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Commentary

A typology of structural approaches to HIV prevention: A commentary on Roberts and Matthews

Alexander C. Tsai*

Center for Global Health, Massachusetts General Hospital, Boston, MA, United States

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ABSTRACT

Renewed enthusiasm for biomedical HIV prevention strategies has followed the recent publication of several high-profile HIV antiretroviral therapy-based HIV prevention trials. In a recent article, Roberts and Matthews (2012) accurately note some of the shortcomings of these individually targeted approaches to HIV prevention and advocate for increased emphasis on structural interventions that have more fundamental effects on the population distribution of HIV. However, they make some implicit assumptions about the extent to which structural interventions are user-independent and more sustainable than biomedical or behavioral interventions. In this article, I elaborate a simple typology of structural interventions along these two axes and suggest that they may be neither user-independent nor sustainable and therefore subject to the same sustainability concerns, costs, and potential unintended consequences as biomedical and behavioral interventions.

Introduction

Despite recent progress, a vaccine against HIV infection remains a distant goal (Johnston & Fauci, 2008). As a result, the 33.3 million people living with HIV/AIDS worldwide (Joint United Nations Programme on HIV/AIDS, 2010b) are likely to see their ranks continue to increase for the foreseeable future. Compared to earlier stages of the epidemic, we now have a better understanding of the biological, behavioral, and social determinants of HIV infection, but much more work remains to be done to translate these findings into interventions to reduce the population incidence. No single "magic bullet" for prevention exists, although several candidates have been weighed on the scales and found wanting (Eaton & Kalichman, 2009; Hayes, Watson-Jones, Celum, van de Wijgert, & Wasserheit, 2010; Hearst & Chen, 2004; Hearst, Kajubi, Hudes, Maganda, & Green, 2012; Rerks-Ngarm et al., 2009). In such a milieu, thought provoking papers such as the one by Roberts and Matthews (2012), "HIV and chemoprophylaxis, the importance of considering social structures alongside biomedical and behavioral intervention," deserve our careful attention.

Roberts and Matthews' article makes several important points. Biomedicine's approach to HIV prevention is relatively expensive because it emphasizes individually targeted biomedical or behavioral interventions and because the outcomes of these interventions are, by nature, user-dependent. Furthermore, these types of interventions do little to nothing to address the *prima causa* in the web of causation (Krieger, 1994). As a result, sustained prevention of HIV transmission through these strategies will require a lifetime of sustained HIV-preventive behaviors, and this may not be feasible in the long run. Roberts and Matthews discuss the results of several recently published high-profile HIV antiretroviral therapy-based HIV prevention trials (e.g., Abdool Karim et al. [2010], Cohen et al. [2011], and Grant et al. [2010]), emphasizing the shortcomings of these individually targeted approaches to HIV prevention. They advocate for renewed efforts to train our collective gaze away from such palliative approaches to HIV prevention and toward structural interventions that have more fundamental effects on the population distribution of HIV.

Although I agree with many of their views about the limitations of biomedicine and the need for more research on structural interventions, I am puzzled by some of their initial arguments. At first glance, Roberts and Matthews seem to have strangely set themselves up to defend against claims that few in the field are making. For example, they motivate their discussion in part by arguing that biomedical and behavioral interventions are limited by suboptimal adherence and that there exists a structural bias against structural interventions. But to whom are they so strenuously arguing these points? Few, if any, in the field contend that biomedical and behavioral approaches are *not* limited by suboptimal adherence. The user-dependence of biomedical and

* Center for Global Health, Room 1529-E3, Massachusetts General Hospital, 100 Cambridge Street, 15th floor, Boston, MA 02114, United States.
E-mail address: actsai@partners.org.

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behavioral interventions is well known and has always been a focal discussion point, especially with regards to findings from the most recently published set of biomedical prevention trials (Grobler & Abdool Karim, 2012; Kashuba et al., 2012; van der Straten, van Damme, Haberer, & Bangsberg, 2012). Behavioral scientists have also long held that "non-adherence" and "non-compliance" are regrettably imprecise terms when employed to describe deviations from prescribed dosing regimens that result from inability to overcome structural barriers (Bangsberg, 2008; Bangsberg, Ware, & Simoni, 2006; Crane et al., 2006).

In addition, few, if any, in the field contend that structural interventions are *not* deserving of further study and implementation. *Contra* Roberts and Matthews, the emerging consensus appears to be that effective HIV prevention will require a diverse portfolio of biomedical, behavioral, and structural interventions – termed "highly active" (Vandenbruaene, 2007) or "combination" prevention (Coates, Richter, & Caceres, 2008). These sentiments have been echoed by journal editors (Horton & Das, 2008), biomedical HIV prevention experts (Abdool Karim, Abdool Karim, et al., 2010; Abdool Karim, Sibeko, et al., 2010; Padian et al., 2011), and individual HIV prevention experts working within the U.S. government (Shelton, 2011) and multilateral organizations (Hankins & de Zalduondo, 2010; Piot, Bartos, Larson, Zewdie, & Mane, 2008). The centrality of the combination approach has also been formally described in documents released directly by the Joint United Nations Programme on HIV/AIDS (Joint United Nations Programme on HIV/AIDS, 2010a, 2011). The big tent of combination prevention has been criticized for being too diffusely vague about the exact distribution of portfolio weights (Halperin, 2009; Potts et al., 2008), but there is plenty of room under the tent for now.

I would like focus specifically on Roberts and Matthews' implicit assumptions that structural interventions are user-independent and more sustainable than biomedical or behavioral interventions. (Indeed, at one point they argue that HIV prevention strategies based on structural interventions may mitigate risk compensation, a concern that has appropriately bedeviled many behavioral and biomedical interventions [Cassell, Halperin, Shelton, & Stanton, 2006; Lakdawalla, Sood, & Goldman, 2006].) It is hard for me to know exactly what they specifically mean when they laud structural solutions for being "sustainable" (p. 2): are structural interventions sustainable because overcoming structural barriers will result in more durable changes in human behavior? Are they more sustainable because overcoming a particular structural barrier is a one-time event (that will inexpensively result in more durable changes in human behavior)? In the discussion below, I draw on insights from industrial hygiene, injury control, behavioral finance, economic development, and health services research to suggest that structural interventions may be neither user-independent nor sustainable and therefore subject to the same sustainability concerns, costs, and potential unintended consequences as biomedical and behavioral interventions. The balance of cost and benefit may still favor structural interventions in certain contexts, but this will depend on the extent to which these factors differentially affect consideration of biomedical and behavioral vs. structural interventions.

The inevitability of user dependence

Roberts and Matthews highlight the waning dose-taking execution (i.e., lack of persistence [Tsai & Bangsberg, 2011]) observed during the course of follow-up in biomedical HIV prevention trials in order to caution readers "to be wary of how any meaningful population-level effect could be sustained" (p. 3). Their critique of biomedical and behavioral interventions is accurate, but it is also important to explicitly recognize the extent to which the outcomes of structural interventions are also contingent upon human behavior. The earliest typologies of structural interventions have distinguished between structural interventions that are user-independent and those that are user-dependent. In the fields of industrial hygiene and injury control, user-independent interventions (such as the elimination of hazardous processes, substitution with less hazardous processes, and engineering controls that improve safety irrespective of worker interactions) are generally viewed as more effective and more desirable than user-dependent interventions (such as policies, procedures, training, and protective equipment) (Brandt, 1947; Office of Technology Assessment, 1985). William Haddon, Jr., the first director of the National Highway Traffic Safety Administration, initiated the term "active" to describe injury control measures that require some degree of volitional activity from individuals and recommended that higher priority be placed on the more effective "passive" strategies (Haddon, 1972; 1974; Haddon & Goddard, 1962). More recently, McLaren, McIntyre, and Kirkpatrick (2010) invoked Rose (1985) while adopting the terms "agentic" and "structural" to draw the same distinctions. The latter category would include large-scale environmental control measures like the fluoridation of drinking water (McLaren et al., 2010), which achieves 100 percent dose-taking execution among all persons who drink water and which can be sustained for as long as the public taps do not run dry. Blankenship, Bray, and Merson (2000) recognized that many, but not all, structural interventions are aimed at individual behavior change – and that there are few, if any, examples of the latter type of "structural" structural interventions in the field of HIV prevention.

In distinguishing structural interventions from biomedical and behavioral interventions that "rely on the individual to be successful" (p. 3), Roberts and Matthews offer as an example the Intervention with Microfinance for AIDS and Gender Equity (IMAGE) (Pronyk et al., 2006). In the IMAGE study, Pronyk et al. (2006) pair-matched and randomized 8 villages in rural South Africa to receive access to microfinance services integrated with gender and HIV education. As a structural intervention, making microloans widely available to women may enhance their status within the household and subvert gender-inequitable norms, which could in turn improve the quality of their lives by reducing intimate partner violence (Pronyk et al., 2006), improving reproductive health (Hung, Scott, Ricciotti, Johnson, & Tsai, 2012), decreasing the risk of HIV acquisition (Shannon et al., 2012; Tsai, Hung, & Weiser, 2012; Tsai & Subramanian, 2012) and improving their children's health (Duflo, 2000; 2003; Thomas, 1990). However, it must be acknowledged that the population health effect is contingent upon a cascade of events, including loan uptake, fruitful entrepreneurial activity, negotiation of household obligations and entitlements, loan appropriation by male partners, and successful loan repayment (the distributions of which cannot necessarily be assumed to shift in the expected direction [Banerjee & Duflo, 2008; Chant, 2008; de Mel, McKenzie, & Woodruff, 2008; Duflo, in press; Goetz & Gupta, 1996; Kabeer, 2001; Macmillan & Gartner, 1999; Schuler, Hashemi, & Badal, 1998]). Given that the outcomes of "agentic" structural interventions are contingent upon human behavior, I believe this class of interventions is potentially characterized by the same gap between efficacy and effectiveness as biomedical and behavioral interventions.

Energizer Bunny(R) or Tomy Rascal Robot(TM)?

In addition to user dependence, a second axis that can be employed to further categorize structural interventions is the intensity of activity involved in their implementation (see Fig. 1). Comprehensive classification of structural interventions is a more