported experiencing first sex at 15 years or younger.

Plotting medians by birth cohort indicated that age at first sex declined gradually among men, from 20.7 years for those born before 1955 to 19.1 years for those born after 1975 (fig 3A). For women the median age at first sex remained relatively constant between 19.2 and 19.0 years (fig 3B).

The reports from those reporting in at least two surveys were then combined and analysed in a life table format to compare reports by the same individuals as they age. The median age at first sex should remain unchanged as a cohort ages. Among those in older birth cohorts (1965–9 to before 1955), trends in age at first sex remained unchanged as these individuals aged (reading across the table), indicating the absence of reporting biases (table 3). However, among those in younger birth cohorts (1970–4 and after 1975), reported age at first sex increased as they aged.

Age at marriage

Across all respondents, 36.9% (8676/23 517) reported never having been married. A higher proportion of men than women

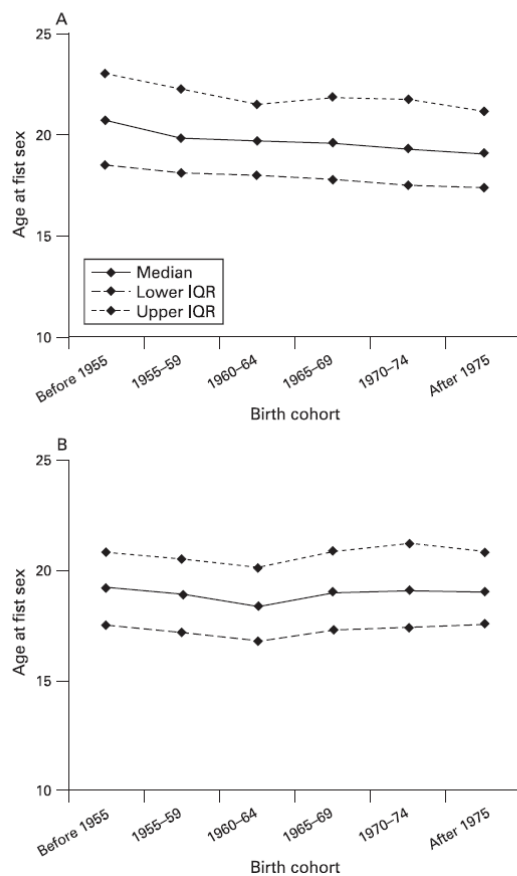


Figure 3 Median estimates of reported age at first sex by 5-year birth cohort for (A) men and (B) women. IQR, interquartile range. Data include all reports after corrections and estimations for inconsistent reports. The upper value of the IQR could not be calculated for those born after 1975 as 60% of men and 60% of women born after 1975 reported not having had sex.

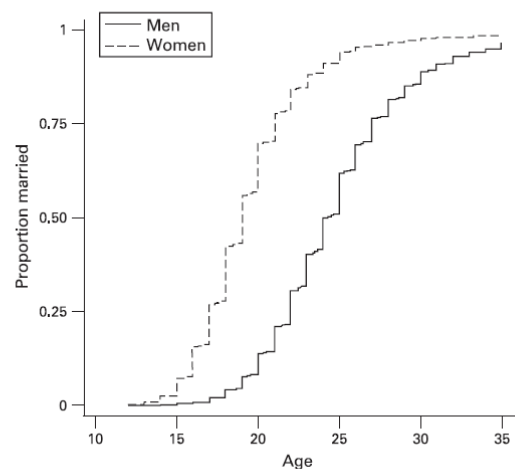


Figure 4 Kaplan-Meier failure curve for age at marriage for men and women. Data include all reports after corrections and estimations for inconsistent reports.

had never been married (50.3% vs 26.8%, χ^2 test, $p < 0.001$). Participants who reported having ever been married or in a long-term relationship were asked at what age they first entered such a relationship. Of these, 43 (0.72%), 45 (0.85%) and 59 (0.55%) did not respond to the question regarding age at marriage in the first, second and third surveys, respectively. Of the individuals who reported an age at marriage, 68% (9874/14 508) only reported it in one round.

Reports were classed as unreliable for 33.2% of women and 52.5% of men who reported age at marriage in at least two surveys (fig 1). Of these unreliable reports, 26.5%, 17.8% and 13.7% of reports differed by 2, 3 and 4 years, respectively. The remaining 41.9% of reports differed by >4 years. Excluding unreliable reports when plotting failure curves did not change the overall trends when compared with trends based on all reports (regardless of consistency). The median age at marriage remained largely unchanged when unreliable reports were excluded (table 2).

Table 3 Median age at first sex and number reporting (N) for men and women reporting in at least two surveys by 5-year birth cohort and age group

Birth cohort	Men							Women						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Before 1955						20.0 (22)	20.0 (224)						19.3 (42)	19.0 (436)
1955-9					19.5 (23)	20.0 (257)	20.0 (172)					19.0 (50)	19.0 (667)	18.7 (544)
1960-4				19.0 (48)	19.0 (379)	19.0 (239)					18.3 (65)	18.0 (816)	18.0 (671)	
1965-9			19.3 (45)	19.0 (352)	19.3 (231)					18.0 (69)	18.3 (656)	18.0 (496)		
1970-4		18.8 (68)	19.0 (609)	19.0 (388)					18.0 (62)	18.3 (750)	18.3 (599)			
After 1975	17.0 (415)	18.0 (1047)	18.3 (458)					17.0 (448)	18.0 (1103)	18.6 (586)				

Data include all reports after corrections and estimations for inconsistent reports have been made. Small sample sizes are indicated in *italics*, along the leftmost diagonal for men and for women. These are low due to the timing of the surveys in relation to birth cohorts (eg, the majority of individuals in the 1970-4 birth cohort had aged past the 20-24 age group when they were surveyed).

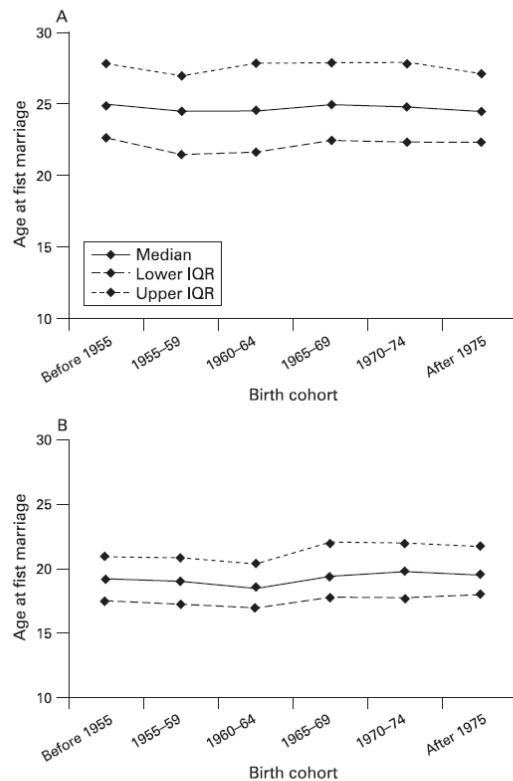


Figure 5 Median estimates of reported age at marriage by 5-year birth cohort for (A) men and (B) women. IQR, interquartile range. Data include all reports after corrections and estimations for inconsistent reports. The IQR and median age at marriage could not be calculated for men born after 1975 as only 20% of men in this birth cohort are (or had been) married. The upper value of the IQR could not be calculated for women born after 1975 as 52% of women in this birth cohort are (or had been) married.

Men marry at significantly older ages than women (log-rank test $\chi^2 = 5647$, $p < 0.001$; fig 4). A stable age at marriage among men and women is also illustrated by plotting the median age for each birth cohort (fig 5).

The reports from those reporting in at least two surveys were then combined and analysed in a life table format. Men generally reported an increased age at marriage as they aged, particularly those in the youngest birth cohort (reading across the table; table 4). Women in older birth cohorts (1955-9 and before 1955) reported decreasing ages at marriage as they aged. However, for women in younger birth cohorts (1965-9 to after 1975), the reported age at marriage increased as they aged.

Time spent single after sexual debut

The average number of person-years spent between first sex and marriage has remained constant for men and women (fig 6). The mean (SD) duration of time spent single after sexual debut is much longer for men than for women (4.1 (4.1) years vs 0.3 (1.6) years). A greater proportion of women than men indicated

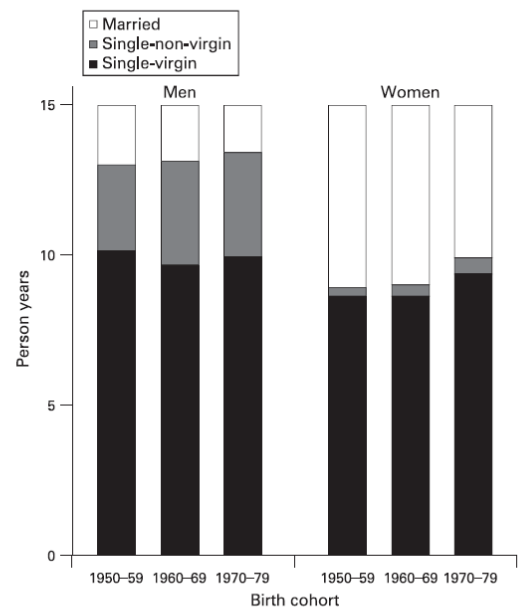


Figure 6 Distribution of person-years spent as a virgin, sexually active and unmarried and married between the ages of 10 and 25 years for men and women.

that their first sexual experience was within marriage; 69.8% (6748/9666) and 15.3% (729/4760) of married women and men, respectively, reported age at first sex to coincide with age at marriage.

DISCUSSION

Including reports of age at first sex and age at marriage identified as unreliable in survival analyses did not alter our results, suggesting that much of the unreliability may be attributable to random misreporting rather than systematic biases such as social desirability bias. This absence of alteration of trends indicates that the observed trends can be interpreted with some confidence, despite the high levels of misreporting. Furthermore, this provides some reassurance when interpreting trends in serial cross-sectional data, such as from Demographic and Health Surveys (DHS) where such inconsistencies cannot be identified. However, consistency of reporting does not always signify accuracy; an individual may consistently report an incorrect age at first sex, a bias which cannot be detected.

In this rural Zimbabwean population, women initiate sex and enter marriage at younger ages than men but spend much less time between first sex and marriage. Comparisons across all surveys by birth cohorts which span a period of >40 years indicate that the median age at first sex has remained constant over time among women but has declined gradually among men. Median age at marriage has remained relatively stable for both men and women. However, tracing birth cohorts between surveys revealed reporting biases. It is possible that some individuals (particularly young people) deliberately report an older age at first sex due to exposure to HIV prevention campaigns promoting delaying age at first sex and abstinence, in addition to the pressure of other social norms. With respect to

Table 4 Median age at marriage and number reporting (N) for men and women reporting in at least two surveys by 5-year birth cohort and age group

Birth cohort	Men							Women						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	15–19	20–24	25–29	30–34	35–39	40–44	45–49
Before 1955						23.8 (22)	24.0 (219)						19.0 (41)	18.7 (425)
1955–9					21.0 (22)	23.0 (254)	23.0 (168)					19.0 (49)	18.0 (661)	18.0 (541)
1960–4				23.5 (45)	23.0 (364)	23.0 (234)					18.0 (63)	18.0 (803)	18.0 (664)	
1965–9			24.2 (42)	23.7 (324)	23.3 (216)					18.0 (67)	18.7 (645)	18.3 (492)		
1970–4		22.6 (50)	23.0 (441)	23.0 (307)					18.0 (59)	19.0 (710)	18.7 (573)			
After 1975	19.5 (55)	21.0 (313)	22.0 (244)					17.0 (357)	18.0 (963)	18.3 (542)				

Data include all reports after corrections and estimations for inconsistent reports. Small sample sizes are indicated in *italics*, along the leftmost diagonal for men and for women. These are low due to the timing of the surveys in relation to birth cohorts (eg, the majority of individuals in the 1970–4 birth cohort had aged past the 20–24 age group when they were surveyed).

reported age at first sex, one may expect decreasing social desirability bias and increasing recall bias as an individual ages. Such effects may generate the similar levels of unreliable reporting observed across all birth cohorts.

We previously reported delays in sexual debut among teenage men and women in the first 3 years of follow-up.¹² In this earlier analysis we compared trends in the percentage of individuals reporting having had sex within a small population subgroup who were starting sex at that time (17–19-year-old men and 15–17-year-old women). These age restrictions were chosen to analyse an entirely new group of maturing adolescents at each survey, thus focusing on very recent trends. These previous findings, using current status data only, are therefore not directly comparable to the longer-term trends in median age at first sex in the entire population presented here by birth cohorts spanning a period of >40 years.

In Zimbabwe, information on timing of sexual debut has been collected in four DHS surveys since 1988, and median age at first sex has been calculated by province for the most recent three surveys.^{25–26} In Manicaland, median ages among women aged 25–49 years are relatively constant at 18.3, 18.2 and 18.4 years in 1994, 1999 and 2005–6, respectively. Among men aged 25–54 years (25–49 years in the 2005–6 survey) the median age at first sex increased from 19.5 years in 1994 to 22.0 years in 1999 and subsequently decreased to 20.6 years in 2005–6. Thus, the medians calculated for women in this study population are a good representation of those in the wider population in the Manicaland province whereas, for men, the medians calculated for this study population are generally younger. Our estimates of median age at first sex are relatively high in comparison with other African countries such as Kenya, Tanzania, Uganda and Zambia where median age at first sex ranges from 16.4 to 18.1 years.²¹

The substantial gender differential in age at marriage observed here is not surprising as women are expected to marry younger than men in Shona society.²⁷ Women may seek to marry at a relatively young age in order to obtain the security associated with marriage and subsequent motherhood. Men are expected to obtain employment in order to afford bridewealth, thus re-enforcing the expectation that they wait until reaching their mid 20s before marrying. Recall bias may influence quality of reporting of age at marriage, particularly among older individuals. In this society, marriage is a long process and individuals may be unable to distinguish their age when the

actual ceremony took place from that when bridewealth was paid, from when the relationship begun. The biases identified in reporting of age at marriage may also be partially attributable to the change in the definition of a long-term relationship.

A mathematical modelling study parameterised for this population has shown that the effect of delaying age at first sex on subsequent risk of HIV infection depends on the length of time spent single (between first sex and marriage).¹⁵ When sexually active and unmarried, the risk of infection is double that when married (2% and 1% per person-year at risk, respectively).¹⁵ Thus, the extended duration of time spent sexually active and single among men, and the brief duration of time spent sexually active and single among women observed here, support previous findings in this population that, in general, young men acquire HIV from premarital relations (as well as extramarital relations) whereas, for women (who typically spend much less time single), the strongest determinants of infection are their spouse's behaviours.^{28,29}

Previous cross-sectional analyses (using the first round of data) investigating age at first sex in relation to subsequent risk of HIV infection found that, among both men and women in this population, riskier sexual behaviour was observed among those reporting an early age at first sex (younger than 18 years) than in those who reported an older age of sexual debut.³ However, for men, an early age at first sex which coincided with age at marriage did not lead to subsequent riskier behaviour compared with men who initiated sex at an older age. This suggests that, among men, early marriage may be somewhat protective against the riskier effects of early age at first sex.

Take-home messages

- ▶ High levels of reports of age at first sex and age at marriage were identified as unreliable among men and women attending multiple surveys.
- ▶ Excluding unreliable reports did not alter the observed trends in age at first sex and age at marriage.
- ▶ Comparing birth cohorts over a 40-year time span, median age at first sex has remained constant over time among women but has declined gradually among men.
- ▶ Median age at marriage has remained relatively stable for both men and women.

However, the change in age at first sex observed here among men may not translate into an additional risk of infection because the average number of years spent single (between first sex and marriage) has remained the same. Thus, the circumstances in which first sex occurs may be more important than the timing.

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Contributors: SG and GPG designed the research, PM, ZM and CN performed the research, IC and TH analysed the data. All authors contributed to preparing the manuscript.

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**Appendix C: Patterns of Self-reported Behaviour Change
Associated with Receiving Voluntary Counselling and Testing
in a Longitudinal Study from Manicaland, Zimbabwe
(published manuscript)**

Patterns of Self-reported Behaviour Change Associated with Receiving Voluntary Counselling and Testing in a Longitudinal Study from Manicaland, Zimbabwe

Ide Cremin · Constance Nyamukapa · Lorraine Sherr · Timothy B. Hallett · Godwin Chawira · Simon Cauchemez · Ben Lopman · Geoffrey P. Garnett · Simon Gregson

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Abstract Voluntary counselling and testing (VCT) is promoted as a potential HIV prevention measure. We describe trends in uptake of VCT for HIV, and patterns of subsequent behaviour change associated with receiving VCT in a population-based open cohort in Manicaland, Zimbabwe. The relationship between receipt of VCT and subsequent reported behaviour was analysed using generalized linear models with random effects. At the third survey, 8.6% of participants (1,079/12,533), had previously received VCT. Women who received VCT, both those positive and negative, reduced their reported number of new partners. Among those testing positive, this risk reduction was enhanced with time since testing. Among men, no behavioural risk reduction associated with VCT was observed. Significant increases in consistent condom use, with regular or non-regular partners, following VCT, were not observed. This study suggests that, among women, particularly those who are infected, behavioural risk reduction does occur following VCT.

Keywords HIV · Testing · Counselling · Sexual behaviour · Zimbabwe

Introduction

Voluntary Counselling and Testing (VCT) is promoted as a primary prevention strategy to reduce the heterosexual transmission of HIV in sub-Saharan Africa [1]. Pre- and post-test counselling sessions are an opportunity to provide information on HIV, correct misconceptions, assist with risk assessment, provide emotional support, encourage disclosure of serostatus to partners, and discuss a risk reduction plan if necessary. To prevent new infections, VCT must motivate individuals to adopt safe sexual behaviour. Modelling studies have demonstrated the particular importance of sustained behaviour change and of reduced risk behaviour among those not infected in determining the population level impact of VCT, since these are the majority at risk [2].

Data from twelve African Demographic and Health Surveys conducted between 2003 and 2005, indicate that a median of only 12% of men and 10% of women had been tested for HIV and received their results [3]. However, provision of VCT in countries with generalized or high-burden epidemics has expanded dramatically in recent years, largely because of increased financial resources to provide treatment [3]. Recent guidance issued by WHO and UNAIDS recommends a routine (“opt-out”) approach to provider-initiated HIV testing and counselling [4]. In Botswana, the policy of routine HIV testing, implemented since 2004 [5], has led to rapid increases in testing uptake, with almost half of adults reporting having tested for HIV in a recent population based study [6].

Scale-up of testing services is closely linked to providing antiretroviral treatment [7]. However, for treatment

I. Cremin (✉) · C. Nyamukapa · T. B. Hallett · S. Cauchemez · G. P. Garnett · S. Gregson
Department of Infectious Disease Epidemiology,
Imperial College London, St. Marys Campus,
Norfolk Place, Paddington, London W2 1PG, UK
e-mail: ide.cremin05@imperial.ac.uk

C. Nyamukapa · G. Chawira · S. Gregson
Biomedical Research and Training Institute, Harare, Zimbabwe

L. Sherr
Royal Free Hospital, University College London, London, UK

B. Lopman
London School of Hygiene and Tropical Medicine, London, UK

programmes to be sustainable, reductions in incidence are required [8, 9]. Thus, preventing new infections through the provision of high quality counselling should be another, equally important, aim.

To date, there has been mixed evidence for the efficacy of VCT in promoting safer sexual behaviour in developed and developing countries [10, 11]. A multi-centre randomized controlled trial [12] and a number of observational studies in Africa have indicated moderate behavioural changes following VCT [12–21]. However, the greatest changes observed in these studies were among those testing positive and those in sero-discordant partnerships and little evidence exists for behavioural risk reduction among those found not to be infected [22, 23]. There is also concern as to whether the standard of VCT that can be administered in trials can realistically be provided and maintained routinely. Given the importance of longevity of behaviour change, and the lack of behavioural risk reduction among the majority of those testing (i.e. HIV negative individuals), the evidence for the effectiveness of VCT as a HIV prevention measure is relatively weak.

Longitudinal data on individuals receiving standard VCT, from the Manicaland cohort study, provides an opportunity to assess the association between receiving VCT and behaviour change, outside of an intervention trial of the efficacy of VCT. The aims of this study are to (1) describe the overall trends in uptake of VCT and (2) assess the patterns of behaviour change associated with receiving VCT, including whether they are sustained.

Methods

Participants

The Manicaland HIV/STD Prevention Project is a population-based open cohort study [24, 25]. Participants were recruited from four subsistence farming areas, two small towns, two roadside trading areas, and four forestry, coffee and tea estates in the Manicaland province of Eastern Zimbabwe. A preliminary household census was carried out at each site to identify individuals eligible for the study. The baseline survey was carried out in a phased manner from 1998 to 2000. Second (2001/2003) and third (2003/2005) rounds of the survey were conducted at each site, providing two rounds of follow-up for those retained from baseline and creating an open cohort with newly eligible individuals being recruited at each round. Initially, men aged 17–54 years and women aged 15–44 years were recruited with only one member of each marital union being selected at random to participate. In the third round, the entry criteria were extended to include all men and women aged between 15 and 54 years with both members of a marital union being eligible

to participate. The household participation rates were 98, 94 and 96% in the first, second and third surveys, respectively. Individual participation rates were 79, 79 and 83% in the first, second and third surveys, respectively.

Dried blood spots were obtained for anonymous HIV serological testing. This testing was carried out using a highly sensitive and specific antibody dipstick assay [26].

Voluntary Counselling and Testing Services

Participants were offered free HIV counselling and testing at each survey. This service was available at a mobile clinic which was present within the study site at the time the survey was being conducted. Participants receiving VCT from the research programme did so after completing the survey questionnaire. During the baseline and second surveys, VCT clients were asked to return 2 weeks after testing, to receive their results and post-test counselling. At the third survey, rapid testing was introduced and clients received their results and post-test counselling on the same day of testing. Counselling was provided by trained male and female nurse counsellors. For those who participated in the third survey and had previously received VCT, the mean duration of pre- and post-test counselling was 37 and 21 minutes, respectively. Data regarding duration of counselling was not collected in the earlier surveys. VCT services provided by government and non-governmental organizations became increasingly available in the study areas over time.

Measures

Demographic and sexual behaviour data were collected at each survey. An informal confidential system of voting was used to collect behavioural data as a means of reducing social desirability bias [27]. Participants indicated their answer to each question on a colour coded voting strip, which they then placed in a locked “voting” box.

Behaviours which were analysed included the number of times the participant had visited a bar/beer hall in the previous month (which is known to be associated with risky sexual behaviour [28]), whether the participant had a sexual partner in the last month, the number of new partners in the last year, whether the participant had multiple concurrent partnerships (self-defined), and whether the participant reported consistent condom use (condoms used in all acts of intercourse over the most recent 2 weeks period) with regular (partnerships of greater than 1 year’s duration) and non-regular partners.

Data Analyses

All analyses considered the non-virgin population who had an unambiguous anonymous dipstick HIV test result.

Participants who reported having been tested for HIV and having received their results were defined as having received VCT. Unfortunately, in the baseline survey, receipt of results was not established.

A binary indicator based on time since last test and collection of results was created which captured whether or not an individual had previous experience of VCT at each round. Reports given by respondents in the second survey were used to identify those who had received VCT previous to the second survey (i.e. at the first survey and between the first and second survey). Reports given by respondents in the third survey were used to identify those who had received VCT previous to the third survey (i.e. at the second survey and between the second and third survey).

Binary indicators were created for each of two time periods since receiving VCT (within the last 2 years and 2–3 years ago). These time-since-testing indicators were included in the models, to investigate how the effect of VCT changed with length of time since testing.

In analyzing the relationship between behaviour and VCT, we are interested in comparing behaviour before and after receiving VCT. Most reported behaviours refer to the month previous to the survey, so only those receiving VCT before that month are defined as having received VCT. However, number of new partners in the last year relates to a longer pre-survey period, so, for this variable only, those who tested over 12 months previously are defined as having received VCT.

Generalized linear models with random-effects [29] were fitted to investigate the reported behaviours in the study, including VCT as a variable in the model. Models adjusting for age (5 year categories), calendar year and marital status were fitted. Variables were dropped from the model one at a time if inclusion did not significantly improve the fit of the model ($P < 0.05$, likelihood ratio test).

In effect, these models allow us to explore behaviour change over time comparing those who received VCT to those who did not receive VCT, stratified by sex and HIV status. Repeated observations for individuals within the cohort mean that the data are not independent. This clustering of the data is incorporated explicitly in the model equations and the likelihood calculations using an individual-specific term (Gamma distributed for Poisson models, Gaussian distributed for Logistic models). Numeric outcomes were analysed using Poisson generalized linear models and binary outcomes were analysed using Logistic generalized linear models.

For those who tested, HIV status at the time of receiving VCT was used for stratification. In stratifying our analysis according to HIV status, we intended to examine whether those who received a positive test result changed their behaviour more than those with similar initial risks. However, we were also interested in changes in behaviour

among those who received VCT and were negative at the time of testing. If we included those who seroconverted subsequent to VCT as positive in this analysis, we would bias our results for those testing negative to only those who remain negative. Therefore, those who seroconverted following VCT were considered as HIV negative in the analysis, as this was their status when they received VCT. Those who did not test and who seroconverted during follow-up were categorized as positive in the analysis. This assumption applied to 228 individuals (174 seroconversions among non-testers between baseline and the second survey and 52 between the second and third surveys). A sensitivity analysis showed that overall findings were unchanged when these individuals were assumed to be negative in the analysis.

Results

Survey Participation and Participant Characteristics

The open cohort consisted of 17,874 individuals; 7,559 men (42%) and 10,315 women (58%). The mean length of follow-up time was 4.2 years. At baseline, the median age among men was 29 years, compared to 30 years among women. HIV prevalence was 19.4, 17.9 and 16.5% among men aged 17–54 years in the first, second and third

Table 1 Socio-demographic characteristics of study participants at each survey

	Round 1 N (%)	Round 2 N (%)	Round 3 N (%)
Sex			
Male	3,787 (45.8)	2,771 (42.3)	4,711 (37.6)
Female	4,486 (54.2)	3,788 (57.7)	7,822 (62.4)
Age			
15–19	1,326 (16.0)	764 (11.7)	1,037 (8.3)
20–29	3,363 (40.7)	2,415 (36.8)	4,808 (38.4)
30–39	2,010 (24.3)	1,647 (25.1)	3,155 (25.2)
40+	1,574 (19.0)	1,733 (26.4)	3,533 (28.2)
Marital status			
Single	2,321 (28.1)	1,334 (20.3)	1,833 (14.6)
Married	4,715 (57.0)	4,227 (64.5)	8,465 (67.6)
Previously married	1,237 (14.9)	998 (15.2)	2,235 (17.8)
Education			
None	306 (3.7)	127 (1.9)	9 (0.1)
Primary	3,343 (40.4)	2,582 (39.4)	4,779 (38.1)
Secondary	4,474 (54.1)	3,672 (56.0)	7,032 (56.1)
Higher	150 (1.8)	68 (1.0)	208 (1.7)
Missing	0 (0.0)	110 (1.7)	505 (4.0)
Total	8,273	6,559	12,533

Table 2 Mean levels of reported behaviour at the first survey and by testing status at the third survey, among males and females in the open cohort

	Males			Females		
	Round 1	Round 3		Round 1	Round 3	
		Received VCT	Did not receive VCT		Received VCT	Did not receive VCT
Times visited bar or beer hall in the last month	5.53	1.26	1.41	0.41	0.88	1.30
Number of new sexual partners in past year	1.10	0.26	0.32	0.30	0.21	0.31
Number of sexual partners in past month	0.77	0.66	0.69	0.68	0.64	0.68
Number of current partners	1.08	0.80	0.80	0.85	0.76	0.80
Consistent condom use in last 2 weeks ^a						
With regular partner	0.13	0.07	0.05	0.07	0.07	0.05
With non-regular partner	0.45	0.26	0.34	0.31	0.16	0.34

^a Proportion reporting consistent condom use in last 2 weeks

surveys, respectively, and 25.9%, 22.4 and 20.5% among women aged 15–44 years [30]. The socio-demographic characteristics of study participants included in this analysis are presented in Table 1.

Baseline behavioural data was compared for those who participated in all three surveys and those who were lost to follow-up due to migration, death, refusal or unavailability at the time of the follow-up visit. Those who were lost to follow-up were significantly more risky in terms of beer hall attendance, new partners in the last year, partners in the last month and number of current sexual relationships, without adjusting for age and sex (χ^2 test, $P < 0.01$ for all comparisons). These individuals also reported more consistent condom use (13% amongst those lost to follow-up vs. 7% amongst those not; χ^2 test statistic 24.5 (1 *df*), $P < 0.01$) with regular partners and (48% vs. 33%; χ^2 test statistic 8.1 (1 *df*), $P < 0.01$) with non-regular partners.

Overall, there have been declines in reported risk behaviours, among both men and women, during the study period. The mean levels of reported behaviour among men and women at the first survey and by testing status at the third survey are presented in Table 2.

Uptake of Testing and Counselling

The reported uptake of testing, counselling and collection of results at each survey is shown in Fig. 1. In the second survey, 18% (1,216/6,559) of participants reported having had a previous HIV test. However, of these, only 56% (680/1,216) reported collecting their test results. In the third survey, 10% (1,248/12,533) of participants reported having tested. Of these, 86% (1,079/1,248) received their results. Overall, 8.6% (1,079/12,533) of participants in the third survey were defined as having *previously* received VCT. Individuals receiving VCT from the research programme at the third survey are not defined as having

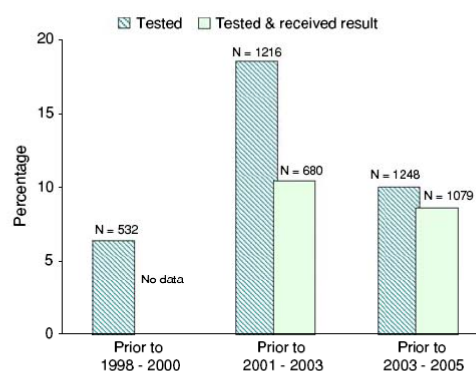


Fig. 1 Previous uptake of testing and results collection reported by individuals at each survey round ($N = 17,874$). In earlier study rounds (1998–2000 and 2001–2003) those who reported to have tested may include those who were tested for medical purposes but did not receive their results

received VCT for analysis purposes, as they received VCT after completing the survey questionnaire.

VCT and Subsequent Sexual Behaviour

Against a background of considerable declines in risk behaviour, including reductions in casual sex, [25], no significant additional behavioural risk reduction associated with VCT was observed among either HIV positive or negative men (Table 3). Women who received VCT reduced their number of new sexual partners in the last year more than those who did not test (Table 3; Fig. 2). This was true regardless of HIV status, but greater additional reductions were observed among those receiving a positive test result. Women receiving a positive result also reduced their bar attendance in the last month more than those not

Table 3 Sexual behaviour change following VCT, from generalized linear regression models predicting each behavioural outcome

	HIV positive					
	Males			Females		
	Exp(Coef.)	SE	95% CI	Exp(Coef.)	SE	95% CI
Visited bar/beer hall in the last month	1.26	0.09**	(1.10–1.44)	0.38	0.16*	(0.17–0.85)
New sexual partner in past year ^a	0.75	0.16	(0.50–1.12)	0.38	0.13**	(0.20–0.73)
Sexual partner in past month ^b	1.19	0.33	(0.69–2.05)	0.92	0.19	(0.61–1.37)
Multiple concurrent partners ^b	0.72	0.32	(0.31–1.70)	0.46	0.58	(0.04–5.35)
Consistent condom use in last 2 weeks						
With regular partners ^b	1.65	0.74	(0.68–3.98)	1.89	0.76	(0.86–4.16)
With non-regular partners ^b	0.65	0.55	(0.12–3.45)	2.07	2.69	(0.16–26.42)
	HIV negative					
	Males			Females		
	Exp(Coef.)	SE	95% CI	Exp(Coef.)	SE	95% CI
Visited bar/beer hall in the last month	1.02	0.04	(0.94–1.11)	1.66	0.39*	(1.05–2.64)
New sexual partner in past year ^a	0.87	0.08	(0.72–1.04)	0.69	0.12*	(0.48–0.97)
Sexual partner in past month ^b	0.89	0.12	(0.68–1.17)	0.91	0.10	(0.73–1.12)
Multiple concurrent partners ^b	1.11	0.25	(0.71–1.73)	0.98	0.66	(0.23–4.26)
Consistent condom use in last 2 weeks						
With regular partners ^b	0.96	0.38	(0.45–2.08)	1.39	0.38	(0.81–2.39)
With non-regular partners ^b	1.08	0.41	(0.51–2.28)	0.01	0.02	(0.00–2.80)

Exponentiated coefficients describe the change in the outcome variable associated with receiving VCT, stratified by sex and HIV status

Results are adjusted for age, calendar year and marital status, see “Methods” for details

Exp(Coef.): Exponentiated coefficient. A value of 1 indicates no change

SE: Standard error

* $P < 0.05$, ** $P < 0.01$

^a Those who had tested within the year before the survey were categorized as not tested when defining the indicator for having received VCT

^b Modelled as a binary variable

testing. Men testing positive and women testing negative tended to report more visits to beer halls in the last month. Overall, levels of consistent condom use increased among men and women testing positive; however, these were not significant changes (Table 3).

The effect of VCT in reducing risk behaviour increased with greater time (2–3 years) since testing among those testing positive, with respect to new sexual partners in the last year and bar attendance (Fig. 3). No significant trends were observed in the effect of VCT over time with respect to sexual partners in the past month. Reduced levels of concurrency, among those testing positive, were maintained for 2–3 years following testing.

Discussion

As a scale-up in provision of VCT services and access to treatment in sub-Saharan Africa is underway, it is important to monitor the uptake of VCT and its impact on sexual

behaviour. In this rural Zimbabwean population, the uptake of VCT services is increasing gradually, but remains low compared with some other countries with generalized HIV epidemics [3]. Promisingly, we found that women receiving VCT reduce the number of sexual partnerships they form. Although the changes were greatest for those testing positive, substantial reductions were also seen for those receiving negative test results. Similar patterns of change were observed for men, but the differences were smaller and not statistically significant. These gender differentials in the effectiveness of VCT for promoting safer sexual behaviour suggest that women may be more receptive to risk reduction counselling than men, in this setting. These risk reductions observed following VCT are particularly encouraging because they are not based on results from a trial of VCT, where services may be implemented more assiduously than they can be done when scaled-up.

Reductions in risk appear to be maintained or even enhanced, only for those testing positive, perhaps due to deteriorating health. However, inconsistencies in reporting

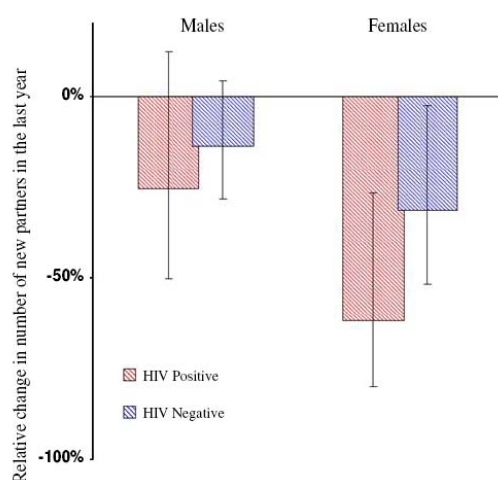
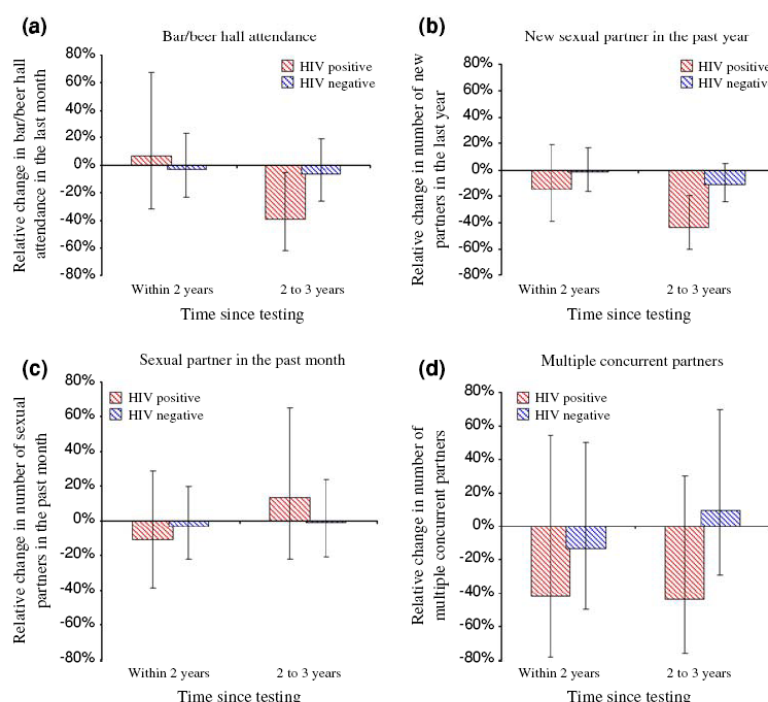


Fig. 2 Relative change in the number of new partners in the last year, following VCT. The results in the above figure are based on comparing those who received VCT to those who did not receive VCT. Thus, this figure illustrates the additional reduction in mean number of new partners in the last year associated with receiving VCT. The 0% indicates no change. Results are adjusted for age (5 year categories), calendar year and marital status. The relative change is calculated as: $\text{Exp}(\text{Coef.}) - 1$

of time since receiving VCT suggest recall bias may have affected these results. An informal confidential voting method was used to minimise social desirability bias in reported sexual behaviour following receipt of risk reduction counselling. Furthermore, the counselling provided by the study was intended to be supportive and not didactic. Also, there was no evidence for increases in consistent condom use. The finding that those lost to follow-up tended, in some respects, to be of a higher risk profile than those followed-up over the study period may mean that we underestimated the potential effect of VCT, since high risk individuals have the greatest potential for substantial reductions in risk.

These results confirm previous findings in this population, which used two rounds of data and different statistical methods, where greater reductions in risk behaviours were seen among individuals testing positive—but not among individuals testing negative—than in the general population [19]. However, importantly, concerns over increased risk behaviour among individuals testing negative, were not confirmed in the current study. The differences in findings may reflect changes occurring over time in the context, nature (including quality), profile of testers, and effect of VCT, as well as the differences in the statistical methods used. Unlike in the earlier analysis, account was

Fig. 3 The effect of VCT on behaviour in relation to time since testing. The results are based on comparing those who received VCT to those who did not receive VCT. Thus, these figures illustrate the additional change in behaviour associated with receiving VCT. Results are adjusted for age (5 years categories) and sex. **a** Bar/beer hall attendance. **b** New sexual partner in the past year. **c** Sexual partner in the past month. **d** Multiple concurrent partners



taken here of the magnitude of change in particular behavioural variables. Furthermore, the current analysis is stratified by HIV infection status, whereas the earlier report was based on separate comparisons between positive and negative individuals who took up VCT and all individuals (i.e. positive and negative individuals combined) who had not received VCT.

Overall, evaluating the evidence for the impact of VCT on sexual behaviour is difficult because studies are diverse with respect to design, outcome measures, statistical analyses and comparison groups, participant characteristics and service provision. Our finding that VCT is more effective for risk reduction among those testing positive is consistent with findings from a multicenter randomized controlled trial [12]. However, this study reports reductions in formation of new partnerships, whereas the outcome of interest in the randomized controlled trial was unprotected intercourse. Nonetheless, our findings are generally consistent with the conclusions of two previous meta-analyses [10, 11]. Our findings are in contrast to those of Matovu et al. [23], who report no difference in number of sexual partners among acceptors and non-acceptors of VCT, and no significant change in risk during follow-up among those who accepted or refused VCT, in Rakai, Uganda. However, almost half of participants (50.9% of VCT acceptors and 41.2% of non-acceptors) had previously received home-based VCT from the Rakai program. Thus, it may not be surprising that no behavioural differences were observed.

In Zimbabwe, there have been widespread reductions in risk behaviour over the study period [25]. We observed declines in risk behaviour among individuals who did not test, as well as among those who tested. However, these behavioural trends have been accounted for in these analyses, in order to distinguish behavioural changes associated with receiving VCT from background reductions in risk. It is encouraging that VCT can be effective in reducing risk behaviour in such a context but it is not known whether the level of uptake of VCT or the more extensive reductions in risk behaviour seen amongst individuals who took up VCT would have been the same in the absence of this underlying pattern of behaviour change. Previous studies of VCT services in Zimbabwe have achieved higher levels of uptake than was observed in the current study in contexts such as antenatal clinics [31], workplace VCT programmes [32], and mobile same day testing [33]. The profile of testers and the effect of VCT are likely to differ according to the method of VCT provided and the specific context in which it is offered, so it is uncertain to what extent our results can be generalized beyond the particular study setting [34–36]. Furthermore, the current study was undertaken in the pre-ART era. The expansion of VCT services, provision of treatment, and the switch to provider-initiated VCT will likely have important implications for

the demand for VCT and its effect on sexual behaviour. Lack of treatment has almost certainly been a barrier to uptake of VCT in this population, as the majority (83%) of participants at the third survey reported that they would test if cheap treatment was available.

Our data do not capture short-lived changes in behaviours measured over the short-term, such as consistent condom use and concurrency. Thus, if an individual reduced their risk immediately after VCT, but this risk reduction was not maintained until the subsequent study survey, this change would not be identified. Mathematical modelling studies of the population-level impact of VCT have found that a critical determinant of the preventive benefits of VCT is the duration of changes in behaviour [2]. If high risk sexual behaviour is reduced following VCT, but these reductions are not maintained, the epidemiological impact of the intervention will be greatly reduced. Furthermore, slight changes in behaviour among negative individuals can result in substantial impact at the population level as the majority of the population will be uninfected.

VCT arguably represents the best opportunity for encouraging sexual behaviour change, which is essential if the transmission of HIV is to be abated and the provision of treatment is to be sustainable. Provision and uptake of testing is increasing as efforts to find infected individuals to start therapy intensify. But, for VCT to be a successful prevention intervention, it must lead to sustained risk reduction among both infected and uninfected individuals. Thus, the importance of adopting and maintaining reductions in risk behaviour must be emphasized through high-quality counselling.

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