

OPEN

Health Behavior Change Models for HIV Prevention and AIDS Care: Practical Recommendations for a Multi-Level Approach

Michelle R. Kaufman, PhD,* Flora Cornish, PhD,† Rick S. Zimmerman, PhD,‡
and Blair T. Johnson, PhD§

Abstract: Despite increasing recent emphasis on the social and structural determinants of HIV-related behavior, empirical research and interventions lag behind, partly because of the complexity of social-structural approaches. This article provides a comprehensive and practical review of the diverse literature on multi-level approaches to HIV-related behavior change in the interest of contributing to the ongoing shift to more holistic theory, research, and practice. It has the following specific aims: (1) to provide a comprehensive list of relevant variables/factors related to behavior change at all points on the individual-structural spectrum, (2) to map out and compare the characteristics of important recent multi-level models, (3) to reflect on the challenges of operating with such complex theoretical tools, and (4) to identify next steps and make actionable recommendations. Using a multi-level approach implies incorporating increasing numbers of variables and increasingly context-specific mechanisms, overall producing greater intricacies. We conclude with recommendations on how best to respond to this complexity, which include: using formative research and interdisciplinary collaboration to select the most appropriate levels and variables in a given context; measuring social and institutional variables at the appropriate level to ensure meaningful assessments of multiple levels are made; and conceptualizing intervention and research with reference to theoretical models and mechanisms to facilitate transferability, sustainability, and scalability.

Key Words: behavior change, HIV, socio-ecological model, factors, multi-level

(*J Acquir Immune Defic Syndr* 2014;66:S250–S258)

From the *Johns Hopkins University Bloomberg School of Public Health, Center for Communication Programs, Baltimore, MD; †Department of Methodology, London School of Economics and Political Science, London, UK; ‡University of Missouri—St. Louis, College of Nursing; and §Department of Psychology, University of Connecticut and Center for Health, Intervention, and Prevention, Storrs CT.

Supported by the United States Agency for International Development Cooperative Agreement #AID-OAA-A-12-00058 to the Johns Hopkins University Bloomberg School of Public Health, Center for Communication Programs and the United States Public Health Service Grant R01-MH58563 (B.T.J.).

This is an open access article distributed under the terms of the Creative Commons Attribution-Noncommercial No Derivative 3.0 License, which permits downloading and sharing the work provided it is properly cited. The work cannot be changed in any way or used commercially.

Correspondence to: Michelle R. Kaufman, PhD, Johns Hopkins University Bloomberg School of Public Health, Center for Communication Programs, 111 Market Place, Suite 310, Baltimore, MD 21212 (e-mail: MichelleKaufman@jhu.edu).

Copyright © 2014 by Lippincott Williams & Wilkins

INTRODUCTION

Attempts to slow the HIV epidemic worldwide have led to a clearer understanding that the battle is not simply about using condoms or adherence to medication. Rather, HIV risk and AIDS care involve complex behaviors influenced from multiple levels, from an individual's knowledge, attitudes, emotions, and risk perception, to power dynamics between partners, accessibility of services, economic inequalities, criminalization of vulnerable groups, and policies that make HIV a priority health issue.^{1–3} Although there have been some calls to be more inclusive of multi-level factors beyond the individual level (e.g., at the interpersonal, network, institutional, or structural levels),^{4,5} evidence addressing a more holistic approach to changing HIV-related behaviors is limited. Among such models, ecological models are a family of approaches seeking to describe the multiple levels of influence on individual behavior in the interest of creating environments conducive to health promotion.⁶ Although there seems to be little disagreement that ecological approaches are more comprehensive and potentially more explanatory and effective than frameworks or models only taking one level into account,⁷ such frameworks have received relatively little research attention, for at least three reasons.

First, assessing impact at multiple levels is often viewed as too difficult or expensive. For instance, an intervention in a low-income setting with the objective of increasing HIV counseling and testing may need to address (1) the stigma of being tested and/or of testing positive; (2) the quality of patient-counselor interactions; (3) facility capacity, supplies, and environment; and (4) access to those facilities by infrastructure, such as good roads and public transportation. Addressing all of those factors and measuring improvements of each is extremely ambitious for any one research project. Even in an individual-focused intervention, addressing multi-level factors has its challenges.

Second, multi-level interventions are diverse and often context specific,⁸ and thus, it is not easy, or even appropriate, to replicate them. Nor do they easily support generalizations across contexts.⁹ For instance, a “structural” intervention for people who inject drugs in Ukraine (eg, needle exchange programs) would seem to have little in common with a structural intervention for poor women in Ethiopia whose financial dependence on men often results in transactional or cross-generational sex (eg, cash transfer).

Finally, with randomized controlled trials (RCTs) still viewed as the “gold standard” in health research,

interventions addressing factors at multiple levels are often not attempted because an RCT is not feasible or even appropriate.¹⁰ Furthermore, combining individual-level and structural-level factors in one study is not straightforward. For instance, Kippax¹⁰ argued that structural influences, such as political will to implement harm reduction strategies or funding for mass media to lead public discussions about sensitive HIV-related topics, have a determining impact on HIV transmission and the likelihood that individual- or interpersonal-level interventions will succeed. But political will and vibrant mass media are rarely amenable to evaluation through an RCT, as the meta-analysis by Lacroix et al.¹¹ in this special issue documents.

Multi-level approaches, thus, are in many ways at odds with contemporary HIV-related policy, which often favors brief, replicable, and easily disseminated interventions. Individual-level or interpersonal-level interventions are most amenable to such constraints. However, this article is guided by the current literature and theory, rather than by policy constraints. Indeed, it is in line with simultaneous policy

shifts (contradictory to the emphasis on brevity and replicability) in favor of structural interventions. Although the field of behavior change research in HIV seems to accept that change means going beyond the individual level,⁴ there is still only a small literature on models taking multi-level approaches. This article aims to contribute to the shift to a more holistic approach by synthesizing and making sense of a complex literature, leading us to outline the next steps required as clearly as possible. Specifically, we (1) list potentially relevant variables/factors related to behavior change at all levels of the individual–structural spectrum, (2) identify characteristics of important recent multi-level models and compare them, (3) identify challenges in using such models, and (4) identify next steps and make actionable recommendations.

A Menu of Behavior Change Factors

Figure 1 provides a menu of the various influences on behavior change at each level of the socio-ecological

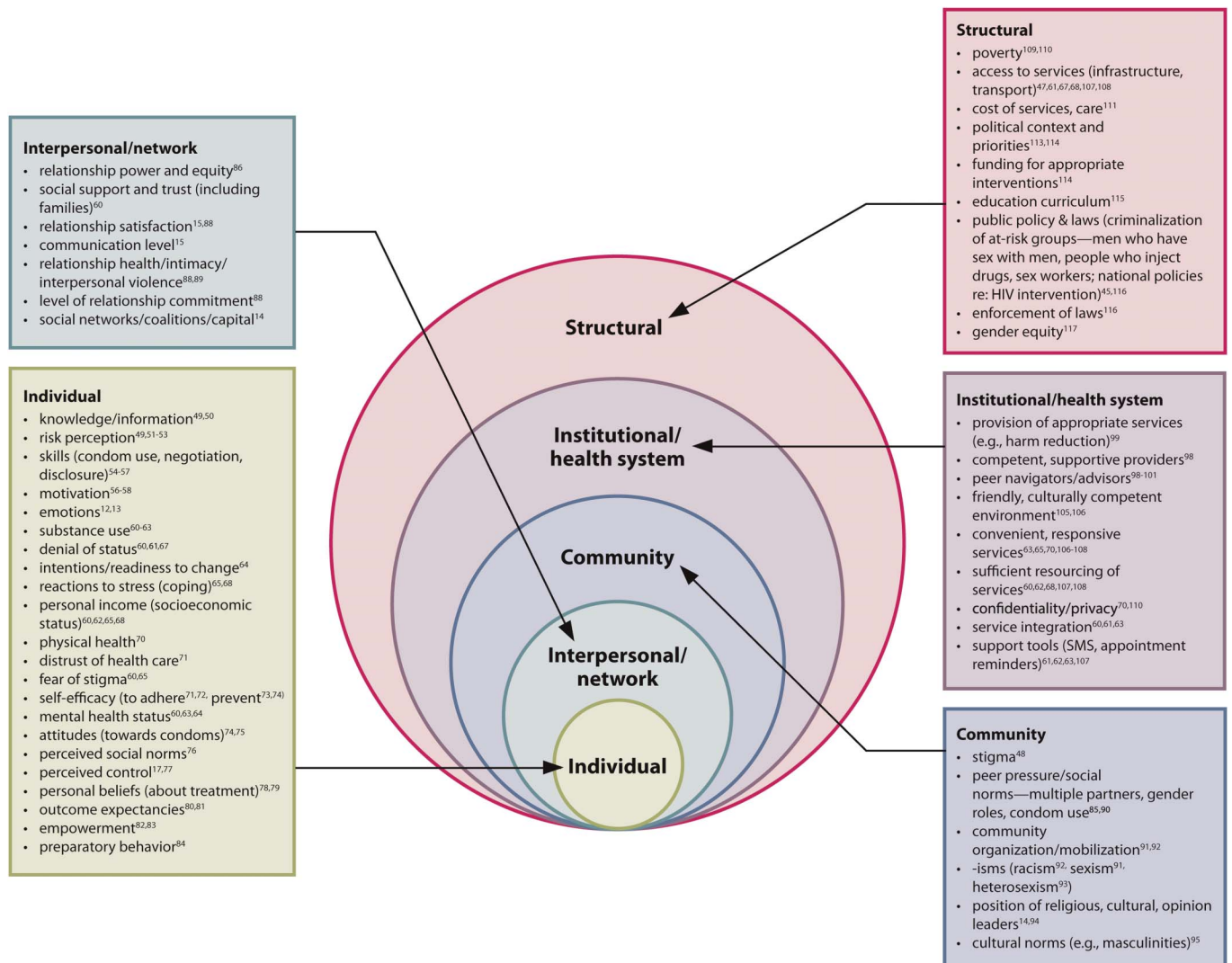


FIGURE 1. Factors influencing HIV-related behavior and/or behavior change at each level of the socio-ecological model.

framework based on our review of existing literature on behavior change interventions related to HIV prevention, treatment, and care. The *individual* level includes factors comprising the micro-level, such as individual perceptions, beliefs, or emotions. The *interpersonal/network* level includes dyadic or family influences, such as relationship satisfaction or social support. The *community* level includes influences at a larger group level, such as social capital or community norms. The *institutional* level focuses on factors within the health system, such as quality of service providers, confidentiality, or sufficient resources. Finally, the *structural* level includes the most macro-level factors affecting behavior, such as the economy, political climate, enforcement of policies and laws, or funding environment. Some structural factors may be more removed from individual control than others. For instance, wars, famines, or droughts are important structural factors further removed from the individual than, for instance, the availability of transport to access a clinic or income-generating opportunities in a particular community. Moreover, although we distinguish between “levels,” they are highly interactive, with processes ranging between micro and macro. Structural influences function only with the cooperation of individuals and their interpersonal relationships, and vice versa.

Many of these factors have been extensively researched and incorporated into successful interventions (eg, self-efficacy, behavioral skills, stigma reduction) while others have been discussed as important factors without much evidence to date on how they can be leveraged for behavior change (eg, emotions, sexual relationship power, community mobilization). The figure provides citations to key articles evidencing or arguing for each factor, where available.

The purpose of this figure is to provide an overview of the diverse influences relating to HIV risk or AIDS care. The figure does not represent a theory of the relationships among the variables at the different levels of analyses, nor can it be used to determine which variables might be most important to address in a particular intervention. Nonetheless, it does highlight some variables that have only recently been investigated, such as emotions,^{12,13} social networks/coalitions/capital,¹⁴ and relationship investment.¹⁵ Moreover, in recent years, theoretical models have begun to conceptualize how these variables and levels are linked together.

Recent Theoretical Frameworks Addressing Multi-Level Factors

Many individual-level theories have played prominent roles in past behavioral interventions focused on HIV prevention and AIDS care, including especially Social Cognitive Theory,^{16,17} the Theories of Reasoned Action¹⁸ and Planned Behavior,¹⁹ the Transtheoretical Model,^{20,21} and the Information, Motivation, Behavioral Skills Model²² (Table 1). Although these models primarily focus on the individual level, they have been associated with significant behavior change across a range of groups with varying risk levels (eg, men who have sex with men, adolescents, people living with HIV/AIDS, African Americans^{23–28}). Nonetheless, reviews of such models have concluded that, because they do not

explicitly consider high-level connections, their success is constrained.²⁹ Of note, meta-analyses of behavioral intervention trials routinely find that inconsistencies in study outcomes cannot be explained solely on the basis of moderators stemming from individual-level theories^{23–28}; until recently, these meta-analyses have rarely considered factors outside the intervention itself in efforts to explain heterogeneity.

Several recent models have taken up the challenge of expanding from individual-level features to be inclusive of higher levels. The Multiple Domain Model (MDM)³⁰ proposes that there are multiple domains of influence on health behavior, with situational/contextual variables being the most proximal to behavior, followed by preparatory behaviors, behavioral intentions, normative, attitudinal, and self-efficacy beliefs, personality and social environmental factors, and finally social structural variables. Essentially, the MDM starts with the Theory of Planned Behavior, replacing perceived behavioral control with self-efficacy. It then adds structural factors in the sociological sense (race, gender, age, social class) and variables that address personality, the social environment (school connectedness or family relationships), and social situational variables (substance use, relationship status, or hormonal contraceptive use). The MDM allows each of these to have direct (not merely indirect) relationships with behavior. Hence, factors outside of the individual are explicitly modeled as factors shaping one’s behavior.

Three recent efforts embraced ecological frameworks as an overarching theme. First, the Network-Individual-Resource Model (NIRM) recognizes and addresses the substantive reciprocal ties of individuals and important social networks across their lifespans—ties that have their basis in the tangible and mental resources individuals and networks possess.²⁹ Second, the Dynamic Social Systems Model (DSSM)³¹ conceptualizes resources, science and technology, formal social control, informal social influences and control, social interconnectedness, and settings as aspects that dynamically intersect to create structural realities ranging from micro- to meso- to macro-levels. Third, the Transmission Reduction Intervention Project (TRIP)³² rests explicitly on the fact that HIV transmission requires body fluid exchange and is spread through community sexual and injection networks. Current expositions related to TRIP emphasize the need to simultaneously intervene at higher levels than the individual (eg, care providers) and rectify power imbalances (eg, ensure they understand patients’ social and economic realities).

All 4 multi-level approaches concur that factors outside the individual relate to risk and the ability to change behavior. For example, a great deal of recent research confirms that social stigma creates health risks and worsens health care.^{33,34} The DSSM, TRIP, and NIRM agree in focusing on resources as critical for sustaining behavior change; they also emphasize power dynamics between individuals and surrounding social forces. The DSSM and NIRM also agree in focusing on the dynamic interplay between levels, although the former focuses only on the structures people face and the latter implies reciprocal interactions between individuals and realities constructed by networks. To the NIRM, networks cannot exist without individuals *and* vice versa. The MDM and the NIRM agree in emphasizing social environmental factors

TABLE 1. Synopsis of Selected Individual HIV Prevention Models on Key Considerations

Model	Depiction	Consideration		
		Social Emotional Dimensions	Micro-macro Process Linkages	Explaining Structural Influence
Social Cognitive Model ^{16,17}	Individuals who have high efficacy to enact safe behaviors do so, limited by barriers	May be relevant to the barriers that individuals face	Focus is micro with no explicit macro linkage	Epidemiological trends help to identify groups at risk, but the model has no role for structural factors per se
Theories of Reasoned Action ¹⁸ and Theory of Planned Behavior ¹⁹	Individuals intending to act safely do; perceived control over action (TPB), also facilitates action; other factors are more distal (attitude; descriptive, injunctive, subjective norms)	May be part of belief structure related to attitudes, subjective norms, and perceived control, but other measures routinely omit them	Focus is micro with no explicit macro linkage except that descriptive and injunctive subjective norms may reflect the realities of others important to the individual	Posits structural factors' influence is only indirect, mediated by impact on variables that underlie intentions (attitudes, subjective norms, perceived behavioral control), but the model has no role for structural factors per se
Transtheoretical Model ²⁰	Individuals who understand the need to change, are ready to act safely, see the benefits, and are confident change their behavior, limited by barriers	May be considered in relation to key variables but routinely omitted in measures	Focus is micro with no explicit macro linkages except that helping relationships, social liberation, and environmental re-evaluation are assessed at individual level	Model proposes same individual-level factors generalize across cultures, with some variability; model assessed support for social policies, but no clear role for structural factors per se
Information-Motivation-Behavioral Skills Model ²²	Individuals who have correct information, sufficient motivation, and behavioral skills act safely; other deficits determined through surveillance	May be part of the motivational deficits that individuals experience	Interactions with macro-levels are targeted at individuals if elicitation research identifies them as important (eg, safer sex negotiation skills) but no necessary linkage to networks	Epidemiological trends help to identify groups at risk, but the model has no role for structural factors per se
Multiple Domain Model ³⁰	Social structural, social environmental, and situational/contextual potentially influence behavior directly	May be present in situational variables, such as relationship status, and self-efficacy	Modeled in the relationship between the social environment and situational context and attitudes, norms, and self-efficacy	Structural variables (race, ethnicity, social class, age, and gender) may directly impact behavior
Network-Individual-Resource Model ²⁹	Congenial to individual-level models but isolates mental and tangible resources of individual/networks as moderating how individual-level variables influence behavior	Are a part of the mental and tangible resources for both individuals and networks tied to them and thus may affect risk positively or negatively	Exchanges between individuals and networks are the mechanism underlying HIV risk and must be targeted to decrease risk behaviors and increase safe behaviors	Networks create structural realities that may have either direct or indirect and positive or negative impact on risk behavior
Transmission Reduction Intervention Project ³²	HIV transmission requires exchange of bodily fluids and is spread through sexual and injection networks in communities	May be part of the challenges communities face	Individuals may avoid health-care organizations if barriers such as provider stigma toward AIDS patients interfere	Organizations possess resources that facilitate or impair individual behavior
Dynamic Social Systems Model ³¹	Resources, science and technology, formal social control, informal social influences and control, social interconnectedness, and settings dynamically intersect to create structural realities that influence risk	Social interconnectedness may affect risk positively or negatively	Primarily focused on macro-level factors	Structural influences may affect risk behavior directly or indirectly

directly influencing behavior, even when the individual may wish to act differently.

The NIRM is the only 1 of these 4 models directly addressing development across the lifespan, which characterizes both individuals and networks. Thus, the NIRM holds that prevention needs, and risk itself, depend importantly on the life stage and circumstances. Individuals with great needs or little autonomous power (eg, infants and children) are vulnerable to others' influence and can be positively (eg, sustenance from caregivers) or negatively affected (eg, harmed by poor care). In parallel, networks that might improve health gain strength when more individuals actively participate in them and promote their goals.

Finally, of these models, TRIP and the NIRM most embrace the perspective that individuals must find ways to cope with stressors. In short, one reason behavior change efforts may fail is because those addressed by an intervention live in circumstances filled with stressors such as demanding physical environments or stigmas associated with minority status, HIV-positive status, or both. Reid et al³⁵ recently showed that both residential segregation and prejudice levels of majority members toward minorities interfered with the success of behavioral interventions meant to decrease sexual risk behaviors. Logically, the stress created by unfriendly social environments—in this case addressed at the U.S. county level—interfered with individuals' ability to improve habits. Understanding how to promote positive coping with environmental stressors and how to make communities more supportive would thus offer considerable hope for larger behavior change effects.

Table 1 compares recent behavior change models and how they attempt to address factors beyond the individual. Because individual and structural elements clearly are relevant to HIV risk and transmission prevention, a strength of the NIRM is that it recognizes the linkage between levels, where *micro* connotes processes or variables solely within individuals, and *macro* implies linkages between individuals and others.³⁶ Thus, the NIRM recognizes that individuals (micro) enact risk behaviors with those to whom they are linked in networks (macro). In contrast, individual-level HIV prevention theories either have no explicit linkage to macro-levels or do so only indirectly. Finally, the individual-level models have little ability to explain structural influences, whereas the other 4 models at least permit a direct influence of such factors on risk behavior. The NIRM and TRIP recognize that networks or organizations possess resources that bear on risk behavior; the NIRM explicitly addresses how networks create structural realities that interplay with risk. Although addressing these high-level factors creates challenges for brevity and replicability, doing so is more likely to result in sustainable behavior change.

Because these multi-level models are all relatively new, there have not been extensive empirical studies evaluating their assumptions. Another consideration in our discussion is that various versions of socio-ecological models have typically been discussed as *organizing frameworks* rather than as *testable* (ie, falsifiable) *empirical models*. Indeed, at this writing, of the broader, relatively new models we discuss

here, we are aware of research supporting predictions only of the MDM and the NIRM. MDM research so far has generally shown that situational and preparatory behaviors add significant predictive power for behavior beyond attitudes, norms, intentions, and self-efficacy. The MDM research also suggests that social-structural variables (eg, gender, age, socioeconomic status) seem to have primarily indirect effects on behavior through attitudinal and situational factors.^{28,37,38} NIRM-related meta-analyses have supported its hypotheses: (1) individual resources are crucial to the success of interventions (eg, interventions were more successful if they also reduced depression³⁹) and (2) the structural dimensions of economic resources and community support in the locales where individuals are targeted by health promotion relate to the success of these efforts.^{11,35,40,41} Only time will tell whether DSSM and TRIP function more as organizing frameworks or begin to be tested empirically. Finally, we have also noted that evaluating multi-level theories is routinely more complex than evaluating individual-level theories.

DISCUSSION

The Art and Science of Understanding Health Behavior

In this article, we have sought to map out the state of the art and science of theorizing the contextual shaping of health behavior. The summary of variables presented in Figure 1 is intended as a useful source to help expand the details of more abstract models when it comes to applying them to intervention design relevant research. One of the lessons to emerge from the growing movement to embrace multi-level and ecological models of HIV-related behavior is their complexity and context specificity. For this reason, coupled with the paucity of evidence directly comparing the influence of the variables in question, we refrain from endorsing any particular single comprehensive model and from producing another. Instead, we believe that it is better to offer a variety of options.

Figure 1, consonant with the majority of the ecological literature, maps out a very broad range of variables at multiple levels, serving as a useful heuristic but one that is oversimplified. Separating out factors into distinct levels can obscure the mechanisms linking the structural, institutional, community, interpersonal, and individual in dynamic systems of influence.^{10,42} For instance, laws criminalizing injecting drugs or same-sex behavior may make health care institutions inaccessible because people fear discrimination or arrest. They may affect the capacity of communities to organize, as members fear identification as groups breaking the law. They may affect stigma at the community and interpersonal levels and impact perceived control at the individual level.⁴³ Similarly, economic inequalities at the macro-social scale may divide communities, encourage transactional sex, and introduce vast interpersonal power inequalities in the negotiation of safer sex.⁴⁴ The benefit of using "levels" to draw explicit attention to the macro-social and community-level influences on health behavior comes at the cost of obscuring some of the mechanisms through which these levels are interlinked (Table 1).

One of the strengths of the theoretical models reviewed is that they explain links between individual behavior and social structures. The NIRM and TRIP emphasize the *networks* in which individuals are embedded and link them in relationships with others and thereby to power dynamics and resources. Such models also highlight the complexity of modeling the social–structural shaping of health. While individual-level models pinpoint a relatively few psychological mechanisms to be targeted by interventions, multi-level interventions seem to differ. As the DSSM argues, HIV-related behavior is contextual and dynamic, and the identification of the most relevant dimensions and variables for any one intervention rests on assessment of the local context.

Different aspects of the ecology of influences on behavior may be relevant in different settings or at different times,^{5,45,46} which complicates the challenges of making policy recommendations, designing interventions, and planning evaluations. It implies all these activities may need to be undertaken in a way that is increasingly flexible and responsive to local conditions. Such flexibility and context-specificity raises challenges to the current *modus operandi* for HIV policy, which often strives for universal statements of policy goals and evaluation standards.

Implications

The foregoing discussion suggests several ways researchers and practitioners can advance in understanding behavior related to HIV prevention and care and incorporate these multi-level approaches into behavior change interventions.

1. When trying to understand the process of behavior change or develop an intervention, consider *all* levels of influence and related variables from individual to structural. Figure 1 and Table 1 may help to identify potentially relevant variables.
2. Mapping out relevant variables is also helped by interdisciplinary collaboration. Multi-level theorizing hinges on using perspectives spanning disciplines: individual-level factors are commonly modeled using psychological and behavioral economic principles; interpersonal relationships need concepts from social psychology, anthropology, communication science, sociology, etc.; structural forces need concepts from sociology, economics, political science, geography, and engineering. Clearly, future scholarship needs to incorporate the richness multiple disciplines afford.
3. Based on the initial collaboration and mapping of potential variables, choose at least two levels to measure, test, and/or include in an intervention. Unless extensive resources are available, measuring or intervening at all levels will be too expensive and complex for comprehensive research.
4. Early formative work can usefully inform the selection of levels to measure and/or interventions to address. Such scoping might include exploratory research, review of existing data or reports on the population/community, and consultations with local practitioners, patients, clients or subjects. Although there is a wealth of information at the individual level, work on higher levels will often likely require exploratory research, given the paucity of current evidence.
5. Consider the direct and indirect levels of influence for the behavior(s) of focus. For example, sharing needles likely needs to include an understanding of social networks, condom use needs to include at least dyadic variables, medication adherence needs to include at least health practitioners and the patient, and all intervention efforts need to consider how difficult the environment is for the targeted populations. The lesson of multi-level theories of health behavior is that individuals and networks may have motivations in addition to those of good health outcomes or acting safely in any particular time and context.
6. Especially at levels beyond the interpersonal, it is valuable to search for the mechanisms by which influences occur (Table 1). For example, what is the mechanism whereby microfinance interventions may reduce risky sexual behavior (financial stability leading to work within a society's standard business model)? What is the mechanism whereby girls who complete school engage in less sexual risk-taking (empowerment, self-efficacy, a different view of gender roles)? Socio-ecological approaches are typically tested merely as lists of variables with little or no attempt to identify mechanisms (organizing frameworks). Understanding mechanisms is more likely to yield sustainable and replicable change than simply reporting associations between variables.⁴⁶
7. Measure variables at levels beyond the individual at the appropriate level where possible rather than at the individual level. For example, social class should be measured at the family level rather than at the level of an individual adolescent; state, provincial, community, or national policy should be evaluated with an appropriate and valid measure rather than researching perceptions of the policy.
8. Use analytic methods that attempt to look at relationships both within and between levels. At best, contemporary “tests” of socio-ecological approaches typically assess only the “proportion of variance” accounted for by variables at each level, usually measured at the individual level. But considering the linkage between levels may be critical to a full understanding of mechanisms and long-term behavior change.
9. Where possible, combine already existing theories at the various levels rather than creating brand new theories, until such time as the need for a new theory is clearly indicated. Competing tests between elements of theories will, over time, help to clarify which factors deserve the most attention.
10. Use theoretical models to inform considerations of scalability and sustainability of an intervention. To move toward “no new infections,” national governments and international donors need research evidence that is applicable on a large scale. Although the most important interventions and behaviors may be quite specific to a particular community, transferability across settings can be gained by conceptualiz-

ing those interventions and behaviors as instances of more widely applied models.

As for future research, in addition to focusing on needed behaviors and content areas, methodological and theoretical work is especially needed to help understand how to select levels at which to work, how theories can be combined across levels, and how processes can be best tested analytically both simultaneously and across various levels. We are beginning to make progress in broadening our behavior change theories and models, but much work remains to be done. Much stands to be gained in improving HIV prevention and care if we consider more comprehensive models of behavior change.

ACKNOWLEDGMENTS

The authors thank Samantha Tsang and Marina Smelyanskaya for their assistance with references.

REFERENCES

- Campbell C, Cornish F. Towards a "fourth generation" of approaches to HIV/AIDS management: creating contexts for effective community mobilisation. *AIDS Care*. 2010;22(suppl 2):1569–1579.
- Gupta GR, Parkhurst JO, Ogden JA, et al. Structural approaches to HIV prevention. *Lancet*. 2008;372:764–775.
- Seeley J, Watts CH, Kippax S, et al. Addressing the structural drivers of HIV: a luxury or necessity for programmes? *J Int AIDS Soc*. 2012;15(suppl 1):1–4.
- Albarracín D, Rothman AJ, DiClemente R, et al. Wanted: a theoretical roadmap to research and practice across individual, interpersonal, and structural levels of analysis. *AIDS Behav*. 2010;14(suppl 2):185–188.
- Storey D, Figueroa M. Toward a global theory of health behavior and social change. In: Obregon R, Waisbord S, eds. *The Handbook of Global Health Communication*. West Sussex, United Kingdom: John Wiley & Sons; 2012:70–94.
- Crosby RA, Salazar LF, DiClemente RJ. *Ecological Approaches in the New Public Health*. Sudbury, MA: Jones & Barlett Learning; 2011: 231–251.
- Glanz K, Bishop DB. The role of behavioral science theory in development and implementation of public health interventions. *Annu Rev Public Health*. 2010;31:399–418.
- Blankenship KM, Bray SJ, Merson MH. Structural interventions in public health. *AIDS*. 2000;14(suppl 1):S11–S21.
- Cornish F, Priego Hernandez J, Campbell C, et al. Impact of community mobilisation on HIV prevention in middle and low income countries: a systematic review and critique. *AIDS Behav*. 2014; epub ahead of print. doi: 10.1007/s10461-014-0748-5.
- Kippax S. Effective HIV prevention: the indispensable role of social science. *J Int AIDS Soc*. 2012;15:17357.
- LaCroix JM, Snyder LB, Huedo-Medina TB, et al. Effectiveness of mass media interventions for HIV prevention, 1986–2013: a meta-analysis. *J Acquir Immune Defic Syndr*. 2014;66(suppl 3):S329–S340.
- Bar-Lev S. "We are here to give you emotional support": performing emotions in an online HIV/AIDS support group. *Qual Health Res*. 2008;18:509–521.
- Halkitis PN, Wilton L. The meanings of sex for HIV-positive gay and bisexual men: emotions, physicality, and affirmations of self. In: Halkitis PN, Gómez CA, Wolitski RJ, eds. *HIV+ Sex: The Psychological and Interpersonal Dynamics of HIV-Seropositive Gay and Bisexual Men's Relationships*. Washington, DC: American Psychological Association; 2005:21–37.
- Wingood GM, Robinson LR, Braxton ND, et al. Comparative effectiveness of a faith-based HIV intervention for African American women: importance of enhancing religious social capital. *Am J Public Health*. 2013;103:2226–2233.
- Mitchell JW. Between and within couple-level factors associated with gay male couples' investment in a sexual agreement. *AIDS Behav*. 2013.
- Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Upper Saddle River, NJ: Prentice Hall, Inc; 1986.
- Bandura A. Social cognitive theory and exercise of control over HIV infection. In: DiClemente RJ, Peterson JL, eds. *Preventing AIDS: Theories and Methods of Behavioral Interventions*. New York, NY: Plenum Press; 1994:25–59.
- Fishbein M, Ajzen I. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley; 1975.
- Ajzen I, Madden TJ. Prediction of goal-directed behavior: attitudes, intentions and perceived behavioral control. *J Exp Social Psychol*. 1986;22:453–474.
- Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *Am J Health Promot*. 1997;12:38–48.
- Prochaska J, Redding C, Evers K. The transtheoretical model and stages of change. In: Glanz K, Rimer B, Viswanath K, eds. *Health Behavior and Health Education: Theory, Research, and Practice*. 4th ed. San Francisco, CA: Jossey-Bass, Inc; 2008:170–222.
- Fisher JD, Fisher WA. Changing AIDS-risk behavior. *Psychol Bull*. 1992;111:455–474.
- Albarracín D, Gillette JC, Earl AN, et al. A test of major assumptions about behavior change: a comprehensive look at the effects of passive and active HIV-prevention interventions since the beginning of the epidemic. *Psychol Bull*. 2005;131:856–897.
- Johnson BT, Interventions to reduce sexual risk for human immunodeficiency virus in adolescents: a meta-analysis of trials, 1985–2008. *Arch Pediatr Adolesc Med*. 2011;165:77–84.
- Johnson BT, Scott-Sheldon LA, Smoak ND, et al. Behavioral interventions for African Americans to reduce sexual risk of HIV: a meta-analysis of randomized controlled trials. *J Acquir Immune Defic Syndr*. 2009;51: 492–501.
- Noar SM. Behavioral interventions to reduce HIV-related sexual risk behavior: review and synthesis of meta-analytic evidence. *AIDS Behav*. 2008;12:335–353.
- Webb TL, Sheeran P. Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychol Bull*. 2006;132:249–268.
- Johnson BT, Scott-Sheldon LA, Carey MP. Meta-synthesis of health behavior change meta-analyses. *Am J Public Health*. 2010;100:2193–2198.
- Johnson BT, Redding CA, DiClemente RJ, et al. A network-individual-resource model for HIV prevention. *AIDS Behav*. 2010;14(suppl 2): 204–221.
- Zimmerman RS, Noar SM, Feist-Price S, et al. Longitudinal test of a multiple domain model of adolescent condom use. *J Sex Res*. 2007; 44:380–394.
- Latkin C, Weeks MR, Glasman L, et al. A dynamic social systems model for considering structural factors in HIV prevention and detection. *AIDS Behav*. 2010;14(suppl 2):222–238.
- Friedman SR, Downing MJ Jr, Smyrnov P, et al. Socially-integrated transdisciplinary HIV prevention. *AIDS Behav*. 2013. epub ahead of print.
- Hatzenbuehler ML. How does sexual minority stigma "get under the skin"? A psychological mediation framework. *Psychol Bull*. 2009;135: 707–730.
- Cook JE, Purdie-Vaughns V, Meyer IH, et al. Intervening within and across levels: a multilevel approach to stigma and public health. *Soc Sci Med*. 2014;103:101–109.
- Reid AE, Dovidio JF, Ballester E, et al. HIV prevention interventions to reduce sexual risk for African Americans: the influence of community-level stigma and psychological processes. *Soc Sci Med*. 2014;103:118–125.
- Karney BR, Bradbury TN. The longitudinal course of marital quality and stability: a review of theory, method, and research. *Psychol Bull*. 1995;118:3–34.
- Xiao Z, Palmgreen P, Zimmerman R, et al. Adapting and applying a multiple domain model of condom use to Chinese college students. *AIDS Care*. 2010;22:332–338.
- Mehrotra P, Zimmerman RS, Noar SM, et al. A test of an adapted multiple domain model in predicting sexual behaviors among unmarried young adults in India. *J Sex Res*. 2013;50:116–127.
- Lennon CA, Huedo-Medina TB, Gerwien DP, et al. A role for depression in sexual risk reduction for women? A meta-analysis of HIV prevention trials with depression outcomes. *Soc Sci Med*. 2012;75: 688–698.

40. Huedo-Medina TB, Boynton MH, Warren MR, et al. Efficacy of HIV prevention interventions in Latin American and Caribbean nations, 1995-2008: a meta-analysis. *AIDS Behav.* 2010;14:1237-1251.
41. Tan JY, Huedo-Medina TB, Warren MR, et al. A meta-analysis of the efficacy of HIV/AIDS prevention interventions in Asia, 1995-2009. *Soc Sci Med.* 2012;75:676-687.
42. Cornish F. Making 'Context' concrete: a dialogical approach to the society-health relation. *J Health Psychol.* 2004;9:281-294.
43. Semugoma P, Beyrer C, Baral S. Assessing the effects of anti-homosexuality legislation in Uganda on HIV prevention, treatment, and care services. *SAHARA J.* 2012;9:173-176.
44. Campbell C. *Letting Them Die: Why HIV/AIDS Prevention Programmes Fail.* Oxford, United Kingdom: James Currey; 2003.
45. Burris S, Cameron E. The case against criminalization of HIV transmission. *JAMA.* 2008;300:578-581.
46. Prestwich A, Sniehotta FF, Whittington C, et al. Does theory influence the effectiveness of health behavior interventions? Meta-analysis. *Health Psychol.* 2013;33:465-74.
47. Posse M, Baltussen R. Barriers to access to antiretroviral treatment in Mozambique, as perceived by patients and health workers in urban and rural settings. *AIDS Patient Care STDS.* 2009;23:867-875.
48. Girma E, Gebretsadik LA, Kaufman MR, et al. Stigma against people with HIV/AIDS in rural Ethiopia, 2005 to 2011: signs and predictors of improvement. *AIDS Behav.* 2014;18:1046-1053.
49. Gerrard M, Gibbons FX, Bushman BJ. Relation between perceived vulnerability to HIV and precautionary sexual behavior. *Psychol Bull.* 1996;119:390-409.
50. Lindan C, Allen S, Carael M, et al. Knowledge, attitudes, and perceived risk of AIDS among urban Rwandan women: relationship to HIV infection and behavior change. *AIDS.* 1991;5:993-1002.
51. Smith KP, Watkins SC. Perceptions of risk and strategies for prevention: responses to HIV/AIDS in rural Malawi. *Soc Sci Med.* 2005;60:649-660.
52. Carballo-Diequez A, Miner M, Dolezal C, et al. Sexual negotiation, HIV-status disclosure, and sexual risk behavior among Latino men who use the Internet to seek sex with other men. *Arch Sex Behav.* 2006;35:473-481.
53. Pulerwitz J, Amaro H, De Jong W, et al. Relationship power, condom use and HIV risk among women in the USA. *AIDS Care.* 2002;14:789-800.
54. Shannon K, Csete J. Violence, condom negotiation, and HIV/STI risk among sex workers. *JAMA.* 2010;304:573-574.
55. Varghese B, Maher JE, Peterman TA, et al. Reducing the risk of sexual HIV transmission: quantifying the per-act risk for HIV on the basis of choice of partner, sex act, and condom use. *Sex Transm Dis.* 2002;29:38-43.
56. Carey MP, Maisto SA, Kalichman SC, et al. Enhancing motivation to reduce the risk of HIV infection for economically disadvantaged urban women. *J Consulting Clin Psychol.* 1997;65:531-541.
57. Kalichman SC, Picciano JF, Roffman RA. Motivation to reduce HIV risk behaviors in the context of the Information, Motivation and Behavioral Skills (IMB) model of HIV prevention. *J Health Psychol.* 2008;13:680-689.
58. Rajabius S, Mallinson RK, McCoy K, et al. "Getting me back on track": the role of outreach interventions in engaging and retaining people living with HIV/AIDS in medical care. *AIDS Patient Care STDS.* 2007;21(suppl 1):S20-S29.
59. World Health Organization. *Consolidated Guidelines on the Use of Antiretroviral Drugs for Treating and Preventing HIV Infection: Recommendations for a Public Health Approach.* Geneva, Switzerland: WHO Press;2013.
60. Pecoraro A, Royer-Malvestuto C, Rosenwasser B, et al. Factors contributing to dropping out from and returning to HIV treatment in an inner city primary care HIV clinic in the United States. *AIDS Care.* 2013;25:1399-1406.
61. Westergaard RP, Hess T, Astemborski J, et al. Longitudinal changes in engagement in care and viral suppression for HIV-infected injection drug users. *AIDS.* 2013;27:2559-2566.
62. Scanlon ML, Vreeman RC. Current strategies for improving access and adherence to antiretroviral therapies in resource-limited settings. *HIV AIDS (Auckl).* 2013;5:1-17.
63. Bogart LM, Chetty S, Giddy J, et al. Barriers to care among people living with HIV in South Africa: contrasts between patient and health-care provider perspectives. *AIDS Care.* 2013;25:843-853.
64. Jemmott LS, Jemmott JB. Increasing condom-use intentions among sexually active black-adolescent women. *Nurs Res.* 1992;41:273-279.
65. Friedland J, Renwick R, McColl MM. Coping and social support as determinants of quality of life in HIV/AIDS. *AIDS Care.* 1996;8:15-31.
66. Moneyham L, Hennessy M, Sowell R, et al. The effectiveness of coping strategies used by HIV-seropositive women. *Res Nurs Health.* 1998;21:351-362.
67. Pellowski JA. Barriers to care for rural people living with HIV: a review of domestic research and health care models. *J Assoc Nurses AIDS Care.* 2013;24:422-437.
68. Stein JA, Nyamathi AM, Zane JI. Situational, psychosocial, and physical health-related correlates of HIV/AIDS risk behaviors in homeless men. *Am J Mens Health.* 2009;3:25-35.
69. Maulsby C, Millett G, Lindsey K, et al. A systematic review of HIV interventions for black men who have sex with men (MSM). *BMC Public Health.* 2013;13:625.
70. Ammassari A, Trotta MP, Murri R, et al. Correlates and predictors of adherence to highly active antiretroviral therapy: overview of published literature. *J Acquir Immune Defic Syndr.* 2002;31(suppl 3):S123-S127.
71. Nokes K, Johnson MO, Webel A, et al. Focus on increasing treatment self-efficacy to improve human immunodeficiency virus treatment adherence. *J Nurs Scholarsh.* 2012;44:403-410.
72. Raiford JL, Seth P, Braxton ND, et al. Masculinity, condom use self-efficacy and abusive responses to condom negotiation: the case for HIV prevention for heterosexual African-American men. *Sex Health.* 2013;10:467-469.
73. Fava JL, van den Berg JJ, Rosen RK, et al. Measuring self-efficacy to use vaginal microbicides: the Microbicide Use Self-Efficacy instrument. *Sex Health.* 2013;10:339-347.
74. Reitman D, St Lawrence JS, Jefferson KW, et al. Predictors of African American adolescents' condom use and HIV risk behavior. *AIDS Educ Prev.* 1996;8:499-515.
75. Valdiserri RO, Arena VC, Proctor D, et al. The relationship between women's attitudes about condoms and their use: implications for condom promotion programs. *Am J Public Health.* 1989;79:499-501.
76. Romer D, Black M, Ricardo I, et al. Social influences on the sexual behavior of youth at risk for HIV exposure. *Am J Public Health.* 1994;84:977-985.
77. Bandura A. Perceived self-efficacy in the exercise of control over AIDS infection. *Eval Program Plann.* 1990;13:9-17.
78. Kalichman SC, Eaton L, Cain D, et al. Changes in HIV treatment beliefs and sexual risk behaviors among gay and bisexual men, 1997-2005. *Health Psychol.* 2007;26:650-656.
79. Kalichman SC, Eaton L, Cain D, et al. HIV treatment beliefs and sexual transmission risk behaviors among HIV positive men and women. *J Behav Med.* 2006;29:401-410.
80. Semple SJ, Patterson TL, Grant I. Partner type and sexual risk behavior among HIV positive gay and bisexual men: social cognitive correlates. *AIDS Educ Prev.* 2000;12:340-356.
81. Bowen AM, Horvath K, Williams ML. A randomized control trial of Internet-delivered HIV prevention targeting rural MSM. *Health Educ Res.* 2007;22:120-127.
82. Johnson MO, Sevelius JM, Dilworth SE, et al. Preliminary support for the construct of health care empowerment in the context of treatment for human immunodeficiency virus. *Patient Prefer Adherence.* 2012;6:395-404.
83. Blankenship KM, West BS, Kershaw TS, et al. Power, community mobilization, and condom use practices among female sex workers in Andhra Pradesh, India. *AIDS.* 2008;22(suppl 5):S109-S116.
84. Bryan A, Fisher JD, Fisher WA. Tests of the mediational role of preparatory safer sexual behavior in the context of the theory of planned behavior. *Health Psychol.* 2002;21:71-80.
85. Sanchez R, Bermudez M, Buela-Casal G. Power dynamics in adolescent couple relationships and risk of sexually transmitted infections and HIV. *Curr HIV Res.* 2013;11:536-42.
86. Cox CM, Babalola S, Kennedy CE, et al. Determinants of concurrent sex partnerships within stable relationships: a qualitative study in Tanzania. *BMJ Open.* 2014;4:e003680.

87. Wu E, El-Bassel N, Witte S, et al. Intimate partner violence and HIV risk among urban minority women in primary health care settings. *AIDS Behav.* 2003;7:291–301.
88. Rhodes T, Cusick L. Love and intimacy in relationship risk management: HIV positive people and their sexual partners. *Sociol Health Illness.* 2000;22:1–26.
89. MacPhail C, Campbell C. ‘I think condoms are good but, aai, I hate those things’: condom use among adolescents and young people in a Southern African township. *Soc Sci Med.* 2001;52:1613–1627.
90. Andrasik MP, Chandler C, Powell B, et al. Bridging the divide: HIV prevention research and black men who have sex with men. *Am J Public Health.* 2014;104:708–14.
91. Abramsky T, Devries K, Kiss L, et al. A community mobilisation intervention to prevent violence against women and reduce HIV/AIDS risk in Kampala, Uganda (the SASA! Study): study protocol for a cluster randomised controlled trial. *Trials.* 2012;13:96.
92. Wilson PA, Yoshikawa H. Experiences of and responses to social discrimination among Asian and Pacific Islander gay men: their relationship to HIV risk. *AIDS Educ Prev.* 2004;16:68–83.
93. Johnson MO, Carrico AW, Chesney MA, et al. Internalized heterosexism among HIV-positive, gay-identified men: implications for HIV prevention and care. *J Consult Clin Psychol.* 2008;76:829–839.
94. Campbell C. Political will, traditional leaders and the fight against HIV/AIDS: a South African case study. *AIDS Care.* 2010;22(suppl 2):1637–1643.
95. Skovdal M, Campbell C, Madanhire C, et al. Masculinity as a barrier to men’s use of HIV services in Zimbabwe. *Glob Health.* 2011;7:13.
96. Wodak A, Cooney A. Do needle syringe programs reduce HIV infection among injecting drug users: a comprehensive review of the international evidence. *Subst Use Misuse.* 2006;41:777–813.
97. Faye A, Fournier P, Diop I, et al. Developing a tool to measure satisfaction among health professionals in sub-Saharan Africa. *Hum Resour Health.* 2013;11:30.
98. Enriquez M, Farnan R, Neville S. What experienced HIV-infected lay peer educators working in Midwestern U.S. HIV medical care settings think about their role and contributions to patient care. *AIDS Patient Care STDS.* 2013;27:474–480.
99. Rhodes SD, Foley KL, Zometa CS, et al. Lay health advisor interventions among Hispanics/Latinos: a qualitative systematic review. *Am J Prev Med.* 2007;33:418–427.
100. Rhodes SD, Kelley C, Siman F, et al. Using community-based participatory research (CBPR) to develop a community-level HIV prevention intervention for Latinas: a local response to a global challenge. *Womens Health Issues.* 2012;22:e293–e301.
101. Vissman AT, Eng E, Aronson RE, et al. What do men who serve as lay health advisers really do? Immigrant Latino men share their experiences as Navegantes to prevent HIV. *AIDS Educ Prev.* 2009;21:220–232.
102. Beyrer C, Sullivan PS, Sanchez J, et al. A call to action for comprehensive HIV services for men who have sex with men. *Lancet.* 2012;380:424–438.
103. Burns FM, Imrie J, Nazroo JY, et al. Why the(y) wait? Key informant understandings of factors contributing to late presentation and poor utilization of HIV health and social care services by African migrants in Britain. *AIDS Care.* 2007;19:102–108.
104. Levy ME, Wilton L, Phillips G II, et al. Understanding structural barriers to accessing HIV testing and prevention services among black men who have sex with men (BMSM) in the United States. *AIDS Behav.* 2014;18:972–96.
105. Govindasamy D, Ford N, Kranzer K. Risk factors, barriers and facilitators for linkage to antiretroviral therapy care: a systematic review. *AIDS.* 2012;26:2059–2067.
106. Kempf MC, McLeod J, Boehme AK, et al. A qualitative study of the barriers and facilitators to retention-in-care among HIV-positive women in the rural southeastern United States: implications for targeted interventions. *AIDS Patient Care STDS.* 2010;24:515–520.
107. Oyomopito R, Lee MP, Phanuphak P, et al. Measures of site resourcing predict virologic suppression, immunologic response and HIV disease progression following highly active antiretroviral therapy (HAART) in the TREAT Asia HIV Observational Database (TAHOD). *HIV Med.* 2010;11:519–529.
108. Lichtenstein B, Bachmann LH. Staff affirmations and client criticisms: staff and client perceptions of quality of care at sexually transmitted disease clinics. *Sex Transm Dis.* 2005;32:281–285.
109. Lopman B, Lewis J, Nyamukapa C, et al. HIV incidence and poverty in Manicaland, Zimbabwe: is HIV becoming a disease of the poor? *AIDS.* 2007;21(suppl 7):S57–S66.
110. Masanjala W. The poverty-HIV/AIDS nexus in Africa: a livelihood approach. *Soc Sci Med.* 2007;64:1032–1041.
111. Bisson GP, Frank I, Gross R, et al. Out-of-pocket costs of HAART limit HIV treatment responses in Botswana’s private sector. *AIDS.* 2006;20:1333–1336.
112. Friedman SR, Mottiar S. A rewarding engagement? The Treatment Action Campaign and the politics of HIV/AIDS. *Polit Soc.* 2005;33:511–565.
113. Berkman A, Garcia J, Munoz-Laboy M, et al. A critical analysis of the Brazilian response to HIV/AIDS: lessons learned for controlling and mitigating the epidemic in developing countries. *Am J Public Health.* 2005;95:1162–1172.
114. Schwartlander B, Stover J, Hallett T, et al. Towards an improved investment approach for an effective response to HIV/AIDS. *Lancet.* 2011;377:2031–2041.
115. Kirby DB, Laris BA, Rolleri LA. Sex and HIV education programs: their impact on sexual behaviors of young people throughout the world. *J Adolesc Health.* 2007;40:206–217.
116. Mykhalovskiy E. The problem of “significant risk”: exploring the public health impact of criminalizing HIV non-disclosure. *Soc Sci Med.* 2011;73:668–675.
117. Dworkin SL, Hatcher AM, Colvin, et al. Impact of a gender-transformative HIV and antiviolenence program on gender ideologies and masculinities in two rural, South African communities. *Men Masc.* 2013;16:181–202.