EFFORTS TO INCREASE THE USE OF HIV TESTING SERVICES: WHAT INTERVENTIONS HAVE WORKED IN THAILAND?

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Abstract. We reviewed and analyzed published research concerning efforts to increase regular use of HIV testing services in Thailand. Separate studies suggested that the creation of participatory and creative online spaces for information sharing and promoting community-based testing positively influence levels of HIV testing, including repeat-testing in some cases. Population targeted approaches, using same-day rapid tests, and using diverse locations for testing (medical and non-medical) may improve rates of testing. Thailand shows an example of successful HIV management and reduction. The challenge is to continue towards zero new infections and end an epidemic that is increasingly associated among people with specific risk behaviors. These characteristics make Thailand a case study for consideration by other national HIV programs.

Keywords: HIV, prevention, testing, Thailand

INTRODUCTION

With its AIDS ZERO strategy and programs, and with near universal health insurance Thailand has taken significant steps towards reducing transmission of HIV. To continue to reduce the impact of the epidemic, however, more effective targeting of people with certain risk behavior characteristics is needed, and levels of testing need to increase. Within the context of AIDS ZERO in Thailand, we reviewed the literature concerning the impacts of interventions to improve levels of testing in Thailand. Thailand provides an example of successful general population management of HIV and of how to tackle concentrated epidemics in specific groups. The trends and suggestions within this review may be applicable to wider geographic contexts.

Thailand has had a long and successful history of public health interventions. For malaria, population-wide strategies of providing mosquito nets, and indoor re-

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sidual spraying reduced case incidence by over 90% from the 1950s to the 1970s, and reduced the remainder by 50-75% between 2000-2015 (WHO, 2015a). Immunization percentages have risen from 60-80% coverage in the 1980s to 99% current coverage for polio, tuberculosis, Measles, Mumps, and Rubella (MMR), and hepatitis B (WHO SEARO, 2013). HIV transmission and mortality have also greatly reduced. The estimated number of new annual infections decreased from 29,619 to 7,816 between 2000-2014 (National AIDS Committee of Thailand, 2015).

Uptake of voluntary counseling and testing (VCT) is required to identify people who are HIV positive; to provide effective and immediate care and treatment for people living with HIV; and for preventing further transmission of the virus. The demonstration that antiretroviral therapy reduces transmission of HIV in serodiscordant couples (Cohen *et al*, 2011), and that HIV infected asymptomatic patients benefit from early treatment (INSIGHT START Study Group, 2015) boosted the synergy between prevention and treatment. With evidence that HIV treatment prevents transmission, access to treatment has been broadened in Thailand, in particular with the decision to withdraw the CD4 cell count level limiting criteria in 2014 (Manosuthi *et al*, 2015).

Universal access to HIV treatment started in 2006 but only for patients with a CD4 threshold of ≤200 cells/mm^3. The threshold was increased to 350 cells/mm^3 in 2013, and the CD4 criterion was removed in 2015. Currently, all HIV positive patients can receive antiretroviral treatment (Bhakeecheep, 2014). While it remains essential to continue efforts to ensure adherence conducive to viral suppression for those already on treatment, the challenge is also to identify HIV infected people through promoting and achieving regular testing, especially within at-risk populations.

Although there have been many campaigns and initiatives designed to improve levels of testing, it is estimated that 43% of people living with HIV in Thailand remain unaware of their status (Bhakeecheep, 2014). We reviewed the literature reporting attempts to increase levels of testing and their possible impacts, and analyzed what has been learned that could help future strategies to improve uptake.

MATERIALS AND METHODS

Literature was selected for inclusion through an online search using the keywords of 'HIV,' 'testing,' and 'Thailand' on PubMed, and then crosschecked using Google Scholar for interdisciplinary research and social science articles. Each study was reviewed for the following three criteria: 1) whether the study had tested the efforts of an intervention or program characteristic, 2) whether it was associated with an improved uptake of testing services, and/or 3) whether it was associated with a behavioral change towards increased repeat testing.

We also consulted literature and reports from the World Health Organization (WHO), Joint United Nations Program on HIV/AIDS (UNAIDS), Non-Governmental Organizations (NGOs), Governmental Agencies, and other prominent studies on HIV prevention in Thailand.

RESULTS

Thirty-two studies were acquired through PubMed, and 78 through Google Scholar. Twenty-nine studies met our selection criteria and objectives. Journal articles, book chapters, and conference

presentations were included in the study if they were returned through the literature search. Publication dates of studies ranged between 1994-2015.

Over half of the studies were published since 2011, when antiretroviral therapy was shown to reduce the transmission of HIV, thus affirming the importance of knowing status and being on treatment from both an individual and public health perspective. Of the total studies, 25 were published in international journals, including two studies in regional journals (Nhurod *et al*, 2010; Thepthien *et al*, 2015), and one study in a Thai national journal (Vutthikraivit *et al*, 2014). One study was a policy brief from USAID (Spratt and Escobar, 2011), one study was a book chapter (Chotiga, 2013), and one study was a conference presentation (Crawford *et al*, 2013).

Overall, the authors of the examined studies expressed a belief that it is possible to increase levels of testing through certain interventions. For example, it would be possible by using different locations to test for HIV, whether they be mobile, community, or peer-based, or in partnership with other medical services (TB or antenatal); and by disseminating information through participative, creative methods, and using new information technologies.

In terms of methodology, we identified seven studies that used a deductive approach, assessing the impact of specified interventions on testing levels. Five of the seven deductive studies used before/after comparisons to evaluate the impact of interventions and program characteristics, while the other two (Teerawattananon *et al*, 2009; Sweat *et al*, 2015) used contemporaneous control and intervention groups to test their hypotheses. These seven studies focused on different types of interventions described below (Table 1). We classified 22 studies using an inductive approach, identifying factors associated with testing levels and making suggestions for the improvement of policy and programmatic interventions.

Information dissemination and increased testing

Two deductive studies emphasized the role of information sharing and education in encouraging testing. The first study encouraged an 'edutainment' approach (Kawichai *et al*, 2012). Edutainment constitutes combining educational messages within or alongside entertainment, such as dance, music, drama, or film. The events,

> ...were divided into several tents, with activities including VCT, HIV education sessions, blood pressure check-up, karaoke, movie projection, sport games, and prize give-always for active participants (Kawichai *et al*, 2012).

The approach was undertaken within broader community based approaches to VCT, and thus could also be included in either analysis of information dissemination or within discussions of community-based voluntary testing strategies. After the introduction of edutainment, an increase from 18-to-28 people per day (average) coming for VCT could be observed within the study population.

The second study (Anand *et al*, 2015), emphasized the importance of information and knowledge. The intervention consisted of using an online platform (website and social media) to disseminate reliable information on risk, location of testing venues, and prevention; while offering counseling to online communities of at-risk groups. The online space, 'Adam's Love,' was reported to have contributed to an increase of men who have

Table 1
Published research concerning efforts to increase regular use of HIV testing services in Thailand.

Study	Population Studied	Investigation	Investigation findings	Intervention /Characteristic identified	Intervention /Characteristic tested (Y/N)	Intervention /Characteristic demonstrated to increase testing (Y/N)	Demonstrated long term behavioural change towards increased testing (Y/N)
Anand *et al* (2015)	MSM	Impact of online communication strategies to disseminate reliable information and increase numbers using VCT services.	High usage of website 'Adam's Love' by users seeking information and advice. 8,288 MSM were directly referred to HTC services from the website. Membership of online community correlated with short intervals between planned tests.	Online recruitment, creation of online membership forums and information dissemination.	Y	Y	Y
Anuwatnonthakate *et al* (2010)	TB patients	Potential for testing for HIV within TB clinics.	Uptake of testing for HIV was higher when offered directly within TB clinics than when patient was referred to a specific HIV testing clinic.	Use TB services to test for HIV.	Y	Y	N
Chotiga *et al* (2013)	Migrants	Accessing factors impacting testing decisions of pregnant migrants from Burma.	Factors impacting on decisions are complex and diverse. Information and linguistic breakdowns impact on decisions to use VCT.	Need for improved communication and information sharing to inform decisions.	N	N	N
Crawford *et al* (2013)	Ethnic minorities	To understand barriers to testing.	Fears and misperceptions hypothesized to correlate to testing rates.	Use education to tackle fears and misperceptions.	N	N	N
Ford and Holumyong (2016)	Migrants	Identifying factors and assessing vulnerability related to testing.	Social integrations and high income status are related to using testing services, along with HIV knowledge and accessing testing during pregnancy.	None unidentified	N	N	N
Genberg *et al* (2009)	General population	Comparison of HIV stigma in four countries.	HIV stigma acts as a barrier to testing. People who have never tested for HIV and have low knowledge about ART are more likely to discriminate against HIV positive people.	Promote widespread testing and education to prevent stigma.	N	N	N

Hendriksen *et al* (2009)	General population	Investigating inter-personal and informal communication on community uptake of VCT.	Common conversations about HIV testing are positively significant factors in previous testing.	Increase conversations between men to encourage repeat testing.	N	N	N
Kawichai *et al* (2002)	General population	Demographic profiling of VCT users.	Community based testing and testing through antenatal services can reach high-risk people – male partners of pregnant women.	Analysis of VCT data crucial for informing interventions.	N	N	N
Kawichai *et al* (2007)	General population	Impact of community based interventions.	Removing barriers – economic, geographic improves testing rates.	Conduct testing at convenient locations and for free.	Y	Y	N
Kawichai *et al* (2012)	General population	Impact of community based interventions	Providing mobile testing improves uptake (particularly in hard to reach populations. Edutainment increased numbers of participants.	Mobile VCT and 'edutainment' should be developed further.	Y	Y	N
Khongphatthanayothin *et al* (2006)	General population	Demographic profiling of positive HIV patients.	Reputation of clinic and confidentiality linked to high usage of VCT, and high usage of VCT shows continuing need for services.	None identified	N	N	N
Le Coeur *et al* (2009)	General population	Why women have earlier access to testing and ART?	Women access testing and treatment through antenatal services. Men often only present for testing after health problems.	Targeted interventions for men	N	N	N
Lolekha *et al* (2014)	General population	Couples testing for HIV in antenatal care settings.	Couples presenting together for HIV testing in antenatal care settings helps identify more HIV positive men. Demonstrated success in identifying serodiscordant couples.	Use of antenatal settings to conduct testing	Y	Y	N
Maek-a-nantawat (2014)	MSM	Investigates the test-and-treat strategy of regular HIV testing and immediate antiretroviral treatment (ART).	Rapid results communicated by participants as a key factor in increasing use of regular testing services. Interest demonstrated in annual routine testing.	Increasing access to rapid testing and introducing regular annual testing	N	N	N
Nateniyom *et al* (2008)	TB patients	Uptake of HIV VCT in TB centers	Acceptance of testing was high but availability and access to services was low.	Increase services, staff capacity, and inter-program coordination	N	N	N

Table 1 (Continued).

Study	Population Studied	Investigation	Investigation findings	Intervention /Characteristic identified	Intervention /Characteristic tested (Y/N)	Intervention /Characteristic demonstrated to increase testing (Y/N)	Demonstrated long term behavioural change towards increased testing (Y/N)
Nhurod *et al* (2010)	FSW	Demographic study on differences HIV rates based on venue of work.	Street-based sex workers significantly higher rates of HIV.	Routine surveillance and targeted interventions for street-based sex workers.	N	N	N
Phanuphak *et al* (1994)	General population	Demographic profiling and impact assessment of VCT.	VCT linked with education. Testing resulted in higher condom use.	Linking education to VCT services could change behavior and reduce transmission.	N	N	N
Sweat *et al* (2015)	General population	Assessing value of community-based interventions.	Community-based interventions are effective at increasing testing – shown by differences in usage between control and intervention studies. Demonstrates increases in repeat testing.	Use community-based interventions to increase testing.	Y	Y	Y
Spaar *et al* (2010)	General population	ART services and HIV preventions.	Expanded ART services (condom distribution, education) strengthens HIV preventions.	Increase ART Services – particularly on partner notification, prompt diagnosis, and stigma reduction.	N	N	N
Spratt and Escobar (2011)	MSM	Access and uptake of testing.	Community based testing options and choice for MSM in testing sites/procedures are limited. Peer-counseling, targeted interventions and accessible services shown to be important.	Introduce rapid testing and improve clinical and community collaboration.	N	N	N
Teerawattananon *et al* (2009)	General population	Comparing healthcare provider initiated testing compared to testing only being providing upon client's request.	Acceptance of testing and HIV detection rate higher in experimental over control group.	Healthcare provider initiated testing should be developed.	Y	Y	N

Thepthien *et al* (2015)	MSM, FSW, IDU	Demographic profiling examining knowledge and attitudes.	Risk behavior does not necessarily correlate with risk perception (FSW). Having received information about VCT services and having someone urge testing were significant factors in increasing testing rates.	Specific and targeted responses needed for at-risk groups.	N	N	N
Ti *et al* (2013)	IDU	Examination of interest in peer-delivered testing.	High interest shown in accessing peer-driven testing and counseling services.	Increase access to peer-delivered testing in IDU, especially through drop-in centers.	N	N	N
Ti *et al* (2015)	IDU	Accessing HIV testing in peer-based settings.	Support shown for testing by medical providers in peer-based settings – offset concerns of confidentiality, hospital administrative barriers, and stigma. Concerns raised over peer-delivered testing – population confidentiality.	Increase access to testing through using peer-based services and settings.	N	N	N
Vanichseni *et al* (1992)	IDU	Testing among IDU.	HIV testing history associated with safer sexual activity.	Increase VCT services.	N	N	N
Vutthikraivit *et al* (2014)	MSM	Prevalence of HIV and barriers to testing among young MSM.	Young MSM at particular risk of contracting HIV and levels of those seeking testing is suboptimal.	Specific and targeted response needed for young MSM.	N	N	N
Wimonsate *et al* (2011)	MSM	Factors affecting HIV testing.	Factors associated with testing were sex work, older age, employment, history of drug use, and knowledge of ART among others.	Unidentified	N	N	N
Wiwattanacheewin *et al* (2015)	General population – youth	Predicting uptake of VCT services amongst youth who had never been tested before.	Significant numbers of youth have never used VCT services before.	Youth targeted interventions and youth-friendly VCT services should be explored.	N	N	N
Wirtz *et al* (2013)	MSM	Modelling projecting the impact of HIV interventions.	Scaled up interventions (condoms and ART) may result in 10,300 infections averted among MSM from 2012 to 2016.	Scale up specific MSM interventions.	N	N	N

sex with men (MSM) receiving testing through the Thai Red Cross by referral.

> …counselors at the Men's Health Clinic at the Thai Red Cross AIDS Research Centre reported that Adam's Love contributed to an approximately 25% increase in MSM patients who received HIV testing at the Thai Red Cross AIDS Research Centre…. (Anand *et al*, 2015).

Online counseling was also suggested to be useful in accessing high numbers of 'closeted' gay men. Thirty-four percent of those surveyed (data was available for 1,181 MSM recruited online) were discreet about disclosing their sexual orientation in public. Online services were suggested as offering an opportunity to reach this group and offer testing to a potentially at-risk population.

Both of these studies suggested that using new technologies and having creative approaches to information dissemination, beyond traditional public health communication, were associated with increased usage of VCT.

A final point for consideration related to information dissemination concerns perception of risk. While a person's perception of their level of risk to HIV exposure may be low, their actual behaviors would not be considered low risk (Phanuphak *et al*, 1994). Within a small study of 56 MSM in Bangkok,

> While 80.4% of men believed that they had been at low risk for HIV infection, but the majority of them also reported having had multiple sex partners and performed receptive and dual role while having anal intercourse. Furthermore, inconsistently condom use was reported by 44.6% of them (Vutthikraivit *et al*, 2014).

This is a problem, as low-risk perception has been inversely correlated with testing in a number of studies (Maek-anantawat *et al*, 2014; Vutthikraivit *et al*, 2014). Not being aware of what constitutes risk behaviors has also been emphasized in other studies (Thepthien *et al*, 2015).

Using diverse methods, locations and providers to increase testing

The other five deductive studies showed associations between using different locations and medical providers, which increased testing. Three studies specifically explored how hospital settings can better integrate and encourage VCT services. In a randomized control/intervention study across 16 hospitals implementing provider-initiated testing (Teerawattananon *et al*, 2009), a significant increase in both the acceptance rate for testing and the HIV detection rate was observed. Promoting the testing of partners in antenatal care services was associated with increased identification of HIV-positive men with negative female partners through couples HIV testing and counseling services (Lolekha *et al*, 2014). Integrating systematic HIV testing in TB centers was suggested to increase levels of testing (Anuwatnonthakate *et al*, 2010), with 86% of 15,903 TB patients unaware of their HIV status accepting testing through services offered by the Thailand TB Active Surveillance Network.

Mobile, free, and rapid same-day testing have been associated with increased levels of testing (Kawichai *et al*, 2007, 2012). In one study, providing a community education session, followed by on-site testing in health stations, schools, and temples encouraged testing: 10% of a target population of 21,000 took part in community education sessions; and, of those, 451 participants (10%) came for

VCT provided at various locations within the following 20 days. The accessibility and proximity of the testing venues was suggested as being an important factor.

In another randomized controlled study conducted in 14 communities in Thailand, it was suggested that community-based interventions could increase levels of testing (Sweat *et al*, 2015). Community-based interventions included community mobilization, using accessible community based venues and mobile testing, rapid testing, and having community based post-testing services. Uptake of testing was 23% in the control group (seven communities: 10,033 total population) with access to standard clinic-based VCT. Within the experimental group (seven communities: 11,290 estimated total population) given access to community-based VCT, 69% used testing services.

Associations with repeat testing

No study specifically quantified the impact of an intervention on improving rates of regular and re-testing, but the issue of regular testing within at-risk populations was addressed by two studies. Long-term behavioral changes in relation to repeat testing were suggested, although this was not the main focus of either study. Other interventions were able to suggest the impact of a program design on repeat testing, but if it was not demonstrated in terms of patient aspirations, it was not included. Long-term data showing whether patient's plans for repeat testing translate into coming for regular tests would be essential for demonstrating potential outcome on the epidemic.

In the first study, 'repeat testing' was defined by participants planning to return for testing (Anand *et al*, 2015). Information dissemination and creating active online membership spaces (Adam's Love Club membership program) and forums were positively associated with shorter intervals planned between tests. Sixty-six percent of those presenting for testing planned their next test for within six months (assessed by surveying the sites users). The authors concluded that the accessibility of the website, its reliability in terms of providing factual information on HIV, risk, prevention, and testing options (in contrast to the wealth of unreliable information on the internet), and its long term approach of engagement and developing ownership contributed to this success (Anand *et al*, 2015).

In the second study, clients reported that they used previous testing services, but data for repeat testing were only collected in the intervention group. In this study, it was estimated that community-based interventions increased rates of repeat testing by 50%, compared to 15% through standard clinic-based VCT services (Sweat *et al*, 2015). This observation was made in Thailand, which was one in the four countries of implementation of the study, and was confirmed in the other three countries, but to a lesser extent.

Population and behavioral studies

The 22 inductive studies in the review made suggestions for improving rates of HIV testing. Many of these suggestions were derived from population surveys and qualitative research on attitudes and behaviors.

It is generally agreed that information and knowledge is correlated to higher testing and retesting (UNICEF, 2014). This was also highlighted by several studies in Thailand, which examined low knowledge about HIV and access to testing and treatment options in both specific population groups and the general population (UNICEF, 2014; Anand *et al*, 2015;

Thepthien *et al*, 2015). Elsewhere, targeted interventions for specific populations and addressing specific barriers were encouraged. A UNESCO study covering 100 interviewed participants additionally showed that inconvenient venues, cramped testing centers, lack of specific venues for transgender or MSM testing, concerns over privacy and confidentiality, among others, all contributed to concerns and perceptions over utilizing VCT services (UNESCO, 2012; Vutthikraivit *et al*, 2014).

Within the general population, it has been suggested that male specific targeted interventions may be useful. In one study, men only presented for testing after experiencing health problems (Le Coeur *et al*, 2009). Targeted interventions for: 1) young people within the general population (under-18-year olds cannot access VCT without parental consent) (Wiwattanacheewin *et al*, 2015), 2) for MSM (Wirtz *et al*, 2013; Vutthikraivit *et al*, 2014; Thepthien *et al*, 2015), 3) for sex workers (higher surveillance required particularly for street sex workers) (Nhurod *et al*, 2010), and 4) for injecting drug users (increase peer-delivered testing services) (Vanichseni *et al*, 1992; Ti *et al*, 2013, 2015) may all help to increase levels of testing. Services designed as user-appropriate, user-friendly, and inclusive are consistent characteristics of studies associated with increased testing.

Increasing access to antiretroviral treatment (ART) services was suggested in two studies (Spaar *et al*, 2010; Wimonsate *et al*, 2011) with the parallel integration and delivery of other preventative services, including testing and counseling into programs. Use of rapid-testing was only specifically discussed in two of the inductive studies (Spratt and Escobar 2011; Maek-a-nantawat *et al*, 2014).

Fears of stigmatization and discrimination are raised in nearly every study analyzed (with different appropriations of significance). One study shows an association between increasing conversations about HIV between peers (Hendriksen *et al*, 2009). A positive response to the question of whether participants had spoken to someone about HIV during the last six months was the only statistically significant variable related to HIV testing. Fears of blame are cited as representing a psychological barrier to testing (Spaar *et al*, 2010). A statistically significant association between never having had an HIV test, and negatives attitudes towards those living with HIV/AIDS has also been shown (Genberg *et al*, 2009).

Across both minorities and the general population, barriers were suggested as highly coherent, with fear of testing (use of equipment such as needles), fear of the outcome of the test result, fear of losing familial and social connections, and fears of testing without support cited consistently. Within ethnic minority communities, additional concerns were cited around access to treatment, access to facilities, and language barriers (Crawford, 2013). Knowledge of facilities, treatments, and testing options were also lower within ethnic minority communities (Kunstadter, 2013). Confusion over citizenship, regulations, visas, and work permits contribute to an atmosphere of suspicion and fear of contact with public and government services. Low-paid workers who were TB positive were also shown by one study to be less willing to get an HIV test for fear of missing work and not being able to claim sick pay (Nateniyom *et al*, 2008).

There are a number of topics that are not present in the papers reviewed. None of the deductive studies examined issues related to sex workers, injecting drug us-

ers, or on legal and institutional barriers, or reforms to improve levels of testing. No deductive studies focused on testing of migrant populations. There were no studies exploring how to increase levels of testing through the existing public health system, and no studies investigating the potential of at-home testing. Our review was limited as description of interventions, client characteristics, and measurable outcomes were often not systematic. Only two comparative studies included control and interventions groups.

DISCUSSION

Since 2011, when treatment was shown to prevent transmission (Cohen *et al*, 2011), it appears that an increased emphasis has been placed on testing. Indeed, 16 of the studies were published after 2011. An estimated 43% of people living with HIV in Thailand remain unaware of their status. Given this significant proportion, and given the benefits of treatment for the infected persons' own health and the prospects of reduced transmission to others, identifying characteristics of these individuals represents an important area of study.

Questions should be asked. Who are these "43%"? What are their social-behavioral-demographic characteristics? One of the successful aspects of malaria programs, and other health interventions in Thailand, was in knowing exactly where the epidemic persists. More information is required in relation to those living with HIV and unaware of their status.

Within our review, a potential for publication bias was suggested. It seems unlikely that these have been the only studies conducted concerning this topic, and that every time an intervention has been attempted it was associated with a positive result. However, all studies published showed an association between an intervention or a program characteristic and an increased level of testing.

It is likely that the results of other programs with no impact on levels of testing have not been published. As shown in the results, a potential bias may also exist in relation to the large number of studies that focus on MSM. A lack of studies on general population, sex workers, and injecting drug users may result in gaps in the data.

There are difficulties related to assessing causality, and whether interventions identified are directly responsible for increased levels of testing or whether other factors may need to be considered. Given the 'bundling' of different methods and approaches within interventions, identifying the impact of one intervention is difficult.

From an overall population perspective, it is difficult to determine whether some interventions are not just redirecting people already seeking testing from other services to new settings without really increasing the proportion of people being tested. Questions such as "Is this your first ever HIV test?" (included in some of the studies) may partly help address this issue. None of the studies asked whether clients would have requested testing services elsewhere if the intervention had not been introduced.

Previous successful public health initiatives in Thailand, such as malaria control and immunization programs, are not referred to in the discussions of any of the studies analyzed. Common features of these interventions were that proximity and accessibility to services were important components of their success, for example, by providing malarial preventative measures with active involvement of local

health volunteers. A wider analysis may provide opportunities to better inform public health interventions.

Studies in our review also suggest the value of attempts to increase HIV testing through using different venue types for VCT, by designing innovative programs through using media, and for utilizing community-based services. Proximity, individual relationships and trust appear to be important factors in encouraging the use of VCT services, and are likely more important than information dissemination alone (Anand *et al*, 2015).

Who communicates the information and how they are perceived is important. Information has to be delivered with reliable and audience-appropriate messaging and the approach to use lay-providers for testing has been encouraged by the WHO (WHO, 2015b). Messaging has to be ambitious and creative, and bring users and target audiences into its dissemination. Ownership in programs and participation (for example, through online forums or community mobilization) are two consistent program characteristics across studies showing increased levels of HIV testing.

It could be speculated that information and knowledge may help counter fears, and perhaps it is necessary to discuss psychosocial support, both professional and peer-delivered, and what potential solutions such interventions could offer. A broader scope and mandate for counseling activities could offer this sort of support. Currently, counseling refers to predominately to the provision of information about the meaning of a test (MoPH, 2013). Guidelines from international organizations suggest providing additional psychological support to at-risk clients (UNICEF, 2009). Systematic assessments of the training provided to counselors and their ability to provide these services may be useful.

In a related sense, little has been discussed about the actual dynamics of anti-stigmatization programs. For example, what messaging works? How should it be delivered? Given the consistency of 'fear' being cited across nearly all studies and population groups, this should be seen as an important component for deeper analysis. More information about treatment, countering ideas of HIV as a death sentence would be useful, especially given the recent move to universal treatment regardless of CD4 count. None of the studies specifically focused on messaging concerning the concept of risk, although this was suggested to have a significant impact on whether people use VCT (Phanuphak *et al*, 1994).

Finally, as shown in the Results section, there is a lack of studies examining reform at the institutional level. Legal barriers exist to testing. This is clear in relation to drug users and the criminal justice system (Ti *et al*, 2013) and for young people and ethnic minorities. Confusion over citizenship, regulation, visa and work permits, knowledge of treatment options (Kunstadter, 2013), and linguistic barriers all exist (Crawford, 2013). These barriers are institutional and political, and need legal and institutional reform and action. Such macro-level examinations, interventions, and reforms are lacking from the literature reviewed. More information on direct and indirect costs to service users may also be useful.

Interventions providing testing out of formal hospital environments and using different providers, such as peers and the community are suggested as being effective in increasing testing. Equally, online spaces and new technology improving communications, offering different opportunities for access, should be better

explored given the results shown in this review. Trends across the two studies associated with repeat testing suggest ownership and participation are important factors. These principles should be built into all interventions. Trends highlighted by this study may be applicable to wider geographic contexts and may provide an example for how to meet the challenges of a concentrated epidemic.

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