Network Models for HIV Outreach and Prevention Programs for Drug Users

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INTRODUCTION

Most drug abuse and human immunodeficiency virus (HIV) prevention programs rely on individually oriented models of change, or they are conducted at the mass media level. The media approach assumes that the mass transmission of information, embedded in emotionally sculptured scenarios, will spur individual behavioral change through social diffusion theory effects. Prevention programs focused on the individual are constructed around competing or complementary assumptions about individual behavior. They assume that people lack accurate knowledge about the targeted problem (health beliefs model), that the problem occurs because situational intensity interferes with the individual's ability to negotiate a favorable situation (self-efficacy model), that the individual lacks the decision-making models necessary to protect oneself (theory of reasoned action), that individuals are not at an appropriate state of readiness to change their behavior (stages of change theory), or that people are in need of motivational support for change (motivational counseling approach) (Bandura 1986, 1990, pp. 128-141; LaFromboise and Rowe 1983; Tyler and Holsinger 1975).

Both individual and mass media programs attempt to strengthen the probability that individuals will overcome risks through increased knowledge, improved self-efficacy, and modeling alternative or resistance behaviors (May 1992). These approaches have had an important impact on HIV and drug prevention programs, but their cumulative effect falls short of a complete elimination of risk-taking behavior.

The most significant element missing from these prevention efforts is an accommodation of the effects of basic units of human interaction: the networks of family, friends, work environments, and the other small human groups that produce the key social contexts for people's daily lives. This chapter describes a model that combines social network considerations with psychosocial approaches to HIV-risk reduction.

The authors propose that the conditions found in group contexts directly affect HIV transmission and drug use. These conditions demand the use of specific social interventions (change in group norms, consensus-based problem solving, improved social dynamics) in prevention programs. This new paradigm should be added to individually targeted culturally competent interventions in order to successfully reduce the overall risk of HIV infection and drug abuse in the United States.

The model being promoted has been constructed from three types of network analytical approaches, used in a complementary fashion. The first is an ethnographic exploration of drug-using networks. The authors employ open-ended questions and conduct direct observations of drug group activities in order to acquire descriptive and typological data on drug networks. The second approach is an ego-centered (i.e., single person-oriented) attributional data collection process that relies on a standardized questionnaire to determine the characteristics of individuals' networks. The final strategy is a network relationship analytical approach that includes both qualitative and quantitative elements for analysis and interpretation.

This multicultural acquired immunodeficiency syndrome (AIDS)-risk reduction program, still ongoing, is focused on the development and testing of culturally sensitive outreach interventions for injecting drug users (IDUs) and crack smokers in small towns and rural areas.[1] Efforts focus on the use of both network and individually based interventions in four cultural groups: African Americans, Anglo Americans, Hispanics, and Native Americans in the Southwest. The authors' objective is to demonstrate the effectiveness of two prevention approaches: a standard approach used at 20 cooperating sites and an enhanced intervention developed locally. The aims are: (1) to define the cultural and psychosocial parameters of HIV/AIDS-risk behaviors in medium-sized multiethnic towns; (2) to develop models for understanding and preventing risk behavior cross-culturally; and (3) to develop relevant network and individual approaches to HIV/AIDS prevention for each cultural group.

The project is being conducted in Strip Town[2], a town of approximately 45,000 people. It resembles other Southwestern towns that stretch along the railroad tracks that bisect them, forming neighborhoods on "both sides of the track." Strip Town is slightly more than 100 years old and contains considerable cultural diversity. The largest population is the Anglo-American community (29,647). The second largest population is

Hispanic (6,972), and the third group is Native American (4,210). (There are several federally recognized Native-American reservations within 100 miles of the town.) The fourth Strip Town cultural community is African American (1,135). The community residents feel that the town is relatively isolated. However, the community is linked to numerous metropolitan areas by more than 3 million tourists who travel through the town annually. These individuals are a potential source of HIV infection, as are local visits to metropolitan areas.

ETHNOGRAPHIC OVERVIEW OF DRUG USE IN SMALL TOWNS

In contrast to urban areas, drug use is rarely visible on the streets of Strip Town. However, ethnographic research has determined that the town is not exempt from any of the drugs found in urban centers in the United States. Heroin, cocaine, methamphetamines, marijuana, hallucinogens, and a variety of prescription drugs are all readily available for illegal consumption. Some drugs are grown or manufactured within the community, but more often drugs are obtained from metropolitan areas within 3 to 5 hours of driving time from Strip Town.

The drug-purchasing sites are bars and individual homes or apartments, complemented by a home delivery service available to some drug networks. Drug users utilize motel rooms scattered around town for occasional drug deals. The program has identified a number of "party houses" where people go to use drugs. These are not commercial enterprises but are a part the social aspect of existing drug networks. Finally, a number of sites called "rock houses" were identified. They are "mom and pop" operations for relatively small drug networks. They appear to be different from crack houses in urban settings and do not involve a significant sex-for-drugs trade. "Shooting galleries" do not exist in town.

Locally Produced Drugs

The most common locally grown drug is marijuana. Respondents have reported that psilocybin mushrooms, jimson weed (Datura), and poppy bulbs grow in the area, although these are drugs that are more often used by "drug experimenters" rather than the drug users who are the focus of this project. Peyote is locally legally used by members of the Native-American Church in religious ceremonies, but it is illegally used as a

recreational drug by some Native Americans, Anglo Americans, African Americans, and Hispanics. Peyote must be imported from other locations since it does not grow locally. Marijuana is grown both in and out of doors, with the most successful production systems being elaborate indoor operations that provide controlled lighting, moisture, and fertilization.

Drugs that require a modest degree of processing, such as crack cocaine and crystal meth, are produced locally. These operations are small enterprises that can be set up in homes or apartments without being highly visible. "Cooking" methamphetamine to produce "crystal meth" is done locally. Another common local production involves "rocking cocaine." This is carried out in multiple rock houses. A rock house will typically serve one or two drug networks of 10 to 15 users. The process utilizes baking soda in place of ether and can be easily and safely done in most settings. People who belong to these rock house circles use the drug in the home of the supplier or carry it away to use elsewhere.

Importing Drugs From Urban Areas

The most sophisticated processes for creating drugs from raw products are beyond the expertise of local groups and occur in urban or international locations that have access to raw materials and necessary production facilities. Crack and powder cocaine (cocaine hydrochloride), heroin, and methamphetamine are usually imported from urban areas. Crack "rocks," or the "tar" form of heroin, are acquired by small-town middlemen who break or cut the drugs into locally usable sizes. The street value of these larger purchases is normally $2,000 to $3,000, which is within the economic range of small operators. The sale of "eight balls" is also common. This amount of money will provide about a week's worth of drugs for the buyer and provide cash for another buy when the part that is not personally used is sold.

The local price of drugs varies in terms of available supply but also varies according to the buyer's social relationship with the seller. If a drug user has a strong social relationship with a dealer, the dealer will sell drugs for a lower price than is charged to people with a more casual relationship with the dealer. Kinsmen tend to get the best price, friends next, long-term buyers, and so on down the line.

The main local crack supply is obtained by dealers purchasing it in an urban area and bringing it back to town. Some drugs are also brought in

by traveling dealers who follow regular routes through the State or through several States. They are the modern-day equivalent of the rural pack peddlers of the past. Crack is commonly distributed by a home delivery system or an individual "pickup" system. Once a dealer is known to have a renewed supply of a drug, regular customers contact him or her; the dealer then takes it to customers' homes, or they come to his or her home and purchase it. There is also at least one "opportunistic scoring location" in town. If someone wants drugs, they go to this location and hang around. Dealers drive by on an irregular basis, and if they recognize the person standing there, they will ask the person if they are "looking," "buying," or "scratching," code words for wanting to buy drugs. These "drive-by" dealers will not normally sell to individuals who they do not recognize in order to avoid local law enforcement undercover agents.

Heroin is imported in two different forms, the traditional white powder called "china white" and a substance locally called "Mexican tar." The tar, or "tootsie roll," form is the most common. At the present time, heroin and cocaine are similar in price. Smalltown heroin-using groups often pool their money and send one of their members to an urban area to score their heroin. This generates a considerable need for trust on the part of group members since the purchases tend to be infrequent and to involve large sums of money in relation to the wealth of the group.

In some cases, one of the network members is a local primary supplier of drugs on a permanent basis. Drug suppliers make trips to urban centers as entrepreneurs. A project respondent who has assumed this supplier position displayed his products recently. They included an "eight ball" of heroin "tar," a small bag of powdered cocaine, a baseball-size crack rock, and several boxes of prescription drugs. This individual is primarily a heroin user but supplies other users a wide range of drugs he obtains in urban areas.

Smalltown HIV Intervention

The U.S. national AIDS effort concentrates on urban systems in which the HIV prevalence is very high. Recently, the Centers for Disease Control and Prevention (1992) has identified a growing HIV risk for nonmetropolitan areas, where there is more limited knowledge of beliefs and attitudes toward AIDS (Estrada, unpublished data; Estrada et al. 1989) and far fewer intervention and education programs. The recent HIV infection surveillance report for the State[3] in which Strip Town is

located indicates a total of 1,900 AIDS cases (52.19 per 100,000) and 3,285 HIV-infected individuals (121 per 100,000). The AIDS infection rate for the predominantly rural county of which Strip Town is a part is 10.35 per 100,000, and the HIV infection rate is 20.71 per 100,000. However, the local drug-using population has an HIV prevalence rate of 3 percent (3,000 per 100,000), based on 470 active local cocaine, heroin, and other IDUs tested by the project in the past 22 months. This differential in HIV rates indicates that the project is targeting many if not most of the highest risk individuals in the area.

Some of the locations where activities that present HIV risks occur in urban areas are missing in Strip Town; others are not. The town does not have prostitution strolls where street-based sex workers are available. It lacks abandoned buildings with crack houses and has no shooting galleries for sharing needles. Most of the HIV high-risk locations for drug users are in homes or bars, and the risks come primarily from sex and needle sharing in defined drug networks. In one park, there is a male homosexual "pickup" area, unobserved by most of the people who take their children there to play. The majority of the activity initiated in the park is not prostitution; it is casual sex for bisexual males in town who are married and want to make homosexual contacts. In addition, a number of bars have been identified where there are drugs available for sale, as well as a high rate of sexual pickups and a high level of sexually transmitted disease contact referrals.

The primary objective of this project is to reduce HIV risks in drug-using networks. The characteristics of local drug use must be taken into account in the intervention, since the size of the town impacts on peoples' attitudes toward AIDS. Some of the conditions ethnographers are investigating act to reduce HIV risk-taking behavior; others create an environment that will support rapid spread of the disease from any node where it enters the community. The protection derives from the fact that it is difficult to hide persistent behaviors in a small town. The anonymity of urban settings is lacking for anyone who has lived in the area for any length of time. This condition helps to reduce behaviors that place people at risk, especially sexually related risks, because the people in the town have a generally conservative orientation toward sexual activities with strangers. On the other hand, the density of the social networks sets up a condition in which the disease, once it penetrates a network, is likely to spread rapidly to a significant portion of the population.

The perceived isolation of the town has an effect on the local population's assessment of their risk of HIV infection. Some people believe that isolation provides immunity; they believe that AIDS is an urban problem. However, since the drugs must at some point be procured from an urban center, someone must take risks in an urban environment. These "drug runs" carry primary risks for rural drug users. The buyers travel to poorly known territory where they must negotiate as outsiders. Respondents report numerous risk-taking activities on these trips, including testing drugs with borrowed "works" (drug paraphernalia) and casual sexual activities. When asked how they try to reduce these risks, the first response is usually "I never share needles when I go to score." However, with further inquiry, most will report that there was "that one time" for either sharing works or casual sex. When enough of these "one time" events are aggregated, the risk becomes significant.

ETHNOGRAPHIC NETWORK APPROACHES TO HIV- AND DRUG-RISK REDUCTION

The project collects baseline and ongoing ethnographic data (Bernard 1986; Trotter 1991) in conjunction with quantitative data collection on psychosocial variables (Bandura 1986; Mays et al. 1990, pp. 128-141; Prochaska et al. 1992). The ethnographic data collected has two purposes: It is used to define the sociocultural elements of drug use and HIV risks in small towns and to develop models for preventing HIV and drug risks cross-culturally. The general ethnographic data and the qualitative network analysis is complemented by quantitative forms of network analysis (Fraser and Hawkins 1984; Klovdahl 1985; Knoke and Kuklinski 1982), as well as other systematic data collection procedures.

Ethnographic Network Data

> A network can be defined as "a specific type of relation linking a defined set of persons" (Knoke and Kuklinski 1982, p. 12).

The authors began exploring rural drug networks at a community level by conducting ethnographic interviews with in-treatment and active drug users. The questions asked included how long the respondent had used drugs, what drugs they used, why they use drugs, which drugs they prefer and why they prefer them, how they get their drugs, how many people they know use drugs, and the characteristics of their own drug-using

network. The purpose of these questions was to establish baseline data and to provide a preliminary overview of the local drug networks. Heroin addicts reported that there were only a few users in the area shooting heroin, often estimating that they knew of 10 to 15 people in this situation. The same was true of most cocaine users, crystal meth injectors, and others. However, it became clear that these individuals, for the most part, did not know each other. They were describing a potentially large number of strongly bounded and mutually exclusive groups. This information was supported by a noticeable lack of consensus between these users on where and how they scored and on the type of membership (family, friends, strangers) in their drug network.

Discovering numerous small drug networks that do not have knowledge of one another appears somewhat counterintuitive given the smalltown nature of Strip Town, where everyone feels they know everyone else. It would be reasonable to assume that most drug users would have common social connections, scoring locations, or long-term associations from grade school and high school. However, a countervailing problem exists that changes the local ecology of drug networks. Drug arrests commonly take place at the user (not dealer) level. Using drugs with anyone but a small circle of well-known acquaintances is hazardous. Therefore, the authors have repeatedly confirmed that there are many more drug networks in town than are assumed by the drug users themselves and that these networks only minimally overlap, being linked by one or two people at the most.

Developing a Rural Typology of Drug Networks. The authors felt that using an ethnographic approach to developing a drug network classification was an important first step for this intervention. Ethnographers found there was no clear local "folk" typology of drug-using groups. People do not have clear labels or descriptions for networks. Yet, the actual networks that have been observed form and maintain stable social relationships. In the absence of a preexisting classification, the authors decided to create a typology that emphasizes the social and cultural variables that appear to be the most promising for the development of the intervention strategies. These variables define differences in risk taking and risk protection for the groups, which would subsequently assist in improving the efficacy of the authors' network intervention programs.

Ethnographic interviews indicated there are three major variables that permit construction of a typology of drug groups in small towns. The

first is the relative degree of openness of the network, measured by the level of recruitment of new members over time. An open network is one that has a high percentage of newly recruited members, and a closed network is one that does not allow the recruitment of new members to any significant degree. This is a continuous variable, from networks that are completely open to new membership at any time (a risky situation given the illegal nature of drug use), to those that never recruit new members after their initial formation. There is nothing, other than mutual agreement, that prevents networks from changing from open to closed and back again over time, depending on internal and external circumstances. However, these networks have not been observed long enough to determine whether or not these cyclical changes occur.

The second set of classification variables includes the types and the number of social bonds that predominate in the group. At present, there are four conditions associated with this set of variables in the project classification system: (1) kinship relationships, (2) long-term friendships, (3) shorter term acquaintanceships, and (4) weak or virtually anonymous relationships. All or only a few of each type of relationship may occur in a single drug-using group. Among the long-term and well-established drug networks, kinship and very long-term friendship are the core structural elements. One particular drug network the project is studying consists of a three-generation family of more than 10 IDUs. At the other extreme, acquaintance based on convenience and almost random association may predominate in a network.

The third variable used to construct this classification is the type and level of social activities or interactions that exist within the drug network, such as group drug use, joint recreational activities, or work-related associations. Joint drug use, in particular, is a key variable. One anchor for this variable is the absence of any of these activities for the group as a whole. The next observable level is face-to-face activities limited to dyads or triads in the group. The other end of this activity spectrum includes a high level of social interaction (e.g., parties, participation in softball leagues, other recreational activities) involving the entire group. These activities are generally associated with the social structure that exists in a network but are not correlated to them in a one-to-one relationship. Even a family-based network may decide not to engage in face-to-face activities due to hostility or conflict in the group. There is some covariation between levels and types of activities in a group and the types of social bonds that predominate in that network, but it is not a perfect relationship.

Another variable was considered in creating this drug network typology: the type of drug used. This variable did not produce a significant improvement in the identification of network types. Most groups prefer a single drug or specific drug combinations. Most groups also use other drugs, especially marijuana and alcohol, when the primary drug is not available. However, there are networks of each type that use each of the drugs available. So, while networks tend to be single drug-oriented, the other relationships (openness, types of relationships, and social activities) determine the actual network structure.

Analyzing the ethnographic network data produced a typology with four distinct (i.e., internally consistent, externally divergent) classes of drug networks. They have been labeled Types A, B, C, and D. Type A (mature injector networks) is a closed system in which members allow virtually no new recruitment. Group size ranges from approximately 5 to 10 individuals. Type A networks often include individuals from a variety of social, economic, and ethnic backgrounds. The most commonly encountered drug of use for this type of group is heroin, although other drug preferences were found in Type A groups. The primary purpose of the group is to pool resources for the acquisition of drugs. Joint drug use activities do not extend beyond scoring for the most part. The group has social bonds based on kinship and very long-term friendship that help to maintain the group, but they socialize less than the other groups. The socialization occurs as dyads or triads and does not involve the whole group. A respondent described scoring, the group's primary activity:

> Somebody in the group will get a hold of the others when they want to score or when they are going to score. Who ever wants some will put their money together and someone will go to . . . (major city) . . . usually, and get the stuff and bring it back and call the others. The others will come and get their part and go home and use.

Type A drug use tends to be very secretive. Most of the members are married or in monogamous relationships. They are employed at various economic levels. They may use on a maintenance level during the week and get "loaded" on weekends or special occasions. The major area of risk for HIV transmission is from contact with persons outside the group (weak ties), for example, when they come in contact with outsiders whose HIV status is unknown. For the most part, this type of network does not

involve sex for drugs, although it is not completely avoided. A respondent belonging to a Type A group states:

> A couple of girls I know up here wanted to work something out for some chiva [heroin] . . . but I didn't . . . coke users do more of that.

Type B drug networks (kin-based groups) are semi-closed and are predominantly kinship groups (family, in-laws, or fictive kinship such as *compadrazgo* relationships in the Hispanic community). One is either born into these groups, marries in, or has a steady sexual partner in the group (with rare exceptions). The members have gone to school together and were often raised together. The groups tend to be homogeneous in terms of socioeconomic status (SES) and ethnic identification. Drug use within these groups could be considered a family tradition, a special case of peer pressure. The individual has very strong pressures to conform to group norms. The nonuser is considered to be sending a message condemning the group's behavior. An example of this was reported by a Navajo respondent who was attempting to abstain from drug use:

> They called me names, they said that I was too good for them . . . I fought with them . . . I beat two of them up but I still had to go to the hospital.

These groups form a contrast with Type A groups, where the social relationships surrounding drug abuse are minimal. The HIV-risk areas for this group include the sharing of works between family and friends. This activity is often not even labeled sharing and may actually be a part of the bonding process that occurs within the group; refusal to share can be considered a distancing from the group's social norms. For the most part, these networks involve individuals with longstanding monogamous partnerships, and there is not a significant amount of exchange of sex for drugs, although there is co-use of sex and drugs in some of the partnerships. These groups can have any one of several drugs as the drug of choice for the group, with the most common being cocaine, crack, rock, crystal meth, marijuana, and alcohol.

Type C networks (friendship-based networks) are semi-open systems whose members score together and are socially bonded by drug use. The majority of these networks are relatively homogeneous in terms of SES and ethnicity, but they are more mixed than Type B groups. The predominant social bonds in the group are long-term friendships,

although some kinship relationships normally are present. Individuals in these networks involve one another in both drug use and in other types of social activities. The members are often connected through work as well as their social activities. These groups are somewhat open to recruitment of new members, although it takes time. "Good friends" may be invited to "party" (to use drugs) with the group, but it is very common for the group to take from 12 to 18 months of feeling people out before they are recruited. Multiple drugs are used in this type of group, including heroine, cocaine, crack, speed, and alcohol. The groups also tend to include both injectors and noninjectors in the same network. A respondent describes a night of mixed drugs:

> People will be drinking or doing coke and those who want to shoot up go in the other room.

The risk areas for this group include the sharing of works "among friends." Sexual activity may also be present within the group, with multiple sexual partners a possibility, and with some changing sexual relationships within the group over time. There appears to be some exchange of sex for drugs, although this seems to involve ongoing social relationships rather than commercial transactions.

Type D (acquaintance) networks are the most open of the four types. They often include polydrug users who bridge or skip from group to group. The most common drug used is crack cocaine. The crack dealers operate more openly than most of the other suppliers, and profit is a major condition for establishing a relationship with recruits. Introduction into the group can be accelerated if an individual has become a known buyer. Others will introduce that person to the group's dealer, saying "He's OK, he's buying." This indicates that the existing group member has seen and has been with the new person when they were scoring. Having a known supply of money is a significant credential for entry into these networks and can expedite the process of acceptance. Individuals in these groups regularly exchange sex for drugs, and there are far more "impersonal" exchanges of this type than in the other groups, including a considerable power differential between the person giving the sex for the drug and the person in control of the drug (and consequently in control of the sexual activity).

A long-time drug user derogatorily referred to members of this type of group as "trash can addicts." They will use anything. These groups are normally heterogeneous in terms of ethnicity. The SES of group

members can also vary to a considerable degree. These networks tend to consist of users who are new in the area and are looking for contacts, people who have progressed to a drug use stage that makes them unattractive to members of the more closed groups, users in transition between groups, or young drug users who have not been recruited to a stable network. As a respondent indicated:

> I was here chipping, running back and forth to [nearby metropolitan area] for a year before I finally ran into one person and from them I met about 10 others.

This person then moved into a more stable and less visible Type C network once he gained acceptance. The Type D groups appear to be at the highest risk for HIV infection, due to a full range of sex-for-drug activities (commercial and noncommercial) and needle sharing with strangers. These groups also include numerous individuals who are highly mobile and who are likely to move back and forth to nearby urban areas during the year, increasing local risks due to contact with higher HIV prevalence sites.

The majority of the networks tend toward the closed end of the spectrum. Of the 23 networks the authors currently have data on in Strip Town, five are Type A, five are Type B, eight are Type C, and five are Type D. This creates a 4:1 ratio of closed to relatively more open networks.

In order to confirm the validity of this general network typology, a small cross-validation study was conducted using the quantitative data collected on the drug use and HIV-risk patterns of project clients. Each client is assigned membership in an existing or a new drug network when they are identified as meeting three of seven assignment criteria. Individuals who do not meet those criteria are considered isolates, peripheral members, or unassigned. Each identified network is classified, using the qualitative criteria described above. The authors then used one-way analysis of variance to compare selected drug- and HIV-risk variables from the Risk Behavior Assessment questionnaire, with the variable identifying the type of network membership (A, B, C, D, or none) for each client.

It was hypothesized that there would be differences in intravenous drug use across the groups, but not general drug use, following the use patterns found in the community. Significant differences were seen for days using intravenous drugs in the last 30 days ($F(4,171) = 9.16$, $p = 0.0000$), with the Type A network reporting most frequent use in the last 30 days

($M = 13.85$, standard deviation [SD] = 16.63), and the remaining four networks seldom using intravenous drugs (isolates, $M = 2.04$, $SD = 6.67$; Type B, $M = 2.52$, $SD = 6.9$; Type C, $M = 4.57$, $SD = 6.90$; Type D, $M = 1.79$, SD 6.09). Post-hoc Tukey-HSD multiple range significance tests indicated that members of Type A networks used drugs significantly more than any of the other four networks. There were no differences across the network types in days using nonintravenous (non-IV) drugs during the previous 30 days ($F(4,171) = 0.78$, $p = 0.54$). This result was expected since the measure of non-IV drugs combines alcohol, marijuana, and cocaine. Almost all subjects report alcohol use, and many report crack use in addition to other IV drugs. The range of use was so large that differences would be difficult to detect.

Sexual risk and HIV testing were also examined across the five groups. Frequency of unprotected sex was expected to differ among the groups. This hypothesis was supported for males ($F(4,90) = 3.93$, $p = 0.006$) but not females ($F(4,49) = .16$ $p = 0.95$), with the kinship network ($M = 1.00$, $SD = 0.00$ and the isolates ($M = 0.96$, $SD = 0.12$) engaging in the most frequent unprotected sex with Type A ($M = 0.70$, $SD = 0.44$) and Type C ($M = 0.76$, $SD = 0.41$) less frequent and the type D the least frequent ($M = 0.51$, $SD = 0.46$). The family-based network members have many socially negative connotations associated with using condoms with regular partners. These results match well with the ethnographic data, including the lack of difference for females. The rate of unprotected sex was uniformly high across all five groups for females, although the smaller group sizes collected for them may obscure some actual differences. Alternatively, insisting on condom use may be a more complicated behavior for women than men, and the power differentials associated with it may be unrelated to the criteria used to assess membership in this social network typology.

Intercourse with IV drug users was also expected to vary across the groups, with Type B networks engaging in the least amount of "safe sex" (intercourse with non-IDUs). This hypothesis was supported ($F(4,139) = 3.06$, $p < 0.02$), with the Type A networks engaging in significantly less safe sex ($M = 0.54$, $SD = 0.48$) than the younger, Type D networks ($M = 0.87$. $SD = 0.31$). The remaining three groups were between these two in frequency of safe sex (isolates, $M = 0.83$, $SD = 0.36$; Type B, $M = 0.73$, $SD = 0.40$; Type C, $M = 0.74$, $SD = 0.41$).

The frequency of HIV testing was not significantly different ($F(4,172) = 1.96$, $p = 0.10$) across the five groups. Although this was not

significant, there was a trend in the data for network Type B to be tested more often with an average of 1.22 (SD = 1.62) tests per person, with Type C (M = 0.70, SD = 0.95) and D (M = 0.73, SD = 1.3) slightly less. Network Type A (M = 0.38, SD = 0.67) and the isolates (M = 0.36, SD = 0.79) had been tested the least. The finding that Type B networks have been tested most frequently may be related to social norms about the need to protect other family members, a consistent theme in the ethnographic interviews conducted with these individuals. The low rate of testing for isolates again may reflect either the social ecology of being an isolate, including a differential access to resources, or may be related to psychosocial conditions of isolation.

Finally, two variables that were identified were not expected to vary across the groups: income in the last 30 days and amount of time spent in jail. Neither days in jail [(F(4,169) = 1.30, p = 0.27)] nor income in the last month [(F(4,172) = 1.23, p = 0.30)] were found to be significantly different across the groups. The lack of variation in income may be due to that targeted sampling strategy. The lack of variation in jail time may or may not be an important condition for network-based interventions. Since the authors hypothesize that the local networks may provide several forms of social protection, it would be interesting to have comparable data for networks in metropolitan areas to determine whether the size and composition of smalltown networks provide a differential amount of protection from jail time when compared to other locations.

These data are useful for targeting intervention and education activities for the highest risk group, IDUs, based on multiple-risk criteria. They also contain important information about the subepidemics that are likely to be part of HIV transmission in rural areas. The authors believe that the overall effort of their ethnographic network data collection is well justified in terms of the advantages it provides in prevention and intervention efforts. It also creates a mechanism to help validate the utility of their network approach beyond its ability to describe drug use in a small town.

Using Ethnographic Network-Based HIV Intervention in Small Towns

The present network typology meets several needs for understanding important social relationships among drug users. One primary use of this ethnographic network approach is to create an effective outreach system for contacting high-risk individuals. Network-associated outreach

follows existing social relationships, and recruitment can be initiated within the context of the same unit that will either reinforce or act as a barrier to program objectives. Once the first few individuals in the network have been recruited, the group itself can provide impetus for other members to participate. Rather than relying on individual-by-individual recruitment, group dynamics are in force beyond individual motivations. Once the group is assessed, the prevention or intervention program can be transmitted to a central individual in the network, with a good chance that it will subsequently be transmitted to part or all of the rest of the network. This makes the prevention effort more effective. For example, there is now one woman, the central person in a kinship-based network, who uses her kin relationships to assure that all of her children, nieces, and nephews have condoms and clean needles before they go out to party on the weekends. The typology also makes it possible to engage in interventions that focus on both group and individual behavior or that pursue only individual-level intervention for isolates and type D network members. The majority of the authors' smalltown drug-using networks show a strong tendency for tight communication and reinforcement of the group's norms. This means that if the network is currently "clean" of HIV infection, the group itself can become an excellent focal point for developing social norms that promote remaining HIV free. Prevention or intervention efforts are enhanced by knowing the variables that cause these differences.

Network-informed outreach has additional advantages. Keeping track of network members is a natural, ongoing function of the gatekeepers of the network. This condition can greatly assist the followup phase of any project. If the core or most influential members of the network can be identified and tracked, then they can act as primary links to the other members of the group 6 months, 12 months, or even longer into the future, reducing the disadvantages of followup that must track every single individual.

An additional benefit to network interventions is related to the condition that drug users in small towns rarely receive positive services from the community. Many programs available in cities do not exist in rural areas or are not accessible to the drug-using population. Drug users are a stigmatized population, and they do not want to become more visible than they already are. Drug users often feel that it is unlikely that anyone outside their group would be concerned about their well-being. This causes them to reject participation in programs if they are approached anonymously or through normal communication channels. Outreach

workers are often confronted with questions like "Who are you really working for?" Participants have expressed fears of being "busted" following interviews. These problems are greatly reduced by network-based recruitment since the first person to participate tests out the system to see if the researchers are doing what they say they will do and to see if they get busted. These drug users tend to become strong advocates of the program when they discover it has value to them. These individuals then help recruit the rest of the network, short-circuiting the suspicion that would be caused by a one-to-one "cold" contact by outreach workers. The need to remain hidden, due to the illegality of drug-related behavior, can be accommodated by normal networked entry into these groups.

EGO-CENTERED NETWORK DATA

The second component of this network approach to risk reduction is also informed by ego-centered network analysis. An ego-centered network consists of a single individual and all of the persons that he or she recognizes as being connected in terms of some specified social relation. The attributional data associated with ego networks (i.e., size, gender and ethnic composition, retrospective conditions) can be identified and described as a "typical" network profile. These data can be further compared with other variables of interest, such as level of HIV risk, choice of drugs, unprotected sex, or any other variable potentially associated with network social relationships. This approach has both advantages and disadvantages for constructing intervention programs. The basic data collection instrument can be administered as a standardized questionnaire, using sampling approaches that provide a reliable communitywide view of ego-centered networks. This allows for much larger samples of networks than other approaches, and the results can be subjected to the same types of analytical procedures as any questionnaire. This is an excellent method for gaining a rapid overview of the networks in a large population.

The disadvantages of this approach stem from the lack of ability to determine connections or overlaps between networks and the missing reciprocal data from the individual's ego discusses, especially, relationships that may be directional (i.e., stronger in one direction than in the other, such as the level of trust between two people). The data are collected from ego's perspective but are not checked by asking the individuals named by the ego to comment on the relationships to the ego or to each other.

The quantitative baseline data for the authors' AIDS prevention project is an attributional survey of HIV and drug risks, using a form called the Risk Behavior Assessment (RBA). Collecting ego-centered network data from informants was managed as a cost effective add-on and provided additional variables that can be analyzed in conjunction with the survey data. The ego-centered network instrument[4] was developed as part of the National Institute on Drug Abuse's (NIDA's) Cooperative Agreement Project and has been tested in five sites. The primary purpose of the instrument is to describe the ego-centered networks of active drug users not in treatment and their risk-taking behavior in relation to possible HIV infection. The primary questions in the instrument ask about the size, composition (age, sex, ethnicity), drug use, and sexual relationships of the ego's network.

The authors collected ego-centered network data from 52 active drug users to provide a statistical overview of the drug networks. The data include general information about the ego networks, information about ego network drug activities in the last 30 days, and information about the ego's last episode of drug use. Table 1 illustrates the gender, age, and ethnic distributions of respondents.

The number of people each ego reports "spending time with" ranges from 0 to more than 25, with 76.3 percent responding that they spend time with 0 to 10 other people. The composition of these networks includes between 1 and 10 family members for all but 16 of the respondents. These findings support other network data indicating that the majority of these individuals belong to relatively small drug-using networks that commonly include both users and nonusers, some kin relations, and close friends. Only 25 percent responded that *all* of the people they "spend time with" use drugs, and 13 percent reported that *none* of the people they "spend time with" use drugs. Of those alters who used drugs, 25 percent injected drugs, 69 percent smoked crack, and the rest used some other drug and method of administration.

Respondents were asked to think about and list (first names only) up to six people they had used drugs with in the last 30 days. They reported the size of these networks as follows: 25 percent denied injecting drugs or smoking crack with anyone else; 17 percent identified one person; 11 percent identified two people; 13 percent identified three people; 11 percent identified four people; 9 percent identified five people; and 11 percent identified six people. There were a maximum of six slots available on the questionnaire; some respondents would have added more

TABLE 1. *Gender, age, and ethnic distributions of respondents, and respondents' 30-day and recent-use networks.*

	Respondent N=52 (%)	Alters in 30-Day Network N=127 (%)	Alters in Most Recent Use N=90 (%)
Gender			
Male	34 (67)	81 (63)	62 (68)
Female	18 (33)	46 (37)	28 (31)
Age			
10-19[5]	12 (23)	36 (28)	28 (31)
20-29	14 (26)	38 (29)	25 (27)
30-39	23 (44)	43 (33)	30 (33)
40-49	3 (5)	9 (7)	7 (7)
50-59	0 (0)	1 (1)	0 (0)
Ethnicity			
African American	10 (19)	22 (17)	16 (17)
Hispanic	19 (36)	64 (50)	42 (46)
Anglo	18 (34)	35 (27)	27 (30)
Native American	5 (9)	6 (4)	5 (5)

people if they had been allowed. Examination of the ethnic mixture of these 52 networks showed that 48.8 percent were confined to a single ethnic group, 46.5 percent included representatives from two ethnic groups, and two networks (3.8 percent) included three ethnic groups.

The risk factors assessed by the questionnaire included needle sharing and sexual relations with network members. Table 2 illustrates drug use and HIV-risk patterns for the respondents' 30-day alter network and for their most recent drug use episode.

TABLE 2. *HIV- and drug-risk patterns for 30-day and most recent use networks.*

	30-Day Network N (%)	Most Recent Use Network N (%)
Drug Use		
Crack	66 (76)	n/a[6]
IV	9 (10)	19 (26)
Crack and IV	21 (24)	n/a
Frequency		
Daily	6 (6)	n/a
Weekly	34 (39)	n/a
Monthly	21 (24)	n/a
<1x/mo	24 (27)	n/a
Missing	1 (1)	n/a
Needle Sharing		
Gave needles	16	4
Got needles	11	6
Sexual Activity		
Sexual relationship	20	15
Sex with drugs	16	n/a

Needle-sharing episodes occurred between 12 egos and 30 alters who injected drugs. These included 11 mentions of needles obtained by the egos from alters and 16 given to alters by egos. Most needles were shared between the ego and the first person identified in his or her matrix. Sexual activity was reported with 20 of the possible 127 alters (15 percent). Sixteen of the relationships were with the first person identified on the ego's list, and 14 of these included sex with drugs. All four of the sexual relationships with other alters included sex during drug use, probably with casual partners.

The authors have identified a number of additional risks that were present in the 30-day ego-centered networks, using a linked network question-

naire and RBA data set. The numbers of respondents were insufficient to look at trends in this sample, but the following risks were listed by at least one individual as occurring in the past 30 days: not cleaning shared needles with bleach, using the same cooker as someone else, using the same rinse water, and having sex during drug use. A larger sample would be required to determine how these risks were distributed through the various networks, but their presence indicates that the egos are definitely at risk for HIV infection from drug use or sexual activities associated with drug use.

The networks for the latest drug use episode show similar results. Thirty-five respondents (67.3 percent) reported using drugs with between 1 and 11 people, for a total of 116 alters. The most frequent was use with 2 others (10 respondents), with 3 others a close second (9 respondents). The egos' perception of their relationship with the alters was assessed. For the people named in the first position, 35 percent were relatives or in the husband-wife-lover category; 48 percent were considered very good friends; 12 percent were friends; and only 3 percent were acquaintances. Of the 26 people in the second position in the matrix, 15 percent were identified as acquaintances or friends of friends. These data support the drug network descriptions and typologies created through this ethnographic research and provide risk-related data for comparison with the full network data below.

The drug use- and sexual-risk factors assessed for these individuals included needle sharing and sexual relations with network members. Nineteen alters were identified as using intravenous drugs during the most recent drug-using episode. Needle sharing between the egos and alters included six mentions of needles obtained by the egos from the alters and four given to alters by egos. All needles were shared between the ego and the first or second person identified in the matrix. Sexual activity was fairly limited, with relationships reported with 15 of the possible 90 alters. Eleven of the relationships were with the first person identified on the ego's list, three with the second person and one with the sixth person on his/her list. Sex during drug use was not assessed for this episode.

The demographic composition of the 30-day network and the "last use" networks are similar, supporting the validity of the ego's responses. The gender and age distributions are representative of the larger sample of drug users in the project, as well as the hypothesized gender breakdown for the drug-using community as a whole. The ethnic distribution is

skewed toward Hispanics more than would be predicted by the total project client population. This is an artifact that is primarily due to the composition of the networks that were being interviewed at that time.[7] Drug-related risks in the form of both needle sharing and sexual activity during drug use occur relatively frequently. Due to the questionnaire's construction of ego-centered instruments, it was impossible to assess the needle sharing and sexual activity of the alters. If their rate of activity is similar to that reported by the egos, the level of network risk could increase exponentially. The finding that most of the sexual activity occurs between close friends, spouses, or lovers can be taken as an indicator of potentially heightened risk. Research findings from within this study and others (Prochaska et al., unpublished data) suggests that the use of condoms with "main" partners is very low and difficult to initiate. As a result, risk of infection from sexual activity may be very high if anyone in the group becomes infected.

These ego-centered data both confirm and advance the present ethnographic data. The data demonstrate that the majority of drug networks in Strip Town are small (2 to 10 individuals), are based on close friendship or kinship ties, and are relatively stable in their composition. The data also indicate that the majority of needle-sharing activities occur with the first three people named by the ego as members of their network and that sexual activities occur predominantly with the first person named by the ego. This finding has potential importance in targeting prevention information using parts of the ego-centered data. A smaller portion of the needle sharing and sexual encounters occur with people outside of the ego's network, but the data also indicate that it is exactly these encounters, called "weak ties," that are the highest risk contacts for the majority of drug users. Based on these data, part of the present HIV prevention and education effort has been directed at making recommendations that would help these individuals break, reduce, or decrease the risks associated with "weak tie" types of relationships.

FULL NETWORK (RELATIONAL) DATA

The ethnographic and ego-centered network approaches described here are providing valuable baseline data for the authors' intervention strategies, but they do not provide all of the information needed about the actual type, strength, or direction of the relationships within drug networks. Nor do they allow comparison of differences in relationships based on diverse kinds of interactions, such as drug use, social activities,

or intimate topics. Therefore, the authors decided to conduct full network analysis on a subsample of the local drug networks in order to collect information about the interactive affiliations of each individual in the network.

The authors currently are working with 23 clearly defined groups of active drug users in Strip Town, as well as a number of individuals who have no known network connections (isolates). The size of these groups varies from 2 (usually couples) to 42 or more. Full network relationship data have been obtained on a total of 10 of the active networks in this study. During the full network data collection process, the group is brought together and asked to rate their relationship to each member of the network based on a structured set of questions about their social relationships, their drug use patterns, and communication about intimate subjects such as sex. The authors also record focus group discussions about the ways in which new members are recruited and the norms the group holds in relation to HIV risks.

These network group interviews identify the perspectives that members have on the social and drug-using characteristics of the group. They provide information on how the group perceives its need to protect itself from HIV risks by either reinforcing or changing group norms about needle sharing or unprotected sexual relations with main and casual partners. The process also includes a network problem-solving intervention that allows the group to identify risks to the group as a whole (without blaming or identifying members). Feedback from these sessions indicates that the sessions are successful in initiating communication within the group on topics that were not formerly discussed. The analysis of the relational network data collected in these sessions provides the opportunity to identify network characteristics that exist in these drug networks (Glover 1989, 1990; Kilworth and Bernard 1974; Knoke and Kuklinski 1982; Panning 1982; Scott 1991). Knowledge of the communication patterns of networks allows a much more focused approach for carrying out the educational and intervention objectives of this project.

One network has been chosen to illustrate the types of information used to analyze relational aspects of the AIDS risk reduction program. This network, labeled "N1," was chosen as an example of a multigeneration, family-based drug network. There also are networks with virtually no family ties or centralized leadership, which demand different intervention approaches. Network N1 contains members from two Hispanic kinship

groups, one of which includes an Anglo-American spouse. The group has both male and female membership, as can be seen from the following kinship diagrams (see figure 1).

The drugs of choice for the group are cocaine and crystal meth, and the group includes both IDUs and non-IDUs. The members of the group are "in the system," living in local project housing. Three undocumented individuals from Mexico are members of the group. The core group has been using drugs together since high school; some of the members are now in their forties. The network is relatively closed, with membership being restricted to kin and sexual partners of kin.

The structural relationships identified in this network (or any network) include different types of connections between actors, the centrality or influence of individual actors as subgroups within the larger group, and as roles or "positions" within the network (Knoke and Kuklinski 1982). The authors are currently studying both the connections and the substructures of the networks. They are analyzing the patterns of

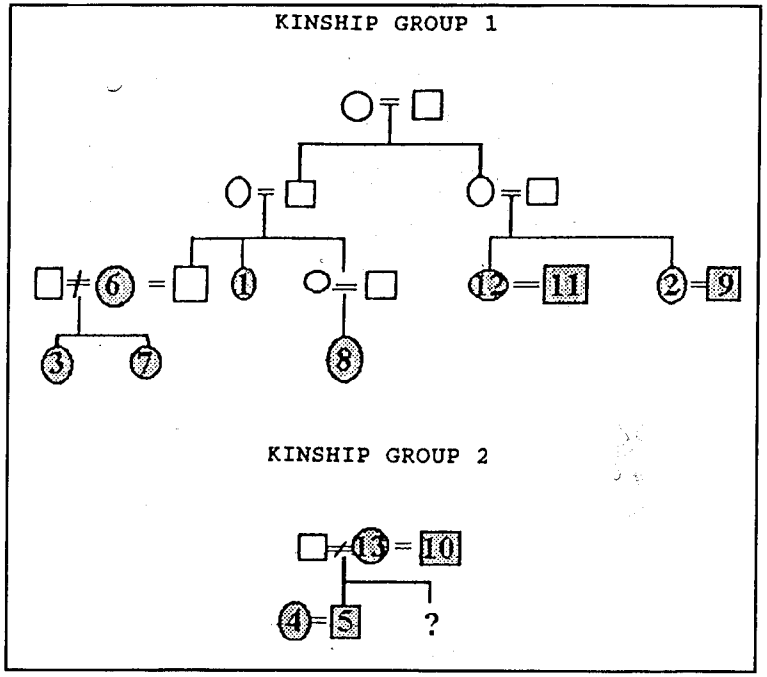

FIGURE 1. *Network N1 kinship charts.*

information flow within networks, sometimes called connectivity (Doreian 1974). This flow can be characterized by several measures, including the amount of information that passes through a particular individual, the length of time it takes information to reach each person in the network, identification of the people who are gatekeepers of the information flow, measures of differential influence in the group, and measures of the probability that someone can or cannot receive information that is injected into the network (Ford and Fulkerson 1956; Gomory and Hu 1964; Katz 1953; Taylor 1969). Issues of subgroups and positions in the networks are also being investigated. Network researchers have created two methods of identifying key structural elements of groups. One is based on the idea of social cohesion, where cliques or circles of social actors are identified by the aggregate bonds that link them together (Bron and Kerbosch 1973; Mokken 1979). The other is based on the idea of structural equivalence, where people who are similarly connected (have the same types of links to others) are thought to be more similar to each other than people in the same subset who have different types of links to others (Kilworth and Bernard 1974). Both the structural and connection data provide information that can increase the effectiveness of HIV education and prevention efforts directed either at individuals or the whole group by identifying the most effective targets for the messages and skills training.

The authors' full network questionnaire is a matrix consisting of 27 questions that allow each individual to define his or her relationships to the other members of their network. The questionnaire includes social relationship questions (e.g., How much do you hang out with X?); drug relationship questions (e.g., How willing are you to share needles with X?), and HIV- or intimacy-related questions (e.g., How willing would you be to tell X you have AIDS?). These are aggregated and analyzed to provide a picture of the social, drug, and other intimate communication relationships in the network. The following diagram provides a sociogram model of the relationships in network N1, derived from the social relationship questions on the matrix (figure 2).

The connecting lines between individuals (identified by a number) indicate the existence of a strong connection between two people. All individuals in this group have some weak interactions with each other, but the influence or communication between some is minimal; the diagram concentrates on the strong ties. Females are represented by a number in a circle and males by a number in a square. An arrowhead

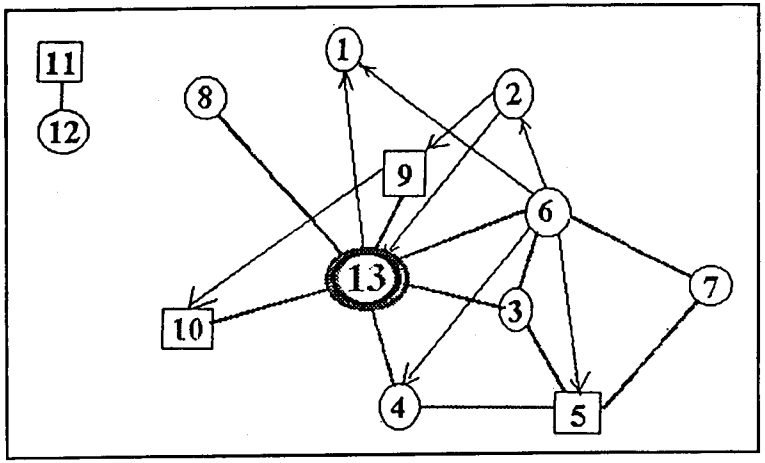

FIGURE 2. *Network N1 sociogram of social relations.*

indicates a one-way connection between two people, while a solid line indicates a two-way connection. The width of the line indicates the strength of the connection. The larger, lighter circle around Anita, #13, indicates she is the central person in terms of influence measures. She is also the most central communication node in the network. The core of the network is comprised of Anita (#13), Lydia (#6), Adelita (#4), Marcos (#5), Jaime (#9), and Josepha (#3). All of these individuals have close kinship ties, and communication between them is strong. Miguel (#11) and Dolores (#12) are living as married, and Miguel is the first cousin of Maria (#1) and Lydia (#6). Aida (#7) is Lydia's (#6) niece and Josepha's (#3) first cousin.

The drug network characteristics (derived from analysis of the drug questions on the network matrix) are an interesting contrast to the social relationships. Several people change position, from peripheral to more strongly connected, or vice versa, as can be seen in the following diagram (figure 3).

There is a change in the information flow and influence patterns of the network in relation to drug issues. Aida (#7) is a nonuser, which is clearly represented in her lack of connections on the drug questions. Anita (#13) shares the influence on drug relationships with her son, Marcos (#5), and with Jaime (#9), who is a central member because he is a bilingual communication bridge between the Spanish (only) and English (only) speakers in the network. Marcos (#5) scores drugs for this

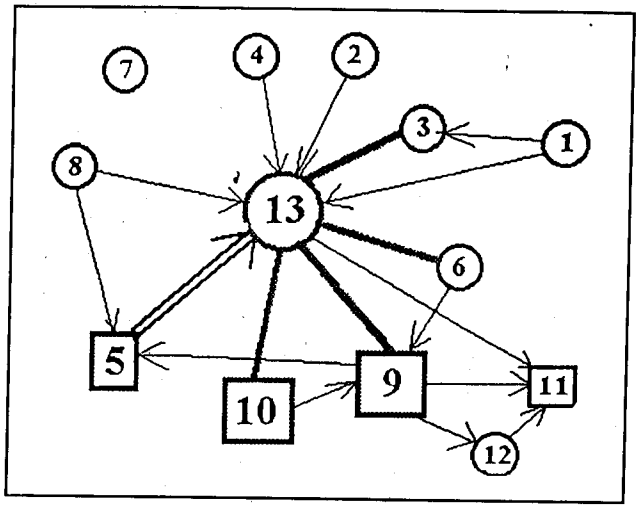

FIGURE 3. *Network N1 sociogram of drug relations.*

network, keeps track of drug-related conditions, and influences the network through his mother's close connections with everyone else.

Some of the individuals who were strongly connected by social relationships are connected by weak ties or are no longer directly connected in terms of their drug relations. For example, Adelita (#4) and Marcos (#5), who are married to each other, are strongly tied in the diagram on social relationships, but Adelita (#4) does not communicate much about drugs with her husband, only with her mother-in-law, Anita (#13). The kinship ties between Jaime (#9) and Maria Elena (#2) (living as married) are not visible in the drug relationship diagram, nor is the aunt-niece connection between Lydia (#6) and Aida (#7). This indicates that some people are reachable for the HIV/drug-risk reduction information but are less accessible to the social-risk-reduction information, such as sexual risk, unless the information is brokered by different individual connections.

As a final note on the relationships displayed by these three representations, the shape of the drug relations network diagram is similar to a classic problem-solving configuration for networks. It is called a star pattern, in which one person acts as a center in direct communication with the rest of the network through dyadic relationships, with relatively few interconnections. This allows rapid input on any issue and facilitates problem solving for the group as a whole. The social network diagram is

a classic communication configuration where there are multiplex ties within the group. This structure ensures that communication will not break down with the loss of one member of the network since everyone in the core group is tied to multiple individuals.

These findings are parallel to those for other networks this project has investigated. The majority of drug-using networks in Strip Town, like N1, are small and relatively tight. They depend on kinship and long-term friendship for entry, and they show a strong tendency for tight communication and reinforcement of the group's norms. This means that if the network is currently "clean" of HIV infection, the group can become an excellent focal point for developing or reinforcing social norms that promote remaining HIV free. These norms can support the elimination of risks through the elimination of ties that produce HIV risks, such as needle sharing with strangers or unprotected sex with casual partners. In addition, the existing boundaries can be reinforced, and some assessment of HIV risk can be added to the trust issues that already affect new recruitment into the group. New recruits could be sought only from low-risk categories of drug abuse or sexual behavior.

The authors have also analyzed several other classic measures of network connections and network structure[8] in the 10 networks for which they have collected relational data in order to inform their education and prevention efforts. These can be taken as a general model of the measures found to be useful for these purposes. The *geodesic distance* measures for the network show that information flow is tight: The general distances between individuals are small even though there are quite a few people in the group (Doreian 1974). A second network measure, Freeman Betweenness Centrality (Freeman 1979), indicates that there are two persons who are the most central in the social relationships, Anita and Jaime. They act as brokers for information flowing through the network for the social relations. Most social information (such as sexual education information) must flow through one or both of these individuals if it is to reach everyone in the network. In contrast, there are three brokers for the drug relations: Marcos, Jaime, and Anita, in that order. Marcos is Anita's son, which decreases his social centrality. In both sets of relationships, Jaime holds a central position in the network and is a critical person to recruit for both information exchange and behavioral change.

A further analysis of the network structures, of factions and cliques, (Borgatti et al. 1990; Bron and Kerbosch 1973; Seidman and Foster

1978) indicates there are only a small number of people who are marginal to the core of the group. The factions within the group change significantly when the drug relation questions are analyzed. These data divide the core drug group into two subsystems. This information has been used to identify boundaries where information may be blocked if at least one individual from each subgroup is not involved in the intervention. If a network is badly fissured, information must be provided to multiple individuals. Centralized networks like this one, with few marginals, can be provided education through fewer contacts and through a smaller number of individuals than in diffuse, less tightly constructed networks.

STRATEGIES FOR NETWORK-BASED DRUG AND HIV INTERVENTION

Current evaluations indicate there are numerous advantages in using a multiple-method network approach in HIV- and drug-risk reduction programs. Ego-centered data collection, especially early in the program cycle, provides excellent baseline data for understanding the general network characteristics in a population. Ethnographic network data collection combined with relational data can provide critical information throughout the project by identifying the most effective recipients of prevention and intervention actions; this type of data collection can also act as an effective evaluation tool to determine the impact of interventions at a level above individual measures of change.

Network-based outreach is an effective mechanism for establishing the contacts and relationships necessary to conduct effective HIV prevention programs in hidden or hard-to-reach populations. The most difficult part of the process is often the initial contact or entry into a new network. Network-based outreach follows existing social relationships. Finding the first individual who will provide access is challenging. However, with the sponsorship of that person, the remainder of the network can be contacted without violating social taboos surrounding the necessary secrecy of the group's membership. Any gatekeeper is a natural go-between who can reduce barriers to participation by endorsing the program to others in the network. Recruitment of individuals into programs can be made within the context of the same social group that will reinforce program objectives or oppose them. Once the network has been recruited, the group itself can provide the impetus to participate rather than having to rely on individual-by-individual motivational

techniques. Group dynamics are in force that can reduce barriers to prevention and education.

Network-based intervention has additional advantages. Keeping track of network members is a natural function of the gatekeepers of the network. Doing this can greatly assist the followup phase of any project. If the core or most influential members of the network are identified and tracked, they can act as primary links to the other members of the group, reducing the disadvantages of individually based followup by providing assistance to outreach workers who cannot spend as much time following the whereabouts of network members as the gatekeepers can.

Once effective outreach is established, networks with strong group norms can be approached differently from those with predominantly weak ties and variable norms. Strong group norms can be helped to adopt or maintain norms that reduce HIV risks with strangers or outsiders and reinforce protective behavior (needle cleaning, safe sex) as appropriate behaviors within the group. The intervention can also support increased communication between members of these groups. If the initial prevention or intervention message is successfully transmitted to a central or core individual in the network, there is a good chance that person will subsequently transmit it to part or all of the rest of the network.

The network approach can also identify individuals who are peripheral to the network, those people intervention will reach only if they are individually educated. It can identify differences in the ease of communication across various topics. The network members may speak openly about cleaning needles but restrict conversations on intimate subjects. Using network techniques to identify these areas of low or nonexistent communication can lead to a more clearly targeted intervention directed toward lifting communication taboos.

In the case of drug networks where members interact as short-term acquaintances and operate in a loosely structured group, the intervention may have to be conducted on an individual, dyadic, or triadic basis. The network structure prevents a synergistic effect beyond anything more than small segments of the group. The intervention is also most likely to consist of reducing the risks associated with sexual and drug interactions among ties that create high risks within the group; it does so by encouraging people to break those ties and reduce their risk or to become associated with a group that has more protective boundary mechanisms. The standard intervention employed by the project described in this

chapter assumes clients are capable of interacting assertively within their peer group and with sexual partners. Since this may not be the case, the enhanced intervention adds the opportunity for the whole network to discuss these issues and to establish group norms that may protect the less powerful group members and reduce the chance of HIV infection for the group as a whole.

Data collected during this project also explain some of the failures of the classic strategy used in both drug rehabilitation and in HIV-risk reduction, which is to move an individual away from high-risk personal social networks into lower risk relationships (peer cluster theory). Smalltown drug networks are frequently kinship based or based on long-term friendship. There are relatively few choices for making friends in a small town; for example, there is a restricted pool to choose from, compared with an urban area with more groups and associations. In a small town, if a person does not like someone in his or her Narcotics Anonymous (NA) group, "that's tough," because it is the only one in town. People might have to leave town or even leave the State to accomplish the classic goal of changing friends and networks. Data show this is an unlikely event for most of the people interviewed. On the other hand, these network data indicate it is possible to change the norms and risk-taking patterns of networks, as a whole, by reinforcing positive risk reduction behaviors. For this reason, natural network-based approaches to risk reduction are a highly desirable adjunct to individual intervention strategies.

Beyond these basics, a number of approaches could be introduced to enhance network-based HIV interventions. Ethnographic network analysis has identified individuals who could become key players at the between-network intervention and outreach levels. These individuals act as a bridge for HIV infection entering or leaving a network through their drug or sexual activities outside of the core group. Once identified, these individuals could be recruited for a number of intervention-related roles. They could become key players by reducing the chances of HIV bridges being activated. These bridge individuals could also potentially be assembled into a grassroots organization to assist in forming a drug community effort to confront the spread of HIV infections. Since they are already backed by social groups, they could form the nucleus for "street-level" community development efforts. This type of organizational intervention provides some opportunity for creating a self-help structure that will last beyond the end of the Federal funding of HIV prevention projects, allowing the effects to continue on their own.

FUTURE DIRECTIONS FOR NETWORK-BASED PREVENTION

The authors' approach to risk reduction in smalltown drug networks has proven to be valuable in the identification, location, and recruitment of hidden or difficult-to-access populations. Ethnographic network analysis has led to a series of suggestions combining qualitative and quantitative approaches to increasing knowledge about HIV and drug intervention in "not-in-treatment" drug users. At the simplest level, network data identify the presence or absence of communication between individuals and between sets of individuals on particular topics. At the next level, network information data can identify the central person or persons who exhibit the most influence on the group, the nodes in the network that act as gatekeepers for interaction, or the subsets of individuals who interact more among themselves than they do with others in the larger network. Each of these conditions can suggest processes for direct and indirect intervention and provide outcome measures of the efficacy of both preventions and interventions.

The authors hypothesize that they will be able to measure both the individual effects of interventions and the cumulative network effects using combined analytical tools. Ethnographic findings demonstrate that qualitative descriptions of network conditions can be used as a direct adjunct to this prevention program. The ethnographic data can also act as an important theory generation bridge into quantitative measures of the impact of social networks on HIV and drug risk-taking processes.

The next step in the present research will be to look at the relationships among aggregated variables associated with individuals in each network in order to test hypotheses on the information obtained about the various groups. For example, there should be additional linkages between network types and the presence or absence of risky conditions. The presence of HIV infection (or percentage of infected individuals) should vary among the networks. The size of the network should have some impact on the ease or difficulty of changing norms that will protect members from risks in the community. The authors should be able to measure differential effects, if there are any, on HIV risk and the type of drug used, holding the type of network constant. They should also be able to measure differences in the overall risk to individuals and to the group as a whole, based on the ratio of kin to nonkin membership, or the ratio of strong to weak ties, or on the basis of group norms that favor or that interfere with positive attitudes toward drug treatment programs.

Knowing the network membership of participants should allow measurement of peer influence on attempts to enter or avoid drug rehabilitation programs.

The authors are hypothesizing that both individual effects of interventions and cumulative network effects using network analysis tools can be measured. For example, those conditions that require increased communication can be measured by increased information flow within the network (Hubbell 1965; Taylor 1969). They are also measurable in terms of reduced geodesic distances among all network members or some portions of the network (Doreian 1974). It should be possible to identify risk reduction in the network, between time 1 and time 2 if high-risk elements of the network have been segmented off and the interactions with those cliques are reduced or eliminated (Glover 1989, 1990). Factions within the network should show either risk reduction or risk concentration with increased distance to the risky parts of the network. Centralization is a measure of the way that information is being controlled by individuals (Stephenson and Zelen 1991), and for some networks, a reduction of centralization should correlate with risk reduction through the creation of more communication linkages between noncentral individuals.

The authors also should be able to detect changes in influence, both in drug and socially related issues, where individuals take on new roles within the group to reinforce protective behaviors and reduce risks (Bonacich 1987). When these data are correlated with qualitative and attributional data sets, it provides an important set of tools to measure HIV-risk reduction in a high-risk population. In sum, network analysis in its various forms appears to be a highly desirable and productive tool for the reduction of HIV hazards in hard-to-reach populations.

The authors have also hypothesized that network relational and structural analysis can identify individuals who should become key players in network-level intervention and outreach, as adjuncts to project staff for a particular network. Once identified, these individuals can be recruited specifically for intervention-related roles. Central individuals from different groups could also be assembled into a grassroots organization to assist in forming a drug community effort to confront the spread of HIV infection. Since these leaders are already backed by social groups, they could form the nucleus for street-level community development efforts. This type of organizational intervention provides some opportunity for

creating a self-help structure that will last beyond the end of the Federal funding for this project, allowing the effects to continue on their own.

An individual's potential for treatment success may be directly related to network variables that can then be converted to a group "willingness to change" measure. The authors should also be able to measure the impact of splits in the group, as well as differences in within-group associations on risk taking and the effects of those risks on both individuals and the groups. They may also be able to detect changes in influence, both in drug and socially related issues, where individuals take on new roles within the group to reinforce protective behaviors and reduce risks. The authors believe there are numerous other qualitative and quantitative measures that will allow identification of the effects of this program beyond the individual level. Many are yet to be discovered, but efforts at the network level appear to be invaluable in helping researchers address the key HIV and drug risks of hidden populations.

NOTES

1. This is a 5-year project funded by the National Institute on Drug Abuse (NIDA) grant #U01-DA07295. It is part of the NIDA Community Research Branch's Cooperative Agreement program. The project principal investigator is Robert T. Trotter II, and the co-principal investigators are Laurie J. Price and Anne M. Bowen.

2. Following the general ethical guidelines for projects like this one, the names of the communities involved in the project have been replaced by pseudonyms or generic terms to meet privacy and confidentiality conditions.

3. The citation for this report has been omitted to protect the anonymity of the community.

4. The instrument *Assessment of Drug Use Social Networks* was developed by Dr. Mark Williams, Dr. Richard Needle, and Dr. Harvey Siegal in cooperation with other researchers from Cooperative Agreement sites. Correspondence should be directed to Dr. Williams, Affiliated Systems Corporation, 3104 Edloe, Suite 330, Houston, TX 77027-6022.

5. In order to participate, respondents must be 18 years of age or older, must not have been in treatment for at least the past 12 months, and must have a positive urine test for either cocaine or heroine use (or have fresh needle tracks and test positive for other injectable drugs) at the time of the RBA interview. Therefore, this category for the clients includes only 18- and 19-year-olds. The nonclient (alter) categories may include younger individuals since no age restrictions were placed on naming the people in these categories.

6. The n/a designation indicates that this variable was not assessed for the designated group.

7. Recruitment is conducted on a network-by-network basis, with an overall targeted sampling plan in effect over a 12-month period. For any given shorter length of time, subsections of the targeted sample may be overrepresented.

8. All of the calculations were conducted using the program UCINET 4.0.

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A Personal Network Approach to AIDS Prevention: An Experimental Peer Group Intervention for Street-Injecting Drug Users: The SAFE Study

Carl A. Latkin

INTRODUCTION

The Stop AIDS For Everyone (SAFE) study is a social network-oriented experimental intervention designed to reduce the human immunodeficiency virus (HIV)-risk behaviors in injecting drug users (IDUs). The outcome of the study has been presented elsewhere (see Latkin et al., in press; Mandell et al., submitted).

In a 3-month followup survey in the initial phase of the study, significant differences were found between the experimental group and the control group regarding changes in the self-reported HIV-risk behaviors of needle sharing, attending shooting galleries, cleaning injection equipment with bleach, and carrying bleach. Although at baseline the experimental group reported higher levels of injection-related HIV-risk behaviors, at the 5-month followup study the experimental group reported significantly greater risk reduction. Individuals in the experimental condition who reported lower levels of risk behavior at baseline demonstrated significantly greater risk reduction, as compared with the control group, suggesting that these results are likely to be a product of a regression to the mean phenomenon. At baseline, personal network characteristics of size of drug network and density of network predicted at followup the risk behavior of needle sharing, and a smaller material aid subnetwork predicted attendance in shooting galleries.

This chapter will first describe the intervention; second, examine evidence of strengths of a social network approach for IDUs not in treatment; and third, examine evidence of the social influence of drug-sharing subnetworks on the HIV-risk behaviors of their members.