

Diffusion of Innovations and HIV/AIDS

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As the HIV/AIDS epidemic continues its relentless spread in many parts of the world, DOI provides a useful framework for analyzing the difficulties in achieving behavior change necessary to reduce HIV rates. The DOI concepts most relevant to this question include communication channels, the innovation-decision process, homophily, the attributes of the innovation, adopter categories, and opinion leaders. The preventive measures needed to halt the transmission of HIV constitute a “preventive innovation.” This article describes the attributes of this preventive innovation in terms of relative advantage, compatibility, complexity, trialability, and observability. It reviews studies that incorporated DOI into HIV/AIDS behavior change interventions, both in Western countries and in the developing world. Finally, it discusses possible reasons that the use of DOI has been fairly limited to date in HIV/AIDS prevention interventions in developing countries.

The Challenge of HIV/AIDS

HIV/AIDS has emerged as the greatest public health challenge in contemporary times. Given the lack of a vaccine or cure, behavior change is the only means to curb the further spread of this epidemic. In the vast majority of afflicted countries, the primary route of transmission is sexual. In response, many countries have instituted prevention efforts focused on the ABCs: abstinence, being faithful, and condom use. However, transmission by injection drug use has fueled the epidemic in other parts of the world, especially in the former Soviet Union and parts of Asia, including India and China. Needle exchange programs—to avoid the reuse of infected needles—are the response of choice to reduce the rate of infection in such countries. The epidemic initially spreads within subgroups of the population with high-risk behaviors, including commercial sex workers, migrant workers, truck drivers, and injection drug users. As HIV rates increase among these groups, the epidemic slowly progresses into the general population through sexual transmission from these groups to spouses, casual partners, and others. Indeed, once the HIV prevalence rate reaches five percent in a given country, the epidemic has generalized into the larger population and becomes much more difficult to contain.

The HIV/AIDS epidemic continues to advance at a relentless pace. Over 40 million persons were infected with the HIV virus as of 2002; over 70% live in sub-Saharan Africa. Five African countries have an HIV prevalence of over 20%. The two demographic giants in Asia—China and India—have relatively low prevalence rates, but the number of persons infected runs into the millions (UNAIDS, 2002). Eastern Europe and Central Asia have the fastest growing regional epidemics, with the number skyrocketing from an estimated 5000 cases in 1990 to 1 million in 2001 (Lamprey, Wigley, Carr, Colleymore, 2002).

San Francisco was one of the first communities to recognize the threat of the HIV/AIDS epidemic, and in the early 1980s members of the gay community mobilized to educate and persuade others to practice safer sex. The results were dramatic, and demonstrated the potential of political advocacy and community mobilization to halt the spread of HIV/AIDS.

In the developing world, only four countries to date have successfully reduced HIV rates or blocked the spread of the virus into the general population. Thailand and Uganda dramatically reduced levels of HIV/AIDS in the 1990s, and descriptions of these successes are frequent in the HIV/AIDS literature (Hogle et al., 2002; Singhal and Rogers, 2003; Steinfatt, 2002). Cambodia has shown more modest reductions, but appears to be following the Thai model. And Senegal, with an HIV prevalence less than 1%, has been successful in blocking the entry of HIV into the general population. However, these countries represent the exception to the rule. Despite millions of dollars that have gone into prevention programs, the majority of developing countries have not been able to curb the spread of the epidemic.

Why has HIV/AIDS been so difficult to stop? The public health community has had dramatic success in other areas of public health requiring behavior change, such as family planning, control of diarrhea through oral rehydration salts, use of Vitamin B, and immunization. However, behavior change for HIV/AIDS has proven far more problematic.

Diffusion of Innovations (DOI) Theory provides useful insight into the difficulty of achieving the behavior change necessary to curb the HIV/AIDS epidemic in developing countries. This paper uses elements of DOI to examine both the lack of success in changing behavior that has resulted in the continued spread of HIV/AIDS in much of the developing world, and in the successful programmatic initiatives that have come to be known as the San Francisco model. Finally, we address the question: why is DOI generally absent from the vast literature on HIV/AIDS prevention in developing countries, with a few notable exceptions described below.

Diffusion of Innovations Concepts Relevant to HIV/AIDS Prevention

The Diffusion of Innovations is characterized by four elements: an innovation, communicated via certain channels, over a period of time, to members of a social system (Rogers, 1995). The innovation refers to an idea, practice, or object that is perceived as new to an individual. The DOI literature is replete with examples of successful innovations: hybrid corn, modern math, new prescription drugs, and family planning, to name a few. However, the changes in behavior needed to halt the HIV/AIDS epidemic constitute what Rogers has labeled a “preventive innovation,” defined as “an idea that an individual adopts at one point in time in order to lower the probability that some future unwanted event may occur” (Rogers, 2003). In countries where HIV transmission occurs primarily through sexual relations, the specific behaviors include abstinence, being faithful (to an uninfected partner), or condom use—known as the “ABCs.” In countries with a high level of injection drug use, the behavior change intervention includes both needle exchange for injection drug users and adherence to the ABCs. For the sake of brevity, this paper will focus on the ABCs only.

Although the theory of DOI is very comprehensive, Rao and Svenkerud (1998) have identified the six DOI concepts that are most relevant to HIV/AIDS prevention:

- **Communication** channels are the means by which a message is transmitted from one person to another.

- **The innovation-decision** process is an over-time sequence through which a target audience member passes. This sequence has five stages:
 1. awareness,
 2. knowledge,
 3. persuasion,
 4. adoption, and
 5. implementation.
- **Homophily** is the extent to which two or more people who communicate perceive that they are similar to one another.
- An **attribute** is a characteristic of the innovation that may be perceived either positively or negatively; these include:
 - relative advantage
 - comparability
 - complexity
 - trialability
 - observability
- **Adopter categories** or classifications of individual groups on basis of relative time at which they adopted a new idea, technique, or process.
- **Opinion leaders** are people who are respected for their knowledge and reputation on some particular topic.

These concepts provide a useful framework for analyzing the effectiveness of programs in the handful of countries that have been successful, as well as the failure of prevention efforts to halt the epidemic in the majority of afflicted countries.

Use of DOI as a Framework for HIV/AIDS Prevention

There is no single theory that informs or guides the development of HIV/AIDS prevention programs. Indeed, many different theories have emerged, both to design programs and to evaluate their effectiveness (King, 1999; McKee et al., forthcoming). King (1999) classifies these different theories in one of three categories:

1. focus on individual change,
2. social theories and models, and
3. structural and environmental.

DOI corresponds to the second category, given that it explains how a new practice can diffuse through a given social system to the point it becomes a social norm. As Rogers explained (1995), when “trend setters” in a social group begin to model a new behavior to others, they alter the perception of what is normative. Subsequently, others will begin to adopt the new behavior. Ultimately, community members, regardless of whether they have had contact with the original trendsetters, are expected to adopt the new behavior as it diffuses throughout the community’s social networks. Members of the social system in question pass through the stages of the innovation-decision process (awareness, knowledge, persuasion, adoption, and implementation) at different rates, leading to the well-known categories of acceptors: from innovators to laggards.

The early experience with HIV/AIDS in the United States lends credence to this theory. DOI was central to one of the most effective HIV/AIDS prevention programs to date: STOP AIDS in San Francisco. The intervention program drew on Kurt Lewin’s small. Group Communication Theory and the Diffusion of Innovation Theory (Singhal & Rogers, 2003). In the early 1980s, gay men in San Francisco took action to combat this

deadly disease that had hit their community with brutal force. STOP AIDS began by conducting focus groups to learn how much gay men already knew about HIV/AIDS (Wohlfeiler, 1998) as a basis for designing effective interventions. However, the founders soon realized that the focus groups were having a strong educational effect, as men shared information about HIV prevention. STOP AIDS then employed a group of outreach workers from the gay community to conduct small group meetings in homes and apartments throughout the gay neighborhoods, which launched the diffusion process. From 1985 to 1987, STOP AIDS reached 30,000 men through its various outreach activities (Singhal & Rogers, 2003).

According to DOI and as shown in San Francisco, only those early adopters, who make up a relatively small segment of the population, need to initiate a new behavior for it to spread throughout the population (Wohlfeiler, 1998). In the case of STOP AIDS, a well-respected individual who was seropositive led the session attended by other gay and bi-sexual men. He would explain how the virus spreads and encourage participants to either use condoms or seek monogamous relationships. At the end of each session, participants were asked to make a pledge to safer sex, and to volunteer to organize and lead future small group meetings with gay men. Concurrently with the small group meetings, media campaigns helped to increase awareness and knowledge of HIV/AIDS among the gay community. The rate of new infections dropped precipitously by the mid-1980s. Curiously, attendance at the STOP AIDS meetings fell off, and STOP AIDS found it difficult to recruit new volunteers. The program had reached the critical mass of early adopters of safer sex. In 1987, STOP AIDS declared victory and discontinued its local operation, only to reopen in 1990 for new cohorts of younger gay men migrating to the city (Singhal & Rogers, 2003).

Unquestionably, the San Francisco experience demonstrated the power of diffusion and the importance of DOI concepts such as homophily and opinion leaders. STOP AIDS had effectively recruited staff who were part of the community to serve as outreach workers. The opinion leaders within the gay community championed the cause, despite the fear of negative publicity it could bring to the gay community.

One cannot attribute the success of the San Francisco program exclusively to DOI. Indeed, it relied heavily on the epidemiological concept of targeting a group at high risk of spreading the disease, and it utilized other strategies such as Lewin's theories of the social psychology of individual behavior change. However, the experience of San Francisco was sufficiently compelling to lead Kelly and colleagues to study other interventions among gay men in different U.S. communities.

Kelly and his colleagues adapted the San Francisco model to reach gay men in small U.S. cities through bars that served as a major congregating point for this group in these cities. The model called for identifying the natural opinion leaders in the community and enlisting them to endorse behavior change. The intervention consisted of four steps:

1. bar staff were trained to identify natural "opinion leaders" among bar patrons;
2. patrons who had been independently nominated by several bar staff were recruited into the project as opinion leaders;
3. opinion leaders were trained in basic communication skills; and
4. contracts were made with opinion leaders to have a specified number of conversations with peers following the training sessions.

Researchers surveyed bar patrons in both intervention and comparison cities, before and after the intervention. These bar-based opinion leader interventions produced community-level adoption of condom use in two-city and three-city comparison group

studies (Kelly, St. Lawrence, Diaz, et al., 1991; Kelly, St. Lawrence, Stevenson, et al., 1992) and in a multi-city randomized field trial (Kelly, Winett et al., 1993). Kelly et al.'s work (1991, 1992, 1993) underscores that the nature of urban gay male bar networks provides a particularly powerful place in which diffusion might occur. It also acknowledges the important role that perceived peer norms play in influencing individuals' behavior (Miller et al., 1998).

Inspired by the Kelly et al. research and by Diffusion of Innovation Theory, Miller et al. (1998) attempted to replicate and adapt the bar-based intervention with male prostitutes and other patrons in New York City "hustler" bars. Moreover, these researchers were more systematic in establishing and testing the underlying theoretical model for the intervention. As with the Kelly et al. (1991, 1992, 1993) studies, they sought to alter peer norms to encourage safer sexual behavior by having opinion leaders endorse these behaviors with their peers. Analysis of data on a sample of 1741 male prostitutes and bar patrons indicated significant reductions in paid, unprotected sexual intercourse and oral sex following the intervention. The changes were generally small, though statistically significant. However, the study failed to demonstrate that peer norms mediated the relationship between intervention and behavior.

DOI was also used in the design and evaluation of a study among gay men in London. Elford et al. (2002) noted that the most rigorous studies to date on HIV/AIDS prevention among gay men were all U.S.-based, and they set out to replicate the work for gays in London. However, instead of bars, Elford et al. (2002) tested the design in gyms that gay men frequented. However, they were not able to replicate the significant change in behavior found in the earlier studies among gay men, possibly because the peer educators found it difficult to approach clients and discuss HIV/AIDS in the atmosphere of the gym.

If HIV/AIDS prevention proved so effective in San Francisco in the early 1980s, why then has the epidemic continued to spread so virulently in many countries around to world, infecting over a third of the population in the most extreme cases? Unquestionably, numerous factors favored the intervention in San Francisco: the gay men were highly educated, had a very cohesive sense of community, and had pre-established media channels that targeted the gay community. Moreover, they could focus high levels of energy on this one problem, in contrast to persons in developing countries who must simultaneously struggle with hunger, unemployment, inadequate housing, and other consequences of poverty.

DOI provides useful insights into the failure of prevention efforts in many developing countries worldwide, as outlined below.

Why has Behavior Change (the ABCs) been so Difficult in Developing Countries?

As mentioned above, a handful of countries in the developing world have been successful in curbing the spread of HIV/AIDS: Thailand, Uganda, Senegal, and, to a lesser extent, Cambodia. Zambia appears to be making progress as well. Yet in contrast to these few nations, the vast majority of developing countries affected by HIV/AIDS have been unsuccessful in reducing their HIV rates.

DOI theory provides a compelling rationale for the failure of prevention efforts throughout much of the developing world. According to DOI, the pace of diffusion relates directly to the five attributes (characteristics) of the innovation, described earlier. If we consider these five attributes in relation to the ABCs, it becomes clear why this "preventive innovation" has been slow to diffuse in the large majority of developing countries.

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. In the case of HIV/AIDS, we are asking sexually active individuals to adopt safer sex practices or forgo sex for a period of time. To do so requires foregoing (or reducing) the pleasure associated with a fundamental biological drive. Adoption of innovations is more rapid when the innovation confers prestige, convenience, or satisfaction. Safer sex confers none of these. Indeed, for a young woman struggling to survive or feed her children, risky transactional sex (*not* abstinence) offers the greater advantage, at least in the short term.

Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. By contrast, the practice of safer sex (or no sex) often challenges the existing value structure. For example, a woman's negotiating for condom use would be taken as a direct affront to the male's position of dominance in sexual decision-making in many societies. Remaining faithful or limiting the number of partners is contrary to "past experience" in societies that condone multiple sexual partners for males, including visits to commercial sex workers, as well as for females in some societies. By contrast, in many societies it is high-risk behaviors—including multiple sexual partners, visits to commercial sex workers, dry sex, unprotected sex, and transactional sex—that fulfill the immediate needs of the population in question.

Complexity is the degree to which an innovation is perceived as difficult to understand and use. Whereas the behaviors that comprise the ABCs are not particularly complex, they are difficult to sustain over an extended period. Young, sexually active adults must maintain constant vigilance over a 30–50 year period if they are to avoid HIV infection. The burden is onerous and for many of those buying condoms, expensive.

Trialability is the degree to which an innovation may be experimented with on a limited basis. Of the five attributes of an innovation, trialability is perhaps the least problematic. A person can experiment with the ABCs on a trial basis. Young people can attempt to delay sexual debut; spouses can commit to being faithful; those who are unable to abstain or remain monogamous can try to use the condom and decide whether it works for them. Thus, the ABCs do offer trialability. Yet trialability is closely linked to observability, on which the ABCs score low.

Observability is the degree to which the results of an innovation are visible to others. In contrast to the early diffusion experiments with hybrid corn in rural Iowa, in which farmers could readily observe the improvements available from adopting a new type of corn, the ABCs do not produce a readily observable outcome. Indeed, the ultimate goal (avoiding HIV infection) is a non-event that is highly desired but low on immediate, tangible rewards. It is particularly difficult to convince sexually active individuals that practicing safer sex is worth the sacrifice, given that they may not get infected anyway. Moreover, the problem itself is not observable; and if they do contract HIV, the symptoms of AIDS may not surface for years to come.

In short, HIV/AIDS prevention provides a textbook example of how the attributes of the innovation can affect its rate of diffusion. The handful of success stories indicates that it is possible to overcome the obstacles outlined above, but the challenge is immense.

Use of DOI for the Design and Implementation of HIV/AIDS Interventions in Developing Countries

Despite the utility of DOI in explaining the slow diffusion of the ABCs in developing countries, DOI Theory has played a relatively small role in prevention programs in developing countries. It is often cited as one of the theories that underscores the design or

evaluation of HIV/AIDS prevention efforts (King, 1999; McKee et al., forth-coming). Yet there are surprisingly few citations to DOI in the vast literature of HIV/AIDS prevention in the developing world.

One exception is the study by Rao and Svenkerud (1998), who analyzed the extent to which relatively more effective and relatively less effective HIV/AIDS prevention programs in San Francisco and Bangkok used Diffusion of Innovations Theory and Social Marketing Theory in reaching culturally unique populations. In Bangkok, as in San Francisco, the programs recruited members of unique populations (e.g., commercial sex workers in the case of Thailand) to reach peers with life-saving information about HIV/AIDS and condom use. With respect to DOI, the authors concluded that program administrators should use outreach workers who are either homophilous with the intended audience or are opinion leaders in the community.

A second exception is the study by Celentano et al. (2000), also from Thailand, which tested the diffusion model in a different way. The researchers designed a field experiment among Royal Thai Army conscripts, including an intervention group, a “diffusion group” (men housed in barracks at the same base but who did not receive the intervention) and controls at a distant base. The intervention promoted condom use, reduced alcohol consumption and brothel patronage, and improved sexual negotiation and condom skills. Whereas the intervention reduced sexually transmitted diseases among the intervention group, it did not produce results in the diffusion group.

Celentano and colleagues are currently involved in a five-country randomized trial of DOI through popular opinion leaders in China, India, Peru, Russia, and Zimbabwe (Celentano, personal communication). However, the research is ongoing, and the results are not yet available.

Given the relevance of numerous elements (e.g., homophily, channels of communication, attributes of the program, information-decision process) and mention of DOI as a key theory for HIV/AIDS prevention in several review articles, why is DOI not more prominent in the literature on HIV/AIDS in developing countries?

Several explanations seem plausible. First, DOI is largely a sociological theory that uses social roles, norms, and networks to explain behavior. It does not provide an answer to the key question “what triggers a given individual to action?” Rather, those designing programs have tended to look to the psycho-social theories for guidance on changing deeply rooted sexual mores and behaviors (e.g., the Health Belief Model, Theory of Reasoned Action, Social Learning [modeling] theory, and Prochaska’s stages of change theory, to name a few).

Second, the DOI model implies a certain rationality of purpose and sequencing of behavior (i.e., awareness, knowledge, persuasion, adoption, and implementation). Adoption of safer sex diffused effectively through the highly educated, cohesive community of gay men in San Francisco. However, critics of Western-based models are quick to point out that sexual behavior is often irrational (Airhihenbuwa & Obregon, 2000; UNAIDS, 1999). Emotions and sexual arousal may overtake the best of intentions (Perloff, 1995), especially where alcohol, drugs, or fear of violence are also involved. Given that adolescents represent a major target audience for prevention programs in developing countries worldwide, this criticism is particularly relevant.

Third, structural and environmental factors strongly influence sexual behavior (Sweat & Denison, 1995). Migrant workers and truck drivers by definition live apart from their families for significant portions of time, increasing their likelihood of seeking out other partners. Poverty causes the families of young girls to sell them into prostitution, and it prompts mothers to accept transactional sex to provide the bare essentials for their children. School girls whose parents can’t afford school fees are more vulnerable to the

advances of “sugar daddies.” As Perloff (1995) stated, “individuals simply may not be in a position to undo the circumstances that led them to the activity in the first place.”

Fourth, cultural norms also dictate sexual behavior. As Singhal & Rogers (2003) explained, culture can be a barrier or a facilitator in controlling the epidemic. One aspect of culture—the role of women in a given society—is recognized as central to HIV/AIDS prevention. In many societies the inferior status of women makes them particularly vulnerable to HIV/AIDS. A faithful wife who suspects her husband of having multiple partners can not refuse to have sexual relations with him or negotiate condom use. Young women are often the victims of forced sexual relations, including by members of their own family. Indeed, there is a growing literature on sexual violence related to women’s efforts to protect themselves from HIV/AIDS.

Fifth, leaders in a position to be highly influential at the local or national level may not model appropriate behavior. Such individuals lose their credibility by preaching one behavior but practicing another (e.g., the school teacher who teaches about responsible sexual behavior but then seduces his students after class). A similar problem arises when a prominent national figure engages in high-risk behavior (e.g., the King of Swaziland, who takes on a new adolescent wife every year, implicitly legitimizing the practice of multiple sexual partners).

Sixth, the innovation-decision process may derail in the face of new situations. For example, the introduction of anti-retroviral drugs has caused many young gay men to let down their guard vis-a-vis preventive behaviors. They may be highly knowledgeable about the HIV risk, but the introduction of drugs has caused them to minimize this risk. Some gay men may perceive certain benefits of being HIV positive, such as a strong sense of community with others living with HIV/AIDS and special medical treatment for those participating in clinical trials.

In sum, the preventive interventions for HIV/AIDS increasingly address the context in which behavior change must take place. This approach is highly consistent with Roger’s basic definition of the elements of DOI: an innovation, communicated via certain channels, over a period of time, to members of a social system (Rogers, 1995). Certain concepts from DOI have been central to prevention initiatives in countries worldwide (e.g., homophily, communication channels, opinion leadership). One possible reason that DOI has not been more prominent in the literature on HIV/AIDS prevention in developing countries is that it recognizes context as an important factor but does not provide explicit guidance on addressing the social, cultural, and economic obstacles related to context. Another reason is the seeming preference for cognitive or psychosocial models that directly address the question: “What triggers behavior?” As the field of prevention gradually shifts from a predominant focus on individual behavior to recognition of the importance of social norms in defining sexual behavior, DOI may reemerge as a useful theory in fight against HIV/AIDS.

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