

A Review of Process and Outcome Measurements in Community-Level HIV Behavioral Interventions among Men Who Have Sex with Men

By

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Abstract

Introduction: Many effective HIV behavioral interventions among men who have sex with men (MSM) utilize the Popular Opinion Leader (POL) model of promoting safer sexual behavior, based on Rogers' diffusion of innovations theory (Rogers, 2003). This paper reviews the process and outcome measures used in a sample of published POL interventions focused on MSM, and examines best practices in both process execution and in outcome measurement among studies of this type.

Methods: I reviewed six studies selected from a PubMed database search that met the following criteria: HIV community intervention among men who have sex with men, which used or intended to use the popular opinion leader methodology.

The process measures I reviewed include selection of study venue, identification and recruitment of popular opinion leaders within the community, obtaining a critical mass of POLs needed to effect changes in behavioral norms, and effective training of POLs.

The outcome measures I reviewed include behavioral measures, survey recall period, and the difficulties in supplementing the behavioral measures with biological measures. An additional intervention design element I considered was time to follow up and the need for continued follow up.

Results: Of the six studies I reviewed, four reported statistically significant reductions in sexual risk behavior among the intervention population. Problems in POL identification and recruitment, as well as limitations in the POL training provided, appear to be factors in the lack of successful results for the two other studies. Implementation challenges existed in these two settings, however, which may have reduced the potential for diffusion of innovation.

Discussion: Difficulties experienced by two studies point out the need for additional research in HIV POL interventions in large metropolitan settings, and the need for longer follow up periods to measure any lasting behavioral changes resulting from the interventions. Measurement of biological outcomes in HIV behavioral interventions in a community setting present ethical and expense issues, with the result that most studies of this type rely on reported behavioral outcomes to define intervention success.

Introduction

In this paper I review process and outcome measures as well as other intervention design elements used in studies that attempt to effect community-level behavioral change among men who have sex with men (MSM) through use of the Popular Opinion Leader (POL) methodology. Review of these POL interventions is intended to underscore best practices among the various evaluation measures in such studies.

Studies among MSM were chosen because HIV/AIDS continues to cause a heavy burden of disease in the United States, especially among men who have sex with men. The Centers for Disease Control and Prevention (CDC) estimates that 53% of all new HIV infections in 2006 in the United States were among MSM, with an estimated 28,720 new cases among MSM that year (CDC, 2008).

Behavioral interventions for MSM are designed to decrease the level of transmission of the HIV virus through a reduction in high-risk sexual behavior, the primary transmission path among MSM. Behavioral interventions for HIV prevention can be at the individual, small group, or community level. Early behavioral interventions for HIV focused on educating individuals or small groups about how HIV transmission occurred, and what steps, such as condom use and a reduction in the number of sexual partners, could be taken to reduce the possibility of virus transmission (National Institutes of Health, 1997). Small group interventions also often focused on skill-building to improve individual capacity to negotiate safer sex practices with partners. These types of interventions at the individual and group level have been shown to be effective among MSM in reducing high-risk sexual behavior (Herbst et al., 2007; Latkin & Knowlton, 2005).

Community-level behavioral interventions seek to influence the behavior of a larger community, rather than focusing on the individuals participating in an intervention. Behavioral interventions targeted at entire communities of MSM have been shown to be both efficacious and cost-effective according to a systematic review by Herbst, reaching larger numbers of the target population than individual or small group interventions

(Herbst et al., 2007). Kelly has argued that properly formulated community-level behavioral interventions are indispensable in the fight to reduce HIV incidence, as face-to-face techniques at the individual and group level cannot reach the large numbers at risk (J. A. Kelly, 1999).

How can community-level interventions best impact HIV incidence? Diffusion of innovation theory is a conceptual framework for how behavioral innovations are accepted and adopted within a community (Rogers, 2003). First published in book form by Rogers in 1962, early forms of diffusion of innovation research began as early as 1903, with Tarde's "laws of imitation." (Tarde, 1903/1969) Rogers' work showed that a transfer of factual information to a community such as through common health education techniques does not always result in lasting behavior change, especially if the goal behavior is at odds with current communal norms. Behavior norms within a community must first be altered, and must become widely accepted within a person's social network, before community-level behavior change is significant and long lasting. Rogers showed that this change can be facilitated by working with natural opinion leaders already present within each community. If such POLs within a community adopt and espouse a behavioral change, that change can more easily disseminate throughout the community, establishing a new norm for behavior over time. This concept is called the theory of diffusion of innovations (Rogers, 2003). Since alteration of sexual behavior norms is at the heart of HIV transmission prevention efforts at the community level, the diffusion of innovations theory is a frequently used theoretical basis underlying many community-level HIV prevention interventions.

Reviewing process and outcome measures used in such POL-based interventions can highlight the most effective measures for use in future similar interventions that attempt to effect community-level behavioral change among MSM through use of the POL methodology. Process evaluation assesses whether the various components of a program or intervention were implemented as intended and designed. Evaluating the processes of an intervention also allows the investigator to determine if any barriers were encountered during execution of the intervention. Poor process implementation can impact intervention outcomes, as the best designed intervention can fail if not implemented correctly.

Methods

In this paper, I examine how effectively a sample of POL community-level interventions have implemented criteria established for POL interventions. I compare and contrast aspects of the process implementations of the POL interventions and discuss several circumstances where implementation of all primary elements was problematic.

I selected intervention studies for comparison from the PubMed database by searching for HIV studies using popular opinion leaders. Exact search terms were not recorded, but studies selected for inclusion in this review all met the following criteria:

- HIV community intervention
- Among men who have sex with men
- Using or intending to use the popular opinion leader methodology

I located six studies that met the criteria, and all were included in the review. Additional studies may exist which meet these criteria, but were not located during the search.

Both Kelly and the National Institute of Mental Health (J. A. Kelly, 2004; NIMH Collaborative HIV/STD Prevention Trial Group, 2007b) have published an identical set of 9 core elements required for successful implementation of the POL methodology in HIV interventions, which are presented in Table 1. I compared process measures, outcome measures, and other study design elements across the 6 studies, using the 9 core elements as a guide. The common features to review were selected based on information availability across at least 4 of the 6 studies, and are shown in Tables 2 and 3. I was not able to compare all facets of the 9 core elements among the studies. Attention is focused on items 1, 2 and 3 among the core elements in Table 1. Additionally, items 4, 5, 6 and 8 are addressed under the general topic of training. All of the POL training core elements could not be addressed point by point, as the published reports do not provide enough detail, but components of each of these elements are discussed.

Table 1: Core elements of the popular opinion leader (POL) model

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| <ol style="list-style-type: none">1. Intervention is directed to an identifiable target population in well-defined community venues and where the population's size can be estimated.2. Ethnographic techniques are systematically used to identify segments of the target population and to identify those persons who are most popular, well-liked, and trusted by others in each population segment.3. Over the life of the program, 15% of the target population identified in intervention venues are trained as POLs.4. The program teaches POLs skills for initiating HIV risk reduction messages to friends and acquaintances during everyday conversations.5. The training program teaches POLs characteristics of effective behavior change communication messages targeting risk-related attitudes, norms, intentions, and self-efficacy. In conversations, POLs personally endorse the benefits of safer behavior and recommend practical steps needed to implement change. |
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6. Groups of POLs meet together weekly in sessions that use instruction, facilitator modeling, and extensive role play exercises to help POLs refine their skills and gain confidence in delivering effective HIV prevention messages to others. Groups are small enough to provide extensive practice opportunities for all POLs to shape their communication skills and create comfort in delivering conversational messages.
7. POLs set goals to engage in risk reduction conversations with friends and acquaintances in the target population between weekly sessions.
8. The conversation outcomes of POLs are reviewed, discussed, and reinforced at subsequent training sessions.
9. Logos, symbols, or other devices are used as ‘conversation starters’ between POLs and others.

Additionally, I evaluated the behavioral and biological outcomes measures used in each study. I compared the reporting of various sexual risk behaviors and the behavioral recall period, as well as collection of any biological or self-reported data on HIV and STD diagnoses. Time to follow up is also assessed for each study.

Results

Process Evaluation Measures in Community-Level HIV Interventions

Venue – Core Element #1

Four of the interventions targeted MSM populations who frequented gay bars or nightclubs (Flowers, Hart, Williamson, Frankis, & Der, 2002; Jones et al., 2008; J. A. Kelly et al., 1992; J. A. Kelly et al., 1997). Authors of these studies acknowledge that the MSM population found at gay bars is unlikely to mirror the general MSM populations of these cities, so results may not be applicable across the broader MSM population. However, all four studies demonstrated statistically significant reductions in risky sexual behavior, most frequently reduced incidence of unprotected anal intercourse. Since MSM frequenting gay bars is a segment of the overall MSM population that is believed to be at higher risk of HIV, targeting this population could have larger impacts in

reduction of HIV transmission than other segments of the MSM population that do not frequent gay bars, and which may be less likely to have higher risk sex with multiple partners.

In their study, Elford et al (J. Elford, Bolding, & Sherr, 2001) targeted an MSM population of gym clientele at gay and predominately gay gyms in London. This intervention was unsuccessful in reducing sexual risk behavior at follow up. The authors acknowledged that less than a third of men surveyed said they came to the gym to meet friends. This implies a difference that likely exists between the social atmospheres of bars versus gyms, and no subsequent study has been found that attempted to replicate a gym-based POL intervention. The gym environment may be less suitable for casual conversation among friends than a local pub. The gym venues were specifically chosen for the London study because of the belief that the gay bar clientele were more likely to be patrons of multiple venues, raising the issue of contamination among intervention and control groups within the same city, while gym members tend to patronize a single facility. Although this approach may have minimized cross-contamination among intervention and control groups, the choice of venue may have had other negative consequences to the intervention process. Although a gym venue appears to meet the requirements of core element #1, additional social factors may be needed besides a common community venue, which are not expressed in the definition of this core element.

Table 2: POL Process Measures in Community-Level Behavioral Interventions among MSM

Author/Year (Citation)	Study Design & Target Population	POL Identification	% of Target Population Trained as POLs	POL Training	Measurement of peer conversations	Presence of conversation starters	Author's assessment of successful POL implementation
Kelly/1992 (J. A. Kelly et al., 1992)	POL in 3 Southern U.S. cities among MSM in gay bars	Bartender referral	7%	4 weekly sessions	Average 6.1 peer conversations in 17 day post-intervention period	Small lapel button with traffic light logo	Yes
Kelly/1997 (J. A. Kelly et al., 1997)	POL in 8 small U.S. cities among MSM in gay bars	Bartender referral, plus friend referrals	8%	5 weekly sessions	Average 10 peer conversations over 3 week post-training period	HIV prevention posters, small lapel button with traffic light logo found on posters	Yes
Elford/2001 (J. Elford et al., 2001)	POL in London among MSM gym members	Gym staff referral	1.3% - most POLs identified did not participate.	1 day, plus phone and email support, informal social events	Average 10 peer conversations over 6 month period	T-shirt with project logo	No
Flowers/2002 (Flowers et al., 2002)	Peer education and gay medical services outreach in 2 Scottish cities among MSM in gay bars	Recruitment of paid peer educators – Attempted POL recruitment was insufficient	Unknown – peer educators not POLs	2 days	Not quantified, although most reported conversations focused on factual information, not risk behavior change	Unknown	No
Amirkhanian/2005 (Amirkhanian et al., 2005)	Social network intervention in 2 cities in Russia and Bulgaria, among young MSM	Peer network analysis	19% (One leader for each of 52 defined social networks)	5 weekly sessions, plus 4 booster sessions over next 3 months	Unreported	No	Yes – modified for social networks versus specific venues
Jones/2008 (Jones et al., 2008)	POL in 3 NC gay cities among Black MSM	Local HIV prevention specialist referrals	11%	4 sessions	Unreported	Logo'd marketing and education materials	Yes

POL: Popular Opinion Leaders

The study population of the Amirkhanian intervention (Amirkhanian et al., 2005) was not based on a specific venue or set of venues, but was a modification of the POL methodology that selected the intervention and control populations based on membership in social networks. Initial network membership selection and analysis (Amirkhanian, Kelly, Kabakchieva, McAuliffe, & Vassileva, 2003) was conducted among bar and nightclub venues in Russia and Bulgaria.

POL Identification and Recruitment – Core Element #2

Two studies (J. A. Kelly et al., 1992; J. A. Kelly et al., 1997) relied primarily on bartender referrals and one (Jones et al., 2008) used local HIV prevention specialists as the referral source. In the latter study, it is possible that the referred POLs were already active in HIV prevention activities. The POL recruitment efforts of these 3 studies were largely successful.

Identification of true POLs was difficult in some cases, however. Even after being identified, some studies had further difficulties in recruiting enough POLs to become active participants in the intervention. Elford et al. relied upon gym staff for referrals of POLs (J. Elford et al., 2001). Although many POLs were identified, a large number of those identified did not choose to participate in the intervention and this study did not achieve its stated POL participation objectives. Flowers et al (Flowers et al., 2002) failed to recruit any POLs, and the study instead used paid peer educators. The Flowers study effectively discarded the POL model during the study implementation by substituting paid peer educators with no known standing in the target community. According to Kelly

(J. A. Kelly, 2004), both the Elford and Flowers studies failed to implement core element #2.

Amirkhanian et al (Amirkhanian et al., 2005) conducted a study using a slightly different model. The authors used an existing social network analysis to identify leaders of 52 social networks of young MSM through analysis of the interrelationships among networks of individuals. This model appeared to be a successful modification of the POL framework, with statistically significant reductions in unprotected anal intercourse among the study population, as well as greater peer acceptance of safer sex norms.

POL Critical Mass – Core Element #3

According to diffusion of innovations theory (Rogers, 2003), diffusion of innovations can best be achieved when an ideal of fifteen percent of the target population is recruited as POL agents of change. The studies reviewed here had POL participation ranging from 1.3% to 18% of the target population. Elford et al (J. Elford et al., 2001) had the lowest participation rate, at 1.3% and Flowers et al (Flowers et al., 2002) did not identify the percentage of the target population used as peer educators. Only the Amirkhanian study met the 15% target threshold, although studies with 7% to 11% of the population recruited as POLs (Jones et al., 2008; J. A. Kelly et al., 1992; J. A. Kelly et al., 1997) reported statistically significant reductions in sexual risk behaviors at follow up.

Kelly (J. A. Kelly, 2004) asserts that the low POL participation rate of the studies by Elford and Flowers (J. Elford et al., 2001; Flowers et al., 2002) meant that the potential

for diffusion of innovation was absent, and therefore establishment of population-level behavioral change could not take place. The Flowers study, although designed to use POLs, is not a test of the diffusion of innovations theory as implemented.

POL Training – Core Elements 4, 5, 6 & 8

Several of the POL core elements identified in Table 1 revolve around the training of the POLs for each intervention. It is not possible here to assess how effective the individual trainings were in supporting all of the POL training objectives, but training frequency and duration can be assessed. These represent specific aspects of core elements 6 and 8.

Four studies provided 4 to 5 weekly training sessions for the POLs (Amirkhanian et al., 2005; Jones et al., 2008; J. A. Kelly et al., 1992; J. A. Kelly et al., 1997), with the Amirkhanian study also providing 4 additional booster sessions over the subsequent 3 months. These studies met the POL core training objectives of training duration while also reinforcing communications skills training and role playing through repetitive exposure and practice. The Elford and Flowers studies (J. Elford et al., 2001; Flowers et al., 2002) provided only 1 and 2 days of training, respectively, although the Elford study also offered phone and email support to participating POLs, as well as occasional informal social events among the POLs. This level of training did not meet the core element objectives 6 and 8, which call for weekly sessions and skills reinforcement through practice over time.

Kelly (J. A. Kelly, 2004) emphasized the need for continuing follow-up and multiple role-playing sessions during training. The multiple week format suggested allows for reinforcement of the communication skills needed for successful implementation. POLs were instructed to have practice conversations among friends between sessions, and could then discuss any difficulties encountered in subsequent trainings. The shortened training exposure in the Elford and Flowers studies may not have allowed for the necessary skills reinforcement over time needed for proper delivery of behavior change messages to their peers (J. A. Kelly, 2004).

Outcome Measures among Community-Level POL Interventions for HIV

I compared several outcome measurements used to evaluate intervention success in the six selected studies. Table 3 summarizes the behavioral and reported biological measures used in each study. No actual biological sampling was conducted in any of the interventions under comparison. Self-reports of HIV testing were collected in pre- and post-intervention surveys in several studies. Self-reports of STD diagnoses were collected only in the Jones study (Jones et al., 2008).

Survey data on unprotected anal intercourse, both receptive and insertive, was collected for all interventions both pre- and post-intervention. Several studies also collected data on numbers of sexual partners and condom use. Additional data was collected by some studies, to a greater or lesser degree, on peer norms related to safer sex behaviors, and

Table 3: Outcome Measures and Time to Follow Up Among Community-Level HIV Behavioral Interventions

Author/Year (Citation)	Intervention	Intervention Components	Time Post- intervention to Follow up Survey	Primary Behavioral Outcome Measures	Behavioral Recall Period	Biological Outcome Measures – Reported Only	Statistically Significant Outcome
Kelly/1992(J. A. Kelly et al., 1992)	POL in 3 Southern U.S. cities among MSM	Trained POLs in gay bars	3 and 6 months	UAI , PAI, # of sexual partners, peer acceptance of safer sex	2 months	None	↓ UAI, ↑ PAI
Kelly/1997(J. A. Kelly et al., 1997)	POL in 8 small U.S. cities among MSM	Trained POLs in gay bars; free condoms in bars	1 year	UAI among casual partners, PAI, # of sexual partners	2 months	HIV status known or unknown	↓ UAI, ↑ PAI
Elford/2001(J. Elford et al., 2001)	Peer education in London among MSM	Trained POLs in gay or predominately gay gyms	6, 12, and 18 months	UAI; needle sharing among steroid users	3 months	HIV status known or unknown	UAI – No Change
Flowers/2002(Flowers et al., 2002)	Peer education and gay medical services outreach in 2 Scottish cities among MSM	Peer education in gay bars; gay medical services; free hotline	3 years	UAI among casual partners	1 year	HIV status known or unknown; Hepatitis B vaccination rate;	UAI – No Change
Amirkhanian/2005(Amirkhanian et al., 2005)	Social network intervention in 2 cities in Russia and Bulgaria, among young MSM	Trained POLs among networks of peers	3 months and 1 year	UAI, condom use peer acceptance of safer sex	Lifetime, 1 year, and 3 months (detailed questioning for 3 month recall)	None	↓ UAI, ↑ peer acceptance of safer sex norms
Jones/2008(Jones et al., 2008)	POL in 3 NC gay cities among Black MSM	Trained POLs in gay nightclubs	At approx. 3, 6, 9, and 12 months	UAI; PAI, # of sexual partners; condom use	1 year	HIV status known or unknown; Diagnosis with any STD	↓ UAI, ↓ # partners, ↑ condom use

POL: Popular Opinion Leaders; UAI: unprotected anal intercourse; PAI: protected anal intercourse (indicated by condom use);
 ↓:Statistically significant decrease; ↑:Statistically significant increase

whether sexual partners were long-term or casual. The common behavioral outcome used to evaluate results across all interventions reviewed was unprotected anal intercourse.

All six studies reported the behavioral recall period, which varied from two months to one year across the studies. Four of the six studies reviewed here (Amirkhanian et al., 2005; J. Elford et al., 2001; J. A. Kelly et al., 1992; J. A. Kelly et al., 1997) surveyed the sexual behaviors of participants using 2-3 month recall periods. The Flowers and Jones studies (Flowers et al., 2002; Jones et al., 2008), however, asked participants to recall sexual behaviors over a one year period.

The ideal biological outcome measure for any study whose objective is to reduce HIV transmission would be to test individuals for HIV exposure before and after the intervention and compare changes in HIV seropositivity among intervention and control groups (Fishbein & Pequegnat, 2000). As a substitute for actual biological testing for HIV, or biological testing of any other STD, four studies under review (J. Elford et al., 2001; Flowers et al., 2002; Jones et al., 2008; J. A. Kelly et al., 1997) collected data on whether the individual had been tested for HIV and the test result. The HIV testing question was intended to determine personal knowledge of HIV status and its impact on behavior, but this data was not evaluated among any of the published results as a factor determining degree of sexual risk behavior.

STD diagnosis questions were only surveyed in the Jones study (Jones et al., 2008).

Although the data was collected, Jones et al did not report on any change in STD diagnosis rate due to the intervention so I am unable to assess if the intervention had any biological impact, even by proxy.

Time to Follow Up

Time to follow-up is the length of time between the start of the intervention and the post-intervention survey to determine results. Most of the studies reviewed here used multiple post-intervention surveys to assess intervention impacts immediately after the intervention and again at a later time to measure lasting effects. Time to follow-up varied from 3 months to 3 years.

The Flowers study (Flowers et al., 2002) had the longest follow-up period at 3 years, and conducted only a single follow-up survey at that time, so any shorter-term impacts were unmeasured. The length of the follow-up period, combined with the fact that paid peer educators were used instead of POLs in the intervention, makes it difficult to assess the root causes for the failure of this intervention to measure any positive changes in sexual risk behavior.

Three of the studies reviewed (Amirkhanian et al., 2005; J. Elford et al., 2001; Jones et al., 2008) measured post-intervention effects at 3 or 6 months, and again at one year. The Amirkhanian study (Amirkhanian et al., 2005) was the only one to differentiate between results seen shortly after the intervention (at 3 months) and again at one year.

Amirkhanian found that the magnitude of some of the positive effects seen at 3 months were somewhat reduced but still present at the 1 year follow-up, indicating that the intervention effects had waned.

The earliest study in the sample, from Kelly in 1992 (J. A. Kelly et al., 1992), performed post-intervention surveys at 3 months and at 6 months. Since that time, subsequent studies by Kelly and others have included longer-term follow-ups in their study designs.

Discussion

Successful implementation of a community-level POL behavioral intervention among MSM requires careful consideration of a number of important factors. This review demonstrates that some studies were less successful than others in meeting the POL core elements outlined in Table 1.

A critical mass of POLs active in the intervention is needed for successful implementation. The difficulties in POL recruitment and retention experienced by Elford and Flowers (J. Elford et al., 2001; Flowers et al., 2002) resulted in few or no true POLs actively delivering the intervention within their metropolitan communities. This was compounded by the abbreviated training provided to the POLs and peer educators in these settings. Together, all of these factors suggest that these POL interventions were not effectively delivered.

Elford and Flowers agreed that although their designs intended to deliver a POL intervention, the implementation failed. In response to criticism, Elford (J. Elford, Bolding, & Sherr, 2004) suggested that the ‘intent to treat’ was present, and that something about the locale or population made successful implementation unworkable.

According to Elford, the unsuccessful POL intervention among London gym clientele was caused by a failure of the POL model itself to transfer successfully from the small towns of the U.S. used in the Kelly interventions to the metropolitan environment of London. Elford contends that the London intervention was designed to include all the elements of a successful POL intervention, but that implementation of that design failed due to differences in both the setting and the time.

Although initial identification of POLs by gym staff in London was successful and not deemed difficult, only one in five potential POLs remained with the project throughout the intervention period. Potential POLs cited both a lack of time and a lack of interest in participating. Elford states that cultural differences may exist between the USA and UK, or between smaller towns and a major metropolitan area, that are barriers to participation. In addition, both Elford’s and Flowers’ studies were conducted after the broad availability of highly active antiretroviral therapy (HAART). Elford asserts that it may be more difficult to induce POLs to participate in this type of intervention when HIV has become both less visible and less fatal. This assertion would require additional research to validate.

According to Elford (J. Elford et al., 2004), the compacted POL training in London was necessitated because the POLs recruited were not available for lengthier commitments, and enforcement of weekly training sessions would have exacerbated the recruitment and retention problems already experienced.

In Rogers' diffusion of innovation theory (Rogers, 2003), many factors affect the outcome when attempting to introduce an innovation into a community. In addition to the need for a critical mass of POLs who are sufficiently trained to deliver the innovation, there are other factors to consider. Rogers states that the rate of adoption of an innovation is dependent on 5 different characteristics of innovation and its relationship with the target community. For rapid adoption, the innovation must have a relative advantage over current practice; it must be compatible with existing values; it must be easy to understand and implement, it must lend itself easily to experimentation and trial, and its use and adoption by others in the community must be visible.

A possible explanation for the difficulties experienced by Elford and Flowers may reflect differences in large metropolitan communities from the smaller communities where POL interventions among MSM have been successful. Perhaps rapid adoption is more challenging in a larger, more diverse community, where the relative advantage and visibility of the innovation are not as clear. In larger communities, it may be necessary to recruit and train successive waves of POLs over a longer period of time, in order to reach a critical mass of opinion leaders that could then shift the behavioral norms over time toward safer sexual practices. Additional research would be needed to assess how well

this type of phased implementation of the POL model could work in larger metropolitan areas. This and other modifications of the POL model of behavioral intervention may be needed for successful implementation in larger cities, before the diffusion of this innovation could successfully percolate through a larger and potentially less homogeneous target community.

In measuring the outcome of POL behavioral interventions among MSM, the studies I reviewed here all used surveys of sexual behaviors, comparing levels of post-intervention behaviors in the intervention communities to either the levels of pre-intervention behaviors in the same community, or to levels of behaviors among control communities. Measuring self-reported levels of various sexual behaviors which either confer or reduce risk of HIV transmission is the most common method of measuring outcomes among HIV behavioral interventions.

Studies have shown (Coates et al., 1988; Fishbein & Pequegnat, 2000) that when subjects are asked questions about their sexual behavior, data can be reliable and valid when the survey is properly phrased and administered. A critical component of reliability, however, is the length of the behavioral recall period. Two studies on sexual behavior recall (Fishbein & Pequegnat, 2000; Kauth, St Lawrence, & Kelly, 1991) show that 2-3 month recall periods provide greater reliability for relatively frequent sexual behaviors than do longer periods of 6 months to 1 year. Studies which ask subjects to recall sexual behavior frequency over longer periods may be less reliable. Longer periods of recall may be necessary to assess infrequent sexual behaviors. The one-year recall period used

in the Flower and Jones studies (Flowers et al., 2002; Jones et al., 2008) may have reduced the reliability of the behavioral data for relatively frequent behaviors.

While it would be ideal to additionally measure any behavioral intervention intended to prevent HIV transmission using a biological outcome, none of the studies reviewed here included any biological outcome measure in their results. HIV testing of the study populations would be expensive, and may change the demographics of the population set willing to participate. This is confounded further within a community-level study, because randomized testing of the entire target community would raise both practical and ethical issues. HIV testing is voluntary in most community settings in the United States, and lack of participation by those who do not wish to be tested could introduce significant bias. There are also implications for informed consent as well as how to notify any HIV seropositive cases.

Use of STDs as a proxy for direct HIV measurement has been advocated, although there is some disagreement about how applicable specific STDs or STDs in general may be as a measure of HIV transmission outcome.

The NIMH Collaborative HIV/STD Prevention Trial Group (NIMH Collaborative HIV/STD Prevention Trial Group, 2007a), in establishing the outcome measures for their adaptation of the POL intervention among a set of international communities, relies on both behavioral and biologic endpoints to establish outcomes. In this major ongoing trial, change in STD incidence over time among intervention and control communities is seen

as a valid marker of intervention success. The chosen biological indicator for this trial is a combined index of incidence of a set of six STDs, including HIV incidence. This was necessitated by the significant variation seen in prevalence of specific STDs across the different study sites and the desire to compare outcomes among the study sites. The investigators in the NIMH trial acknowledge, however, that STD endpoints are best used in high-prevalence settings, whereas behavioral outcomes may be more appropriate in low-prevalence settings. This is because low-prevalence settings would require very large sample sizes for enough statistical power to evaluate changes in STD incidence, and such large samples may not be economically feasible.

Fishbein and Prequegnat (Fishbein & Pequegnat, 2000) argue for a slightly different approach. Since different STDs have very different transmissibility rates, measurement of certain non-HIV STDs are appropriate as proxies for HIV only when the transmissibility rates of the STD are similar to those of HIV. Condom use may also impact transmission of HIV more or less than some other STDs, and male-to-female transmission may differ from male-to-male or female-to-male transmission, all of which can reduce the validity of STD outcome measures as a surrogate for HIV incidence.

This review contains several limitations. Only 6 POL interventions among MSM were included, and others may exist. The published studies contained limited information on the methodologies used for selection of the POLs, and inaccurate identification of opinion leaders could lead to significant bias. Although I examined the duration of POL

training for each study, little information was published on the quality of the training content itself, which may have varied considerably.

In this review of community-level POL behavioral interventions among MSM, I have highlighted a number of factors that must be considered in both the process implementation as well as in measuring the outcomes of such interventions. Despite some hurdles that exist in designing and implementing successful POL interventions, current results indicate that these interventions can be very successful. Additional research in larger metropolitan communities of MSM, as well as in longer term follow-up to evaluate any enduring changes in sexual behavioral norms are indicated. Successful community-level POL interventions among MSM are a way to reach large segments of a population at high risk for HIV, and should be considered by any organization seeking to limit the spread of HIV.

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