



Understanding the Dynamics of Sexual Transmission of HIV Among Drug-Using Populations: An Integration of Biological, Behavioral, and Environmental Perspectives

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In October 2002, the Center on AIDS and Other Medical Consequences of Drug Abuse (CAMCODA) of the National Institute on Drug Abuse (NIDA) sponsored a science meeting, HIV Acquisition and Transmission Among Drug-Using Populations: Future Research Strategies. The meeting, chaired by Dr. David Vlahov, Director of the Center for Urban Epidemiologic Studies at the New York Academy of Medicine, convened experts in HIV/AIDS and drug abuse research to examine the dynamics of HIV disease transmission among drug users and other at-risk populations, and to explore why new infections continue apace despite our best efforts at HIV prevention and control. This special issue of the *Journal of Urban Health* represents one step in the process of addressing new and emerging research gaps and unanswered questions that challenge our best efforts to prevent the continuing spread of HIV/AIDS. The particular focus of the issue is on identifying and understanding some of the dynamic factors involved in the sexual transmission of HIV among drug-using populations. It is hoped that, as we are challenged by yet another decade of HIV/AIDS, we will develop novel, more effective behavioral and biomedical strategies to reduce and prevent—and possibly even to eliminate—this disease.

Since HIV/AIDS was first identified in the early 1980s, knowledge and understanding about the disease have grown exponentially. Today, we know more than we ever imagined possible about the natural history, epidemiology, virology, etiology, pathogenesis, prevention, and treatment of HIV/AIDS. Yet despite these gains, dynamic changes in the epidemic continue as new infections spread among drug users and their sexual partners both in the United States and around the world. In the United States today, the estimated annual rate of 40,000 new HIV infections continues, as it did throughout the 1990s. This persistent rate of new infections reminds us that, while we have made advances in the science of HIV prevention, there is much that we have yet to do to make HIV prevention efforts better, more far-reaching, and sustainable.

The HIV/AIDS surveillance data from the US Centers for Disease Control and Prevention¹ reveal that, since the 1980s, there have been notable shifts in the demo-

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graphics of populations at risk, with substantial increases in the proportion of new HIV/AIDS diagnoses among women, racial/ethnic minorities, lower income groups, and young men who have sex with men (MSM). Although up to 57% of the cumulative AIDS cases among women have been attributed to injection drug use or sex with partners who inject drugs, heterosexual contact has now become the leading cause of new HIV infections among women, especially within minority communities. Recent surveillance data¹ also reveal a significant increase in new AIDS cases attributable to heterosexual transmission in the last few years.

Today, there is reason for concern that a resurgence of HIV may be occurring, especially among young MSM and MSM of color. Recent reports indicate that the incidence of HIV in young black MSM is among the highest of all risk groups in the United States.² Other indications come from reports of new outbreaks of primary and secondary syphilis among MSM and of increases in newly diagnosed HIV infections among both MSM and heterosexuals.³ In addition, it has been found that many HIV-infected MSM are unaware of their infections, particularly black MSM. For example, in a study of 573 HIV-infected young MSM in six US cities, proportionally more black MSM were unaware of their infections than were white MSM (91% vs. 60%).² Other recent data suggest that up to a third of persons with positive tests for HIV do not return for their test results.⁴ HIV-positive individuals who are unaware of their serostatus or who do not return for their test results may be at high risk of transmitting HIV. Moreover, a delay in HIV diagnosis means a delay of medical care and treatment, which increases the risks of rapidly progressing to AIDS. For example, a recent report showed that, of 104,780 persons in whom HIV was diagnosed between 1994 and 1999, AIDS was diagnosed in 41% of persons within 1 year after their positive HIV tests.⁴

Since the introduction of highly active antiretroviral therapy in the late 1990s, the numbers of new AIDS cases and deaths have declined substantially, but these declines now appear to have ended.⁴ Although continual changes are occurring in the dynamics of HIV transmission, the tools we have today to prevent HIV are little changed from what they were two decades ago—namely, behavioral interventions.⁵ A review of the research has shown that HIV behavioral and social interventions for drug users have been effective in reducing injection-related risks for HIV, but less so in reducing their sexual risks for HIV and other sexually transmitted infections.⁶ It is obvious that more needs to be done—but what?

For one thing, the next generation of HIV prevention efforts will depend in large part on our ability to recognize and respond more quickly to the dynamic nature of the epidemic. This requires greater attention to the role of biological, social, and environmental factors that interact and influence new and emerging patterns of drug use and sexual risk behaviors. For another, we need better knowledge to develop effective interventions that keep pace with dynamic changes in the epidemic. For example, the boundaries between the major risk groups are less distinct today than they were at the beginning of the epidemic. Considerable mixing is occurring among different at-risk populations who engage in multiple types of drug use, high-risk needle practices, and unsafe sex. As a result, the traditional method of classifying populations at risk of HIV by exposure category (e.g., MSM, injection drug user [IDU], MSM/IDU) may mask the actual prevention needs of individuals at high risk, and be less helpful in designing and improving the next generation of HIV prevention interventions.⁷

The articles in this volume discuss these and other issues from the multiple and diverse perspectives and disciplines of the meeting participants. The contents paral-

led the agenda of the science meeting, which included three panels on different aspects of the changing epidemiology of HIV among drug users, strategies for prevention, and discussions of new and emerging research gaps and questions to shape the next generation of HIV interventions for drug-using populations.

The first section of the volume addresses epidemiological issues in the sexual transmission of HIV/AIDS among drug users, including the biological, behavioral, and environmental risk and protective factors associated with sexual HIV transmission and drug abuse, and the diffusion of risk and protective behaviors within and across population subgroups. The section includes five articles. The first, by Strathdee and Sherman, provides background information and findings from two major studies in Baltimore of HIV risk factors and correlates among IDU cohorts, as well as from corroborating literature and international research. Together, these data sources highlight the need for new HIV prevention interventions for drug users that incorporate sexual risk reduction and are targeted to specific subgroups of high-risk IDUs.

In the second article, Gorbach and Holmes discuss the importance of certain types of sexual partnerships, particularly concurrent partnerships, in the rapid spread of sexually transmitted infections (STIs) and HIV. They show how concepts of concurrency can help us to better understand and differentiate types of partnerships for the design and development of new interventions that target risks within specific types of partnerships. For example, interventions that target concurrent partnerships need to recognize that concurrency is a survival mechanism for some individuals, and may be more socially acceptable in some situations than in others. The authors also introduce a conceptual framework that suggests how individual and partner characteristics influence partnership dynamics. In turn, these dynamics influence risk behaviors, such as concurrency and not using condoms, and are associated with the acquisition and transmission of HIV and other sexually transmitted infections.

The third article, by Clatts, Goldsamt, Neaigus, and Welle, addresses the initiation of drug injecting among high-risk youth. They review epidemiologic findings on the initiation of noninjecting and injecting drug use among youths and young adults, and the association of early initiation of drug injecting with rapid acquisition and transmission of viral pathogens, including hepatitis B (HBV), hepatitis C (HCV), and HIV. The authors describe the relevance of social networks for understanding the epidemiology of infectious diseases among new initiates to drug injecting. Specifically, a social network approach is useful for examining individual, social, and ecological factors that influence the social course of drug injection and sexual activities among youth and young adult populations. Moreover, it may be relevant for identifying and developing prevention interventions to reduce risk behaviors and prevent the spread of new infections among young drug users and their peers before they initiate drug injection.

Ellen considers advances in the behavioral and epidemiological sciences that can inform the next generation of HIV prevention interventions for reducing the incidence of HIV and other STIs among adolescent females. New interventions are particularly important now because, as the dynamics of HIV/AIDS continue to change, young adolescent women of color are rapidly becoming a group at highest risk. Ellen describes research that identifies concurrent partnerships, contact with small core groups of high-risk adults, and age discordance of the sex partner as important risk factors for HIV and STIs among adolescent females and their social networks. He also discusses how other factors, such as social disorganization, sta-

bility, and cohesiveness, may influence the attitudes, perceptions, and behavioral norms of a neighborhood regarding drug use and unsafe sex, and thereby impact the local incidence and prevalence of HIV and other STIs.

The final article in this section, by Galea, Ahern, and Vlahov, discusses contextual determinants of drug use risk behavior. The authors observe that individual differences in and of themselves do not fully explain variation in HIV incidence and prevalence, and that other factors, including social, structural, and environmental factors, have to be considered if we are to understand and respond effectively to the dynamics of HIV/AIDS. They present findings from a recent study of street-recruited IDUs to show how the ecology of risk can shape individual behaviors and the spread of HIV and other infectious diseases. The authors conclude with a discussion of some of the methodological and analytical challenges of conducting multilevel research to understand how contextual determinants impact individual drug use risk behaviors and the spread of HIV.

The second section of this special issue addresses the theme of HIV prevention in drug-using populations. The articles in this section, like the presentations given at the meeting, consider the importance of ethnographic and qualitative and quantitative research methods for improving HIV prevention strategies for diverse subgroups and populations, including IDUs, MSM, and sexually active, heterosexual women. Metzger's article provides an historical perspective on the HIV epidemic and interventions to prevent HIV in IDUs. He summarizes key lessons learned from research on HIV prevention among IDUs since AIDS was first identified in 1981, on the importance of early HIV interventions, sterile syringe access programs, and substance abuse treatment. He then discusses emerging challenges that HIV prevention scientists and the public health community face today, as well as in the years to come, in responding to the dynamics of the epidemic among drug users. These challenges, like the epidemic itself, are multidisciplinary in scope. Meeting them effectively will require dedication, commitment, and, most important, an integrated approach that combines expertise from the biological, behavioral, social, and epidemiological sciences.

Wingood's article focuses on the feminization of the HIV epidemic in the United States. The gender shift of the HIV epidemic is evident from trends in AIDS mortality data and in the disproportionate rates of new infections among women, particularly among black and Latina women. Wingood reviews some historical and recent research findings on HIV prevention and women as the context for identifying key questions that future studies should explore in order to develop more effective HIV prevention interventions for women.

The final article in this section, by Patterson and Semple, reviews the results of several studies of sexual risk reduction among HIV-positive injecting drug-using men who have sex with men (IDU/MSM). They have found that most behavioral interventions to reduce sexual risk behaviors focus on primary prevention, that is, on preventing the acquisition of infections among HIV-negative individuals. However, because HIV-positive individuals are living longer, healthier lives, and are remaining sexually active, there is a need for secondary prevention interventions to reduce their risks of transmitting HIV and other infections to others. The authors describe their ongoing research to develop and evaluate behavioral interventions aimed at increasing the safer sex practices of HIV-positive MSM who currently use methamphetamines as well as other drugs. They also discuss a range of issues that are likely to influence the HIV/AIDS research agenda in the years to come.

The third and final section centers on international issues in HIV epidemiology,

prevention, and modeling. Panelists who participated in this session of the meeting were invited to discuss some of the challenges of developing phase-specific HIV interventions that are tailored to the local context as well as the age of the epidemic in the local area. A second major topic concerned the application of mathematical models to study the spread of HIV within and across population subgroups, the differential effectiveness of various disease prevention and control strategies, and the impact of behavioral change on HIV incidence in and along local, regional, and national borders. The section includes two articles.

In the first of these, Miller reviews the recent literature on mechanisms that may underlie HIV sexual transmission, examines linkages between sex and substance use transmission of HIV, and describes how social network research can benefit the development of community- and network-based HIV prevention interventions. She describes differences in how developed and developing nations perceive the role of drug use in fueling the HIV epidemic today. In developed countries, there has long been a recognition and acknowledgement of the important role of drug abuse in the spread of HIV among drug users and from drug users to their sexual partners. By contrast, in developing countries, where heterosexual transmission has fueled the epidemic, substance use has received relatively little attention. Instead, the focus has been on population mixing patterns and the role of environmental factors, such as migratory labor practices and trucking routes, in facilitating sexual transmission of HIV through geographic diffusion. Miller argues that, as the dynamics of HIV transmission are changing and becoming more complex, it is urgent to address the role of drug abuse as a framework within which HIV sexual transmission occurs. Social network research methods can facilitate this process by helping us to understand linkages between drug abuse and sexual risks for HIV, and to develop more effective community-based HIV prevention interventions.

In the final article, Celentano discusses what we have learned in the United States from efforts to prevent HIV and other infectious diseases among drug-using populations, and how these lessons can be extended to other regions of the world that are now experiencing daunting rates of HIV incidence, morbidity, and mortality. Celentano describes how geopolitical changes in opium production in Southeast Asia have led to a resurgence of trafficking along overland trade routes, which has been paralleled by increases in injection drug use, HIV/AIDS, and, of particular interest, changes in HIV subtypes. He also presents information on Thailand's success in containing the heterosexual spread of HIV, but its ongoing difficulties in addressing the transmission of HIV among drug users. Finally, he discusses critical research gaps and questions about the epidemiology and prevention of HIV/AIDS. We know that drug use, including alcohol use, are global problems that are inextricably linked to the HIV epidemic. We also know that HIV-infected drug users serve as bridges to the wider heterosexual population. What we have yet to learn—or at least, to learn better—is how to intervene more effectively, with whom, and when, to disrupt this chain of events before it ever occurs.

As the articles in this special issue illustrate, despite progress in understanding the spread of HIV/AIDS, we continue to see dynamic changes in the epidemic as new infections spread among drug users and their sexual partners both in the United States and worldwide. The more we know about HIV, the more we have to learn, not only about transmission risks from drug use and sexual risk behaviors, but also about the biological, social, and environmental interactions and processes that influence these behaviors. Our hope is that this special issue will expand the knowledge base on the dynamics of HIV/AIDS and drug abuse, raise new questions

and point to new directions for future research, and ultimately help us develop a stronger, more effective public health response to prevent sexual HIV transmission among drug users and from drug users to non-drug-using populations.

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