Experts' Estimates of Coverage Needed for Interventions to Control HIV Transmission among Injecting Drug Users

Don C. Des Jarlais[1], David Burrows[2] and Samuel R. Friedman[3]

[1] Beth Israel Medical Center
160 Water Street – 24th Floor
New York, NY 10038
Ph: 212.256.2548
Fax: 212.256.2570
Email: dcdesjarla@aol.com

[2]AIDS Projects Management Group
Level 2 – 50 York St.
Sydney, 2000, Australia
Ph: +612.8231.6625
Fax: +612.8231.6624
Email: dave@aidsprojects.com

[3]National Development and Research Institutes Inc.
71 W. 23rd Street
New York, NY 10010
Ph: 212.845.4467
Fax: 917.438.0894
Email: friedman@ndri.org

Experts' Estimates of Coverage Needed for Interventions to Control HIV Transmission among Injecting Drug Users

Keywords: interventions, HIV, injecting drug users

Abstract

Allocating resources for the prevention of HIV infection among injecting drug users (IDUs) in transitional and developing countries can be a challenging task. The resources available are likely to be quite limited. But pilot programs are unlikely to have any meaningful effect on the transmission of HIV in IDU populations. There is also reason to believe that if prevention programming can reach a critical level in a local IDU population that very strong prevention effects can be achieved. The resource allocation question can be phrased in terms of 1) what interventions should be implemented? And 2) what level of "coverage" of the interventions should be achieved? We conducted a survey of 19 experts in HIV prevention to address these questions. There was strong agreement regarding which interventions are "very important," with almost all respondents mentioning needle/syringe programs, outreach programs and drug abuse treatment (particularly opiate substitution treatment). There was modest agreement with respect to coverage, with a majority of the respondents giving a coverage of 20% to 33% of injections with new equipment obtained from needle/syringe programs and capacity to provide treatment for 20% to 33% of the local IDU population. Given cost factors, needle/syringe programs and outreach might be prioritized first in conditions of limited resources. While noting the need for local information and the multiple purposes of different programs, and the possibility that HIV prevalence and incidence rates might require higher coverage rates, we suggest that the agreement among these experts can be

used for the initial planning of prevention programs for IDUs in transitional and developing countries. An agenda for future research on coverage is presented.

Introduction

Rates of transmission of HIV among injecting drug users (IDUs) present some extreme contrasts. Multi-person use ("sharing") of needles and syringes is a relatively efficient means of transmitting HIV and there are many examples of extremely rapid spread of HIV within populations of injecting drug users. HIV incidence rates of 10/100 person-years to 50/100 person-years have been reported (UNAIDS, 2006).

IDUs are also quite capable of reducing their injection risk behaviors (Des Jarlais et al., 2000b; Friedman et al., 1987; Friedman, Curtis, Neaigus, Jose, & Des Jarlais, 1999) and there have been outstanding examples of HIV prevention programming for IDUs. In many areas in industrialized countries, it has been possible to keep prevalence low indefinitely, literally preventing HIV epidemics among IDUs (Des Jarlais et al., 1998; Stimson, 1995; Wodak, 1998). It is also possible to "reverse" large-scale HIV epidemics among IDUs (greatly reduce both HIV incidence and prevalence) with large scale prevention efforts applied over long time periods.(Des Jarlais et al., 2005; Emmanuelli & Desenclos, 2005; Santibanez et al., 2006)

The problem. There are three interrelated technical problems with implementing HIV prevention programs for IDUs in developing and transitional countries. First, the resources available for HIV prevention among IDUs are likely to be quite limited. Second, it is important to begin HIV prevention for IDUs early. Delay in implementing programs permits the virus to spread within the IDU population, making it more difficult to prevent both further transmission among IDUs and transmission from IDUs to non-drug injecting sexual partners. Thus, it may be necessary to plan and implement prevention programs without having all of the information one would like to have. Third,

pilot programs do not stop epidemics. If HIV prevention for IDUs is to be effective at the community level, it will be necessary to implement programs on a public health scale rather than a pilot program scale.

The idea of implementing prevention on a public health scale is particularly important with respect to "critical level" prevention effects. It is not necessary to eliminate risk behavior in a population of IDUs in order to dramatically reduce HIV transmission. It is very likely that there is a critical level of risk reduction at which actual cases of HIV transmission become relatively uncommon events despite some continuing risk behaviors. The critical levels would represent non-linearities in the relationship between risk behavior and HIV incidence, where small additional reductions in risk behavior would result in large reductions in HIV incidence. That HIV prevalence has often stabilized shortly after large-scale risk reduction in low (Des Jarlais et al., 1995; Kemp & MacDonald, 1999; Stimson, 1995; Wodak, 1995) and high (Des Jarlais et al., 1992; Kaldor, Elford, Wodak, Crofts, & Kidd, 1993) seroprevalence areas strongly suggests that critical level prevention effects occur. When implementing HIV prevention at a public health scale, one would want to implement at the scale needed to obtain such critical level effects.

The need for expert judgment. The three issues of limited resources, the need for early implementation, and the need for sufficiently large programs can make planning and budgeting for HIV prevention a complex and difficult task. Empirical research should be able to provide an evidence base to guide such planning and budgeting. This is not the type of research question, however, that can be readily addressed through standard methods such as randomized clinical trials. Randomization at a community level would

be logistically difficult, resource intensive, and unethical in many situations. Additionally, there are a potentially large number of variables in community-level HIV prevention, including different types of programs and different levels of implementation and different combinations of programs and levels of implementation. Thus, the "gold standard" randomized clinical trial design is not likely to be usable for obtaining the needed information.

Rather, the best methods may be expert analyses of case histories of the spread of HIV among IDUs in areas where there are good data on risk behavior, the social conditions of IDUs, prevention programming, and HIV transmission over time. Quantification and extension of the analyses through mathematical modeling might also be very useful, though expertise would clearly be required in deciding the assumptions, parameters and form of the models (Friedman et al., 2000; Grassly et al., 2003; Vickerman & Watts, 2002; Vickerman, 2001; Vickerman, Hickman, Rhodes, & Watts, 2006).

At present, there are no officially accepted guidelines for allocating resources to prevent HIV infection among IDUs, but decisions on allocation of resources still need to be made. We conducted the present study in order to assess possible agreement and disagreement among experts regarding the types of programs considered important for preventing HIV infection among IDUs and the desirable level of implementation (coverage in the local IDU population).

Methods

We used a modification of the Delphi technique (Dalkey, 1969; Helmer-Hirschberg, 1967; Linstone & Turoff, 1975). In the Delphi technique, one first surveys a

group of experts, using structured questions. Next the responses are collated. The answers are then fed back to the experts who are again asked the questions. It is expected that some of the experts will modify their opinions based on the information provided by the others. This process of survey, feedback and survey again is repeated until either a consensus emerges or a pattern of stable differences emerges.

Developing a limited set of questions to address the complexities of the types of prevention programs for IDUs and the coverage needed was challenging. We first tried a moderately long series of fairly complex questions in an email questionnaire. This questionnaire did produce some very useful responses, but it also was rather difficult for many of the respondents. We then reduced the number of questions and used either face-to-face or telephone interviews. The great majority of the interviews were conducted face-to-face at various international meetings attended by the authors. The sample of experts can thus be considered a convenience sample. The final questions were:

1. What types of interventions do you believe are very important for preventing HIV transmission among IDUs?
2. What level of "coverage" for each type of intervention do you believe is need to either prevent or stabilize an HIV epidemic among IDUs?
3. Do you believe that the needed coverage will vary across low versus high HIV seroprevalence situations?

The direct interaction format provided for immediate clarifications and the reduced number of questions led to most interviews taking about 15 minutes. We then drafted a first version of the paper with the results of the first series of interviews and sent it to experts (including some who had not been previously interviewed) for comments. In the

comments on the first survey results, none of the experts indicated that they would change their estimates based on the estimates of the other experts. This is not too surprising in that there was essentially consensus on which types of programs are "very important," and that the idea of needed "coverage" has been frequently discussed in the field, without reaching consensus. We did obtain estimates from seven additional experts in this second round of the survey, and their estimates are included in the results below.

Results

Results from the two rounds of interviews (n = 19)

I. Types of interventions needed:

There was very strong agreement among respondents that the following types of interventions are "very important:"

1. Needle-syringe programs, including exchange and/or distribution (all respondents agreed).
2. Community outreach, through outreach workers, peer educators, user groups, and from syringe exchange programs (all respondents agreed).
3. Methadone maintenance or other substitution treatment in areas where opiates are the primary drugs used (all but one respondent agreed).

II Coverage

1. Don't know. Four respondents replied, "Don't know" for coverage in general and suggested conducting additional research and/or looking at existing modeling efforts. Another respondent provided coverage estimates for syringe exchange and substitution treatment but replied, "Don't know" to outreach coverage.

2. Coverage for needle-syringe programs: 15 respondents gave estimates of 15% to 60% of injections with new syringes obtained from syringe exchange programs. There was a clear indication of a central tendency, with 11 suggesting coverage in the range of 20% to 33%.

3. Coverage for outreach: 7 respondents gave estimates from 20% to 50% of the local IDU population reached on a regular basis (once per month or more frequently); 4 suggested the need to reach close to 100% but did not discuss the regularity with which outreach needs to occur; 1 recommended reaching 30-50% within 2 years, and mentioned that targeted outreach is also needed for 20% to 30% of novice injectors; with another mentioning "user groups" without giving an estimate for coverage. Two respondents recommended that targeted outreach be used to reduce injection frequency, but did not specify coverage levels. There clearly was not any central tendency in the responses.

4. Coverage for opiate substitution (methadone) treatment: 13 respondents gave estimates that sufficient treatment capacity is needed for 20% to 50% of the IDU population to be in substitution treatment. There was a central tendency, with 11 recommending coverage of 20% to 33%.

5. Variation in coverage by epidemic situation: 13 respondents suggested that less coverage would be needed in low HIV prevalence situations compared to high-prevalence situations, with 2 respondents suggesting that interventions with the same coverage would be needed for longer periods, and 1 respondent recommending no difference between low- and high-prevalence situations. Of the 5 respondents who gave separate estimates, 2 suggested that coverage for syringe exchange would

probably need to be approximately double in high prevalence situations compared to low prevalence situations, and 3 suggested that coverage of syringe exchange should be one-third to one-half higher in high-prevalence situations.

6. In addition to the above three interventions, several other activities were mentioned by some respondents. Interventions related to sexual transmission of HIV were recommended by 4 respondents, with coverage estimates provided by 2 respondents. One recommended of 100% (for both low- and high-prevalence situations), and the other recommended 60% to 80% in low-prevalence and over 80% in high-prevalence situations. Policy and legal work (including addressing drug policies and laws that lead to high rates of incarceration of drug users), advocacy and a range of social service issues (assistance with employment, housing, family issues, etc.) were suggested by 3 respondents. A wide range of drug treatment options (in addition to substitution treatment) was recommended by 3 respondents, with one noting that there should be sufficient treatment to meet demand and that it should be easy to access. One respondent each suggested the following interventions: Interventions in prisons with coverage of 100% of prisoners, treatment for HIV infection, voluntary counseling and testing, and safe injection facilities.

As noted in the methods section above, when we circulated the results of the first survey round, we also asked for comments that the experts might have on the data. The two most frequent comments were that the survey had addressed the major issues in the area, and that “more research is needed.”

Discussion

Limitations of the Delphi technique. Several limitations of the Delphi technique should be noted. First, the technique is designed to capture common ground in the opinions of experts in a given field. It is not designed to generate new provocative new ideas, as a brain storming session might. A second limitation of the Delphi technique is that there is no external validation of the opinions of the experts. Thus, it may be that even where there is consensus among the experts, the consensus opinion of experts might be "wrong."

The Delphi technique also requires simplification of the questions to be addressed. Two simplifying assumptions should be noted here. The first simplifying assumption is that the social and legal environments are supportive of (or at least not opposed to) HIV prevention programs for injecting drug users. Planning the scale of the prevention programs is likely to be irrelevant if the social and legal environment does not permit the drug users to utilize the programs. A second simplification is that the programs are only in terms of preventing HIV infections. HIV prevention programs may provide a large number of services to drug users, including preventing hepatitis B and hepatitis C infection, and linking drug users to other social and health services, and preventing transmission of HIV from IDUs to non-injecting sexual partners. These other functions certainly may support HIV prevention among IDUs, but they also can clearly go beyond HIV prevention among IDUs. Including these other goals would greatly complicate any attempt to estimate the needed levels of program implementation.

General Level of Agreement. Given the absence of anything close to definitive data on stabilizing HIV prevalence in populations of IDUs, there was very strong agreement on

the “very important” types of interventions” and moderate agreement on the desired coverage levels for needle/syringe programs and for opiate pharmacotherapy treatment. Some of this agreement undoubtedly reflects discussion of the interventions and coverage estimates among experts in the field, including those who were interviewed. We do believe that the areas of agreement in the results can be used as general guidelines for planning HIV prevention programs for IDU populations, while cautioning that a meaningful proportion of experts thought higher needle/syringe coverage might be needed.

In the interviews, we did not attempt to code the rationales of each expert for why a particular intervention was “very important” or for the coverage level for each specified intervention. While it would be very interesting to examine the different rationales, doing this would be a very labor-intensive exercise and was beyond the scope of this project. A number of interpretative comments are provided below, particularly with respect to the coverage estimates.

Why “very important?” Three interventions—needle/syringe programs, outreach and substitution therapy (in areas where heroin is the primary drug used) were consistently mentioned as very important. This is in agreement with the US National Institutes of Health Consensus Development Conference (NIH, 1997) and the WHO Evidence for Action reports (WHO, 2004) that these three interventions are effective in reducing injection risk behavior among IDUs.

Two of these—needle/syringe programs and community outreach—may be not only “very important” but “necessary” for stabilizing HIV prevalence in populations of IDUs. It is difficult to imagine how IDUs could practice large-scale safer injection

without access to sterile needles and syringes. Similarly, it is difficult to imagine how IDUs would come to practice large-scale safer injection without accurate information on HIV/AIDS, how it is transmitted, and how risks can be reduced. In some situations, such information may diffuse through media coverage of HIV/AIDS and diffusion efforts of IDUs themselves. However, it clearly would be important for public health authorities to initiate diffusion of accurate information on HIV/AIDS rather than wait to see if formal programs were not needed. Additionally, community outreach serves to help change the social norms in the IDU population to proscribe the sharing of injection risk behavior and to socially reinforce risk reduction. Again, it is difficult to envision how large-scale risk reduction could become self-sustaining without the appropriate changes in IDU community norms. Thus, in many communities, both needle/syringe programs and some form of outreach programming may be necessary to stabilize HIV prevalence in populations of IDUs. It is also relatively easy to envision how needle/syringe programs and community outreach programs might generate critical level prevention effects.

One additional aspect of community outreach should be noted. It may be possible to conduct outreach efforts in combination with other prevention activities, such as syringe exchange. Indeed, successful syringe exchange may require some degree of outreach in order to inform users of the exchange services. Exchange sites may also serve as sources of information about HIV/AIDS that then diffuses through the local IDU population.

Providing effective drug abuse treatment (substitution therapy in particular) may have a qualitatively different type of importance. Drug abuse treatment can certainly reduce injecting and thus reduce the chances that individuals would become infected with

HIV and transmit HIV to others. (Friedman, Jose, Deren, Des Jarlais, & Neaigus, 1995; Metzger & Navaline, 2003) The potential for generating critical level effects from providing drug abuse treatment would seem to be more limited. Simply taking a random sample of drug injectors into treatment would serve to reduce the size of the IDU population at risk, but would not affect transmission among those who are not in treatment. If the treatment were targeted to persons who were particularly likely to become infected and/or to transmit to others, then potential critical level prevention effects might be possible. If, in a low prevalence community, a large percentage of the HIV seropositive IDUs entered drug abuse treatment, this could reduce transmission the population as a whole.

Drug abuse treatment can be important for preventing HIV infection in several other ways. Being on methadone or other substitution treatment may greatly increase the ability of former IDUs to work as peer educators and or as staff of syringe exchanges or as staff of users' group. (Des Jarlais, et al., 2004a; Friedman, de Jong, & Des Jarlais, 1988) Additionally, providing effective drug abuse treatment may also help assure drug users, political leaders, law enforcement officials, and the community as a whole that the HIV prevention efforts include addressing the many potential harms associated with injecting illicit drugs and not just HIV infection. This can increase acceptance of the prevention programs in both the IDU population and the community as a whole.

Coverage Estimates.

Needle/syringe programs. The majority of the coverage estimates were that 20% to 33% of injections should be made with a needle and syringe obtained from a program source (and thus guaranteed to be free of HIV), although there was considerable overall range in

these estimates, with some experts saying more coverage is needed, and a common belief that a high local HIV seroprevalence level might require higher levels of coverage. These estimates are substantially lower than the 60% estimate that has been often been discussed previously**.** These lower estimates may reflect greater appreciation of several factors, including: 1) drug users may re-use their own needles and syringes multiple times without risk of HIV infection, and 2) drug users may share needles and syringes within small, stable groups with only very modest risk of HIV transmission.(Des Jarlais, et al., 2004b). The difference may also reflect a clarification in coverage. We used the percentage of injections with syringes obtained from a needle/syringe program, while previous estimates of coverage may have focused on the percentage of IDUs who were regularly using needle/syringe programs.

Outreach programs. A number of the respondents preferred to use their own definitions of coverage so that comparing the estimates for coverage is difficult. Other respondents specified mechanisms for providing outreach (build from syringe exchanges, users' groups) without giving numerical estimates. Thus, unlike the coverage estimates for needle/syringe programs, there was no clear central tendency. The difficulties in making coverage estimates for outreach may reflect a lack of quantitative research on the diffusion of HIV-related information among IDU populations and how such information may lead to the development and maintenance of social norms promoting risk reduction.

Drug abuse treatment (substitution treatment) programs in areas where opiates are the primary drug being injected. A majority of the respondents gave coverage estimates that would provide treatment for from 20% to 33% of the local IDU population at any point in time. This is a relatively high level, perhaps currently attained in some, but certainly not

all, industrialized countries and in few, if any, developing/transitional countries (Ball, Rana, & Dehne, 1998; Stimson, Adelekan, & Rhodes, 1996). For example, in a study of US metropolitan areas, the median metropolitan area provided treatment to only 8.6% of its IDUs (Friedman et al., 2004a). As noted above providing drug abuse treatment may be very important for many reasons beyond a simple reduction in HIV risk behavior and HIV transmission.

"It depends," and modeling. Several of the respondents did not give coverage estimates for the three interventions, but specifically noted that the desired coverage levels would depend greatly on local conditions, and referred to mathematical modeling (Friedman et al., 2000; Grassly et al., 2003; Vickerman & Watts, 2002; Vickerman, 2001; Vickerman et al., 2006); as a method for setting coverage targets within the local conditions. Local conditions could include the types of drugs injected and changes in the types of drugs injected, locations in which drugs are used, tendencies for IDUs to re-use their own injection equipment, patterns of law enforcement, different patterns of social networks, and residential conditions (homelessness) within the IDU community. Additionally, many of the respondents indicated that higher coverage levels would be required in high HIV seroprevalence populations. The currently existing HIV seroprevalence and HIV incidence may be considered as primary local conditions for both HIV prevention planning and for modeling efforts.

In addition to historical epidemiological studies, much could be learned from mathematical modeling of HIV transmission among IDUs. Modeling would need to incorporate the important initial local conditions and the effects of interventions on risk behaviors to generate the resulting patterns of HIV transmission over time. Fully

developed models could contribute considerably to estimating the coverage needed to control HIV transmission in populations of IDUs. In our assessment, important advances have been made in modeling the effects of needle/syringe programs on the frequency of sharing (Kaplan & Heimer, 1992; Kretschmar & Wiessing, 1998; Vickerman et al., 2006). However, we do not have working models for how various interventions might affect network parameters such as rates of partner change (how many different people an injector shares with per unit of time) and the size and interconnectedness of groups within which syringes are shared. Without a better understanding of how interventions affect network parameters, it is difficult to use modeling to estimate the coverage needed for different interventions to reduce HIV transmission among IDUs. We also do not have models that incorporate fundamental changes in local drug scenes, such as large increases in cocaine or amphetamine injection, and how these might change the need for various interventions.

Data for Planning and Evaluation. While the respondents were willing to estimate coverage targets in general, they also recognized the need for considering local conditions in allocating resources for HIV prevention for IDUs. It may be difficult to obtain sufficient local conditions information before prevention planning must be done. We would recommend, however, that at least a Rapid Assessment (Fitch, 2004; Stimson et al., 2006; WHO, 1998) and some HIV seroprevalence data be collected.

Once programs have been implemented it is critical to obtain ongoing process and outcome evaluation. Outreach programs, including peer educators and through users' groups, can be important sources of qualitative data. (Some training in systematic data collection and interpretation would be required.) Where feasible, professional

ethnographic studies of the local drug scenes can also provide very valuable information. The numbers of syringes and condoms being distributed are very important quantitative indicators. Periodic surveys of HIV seroprevalence (and ideally incidence) can serve as outcome measures. Conducting cohort studies to estimate incidence is likely to be too resource intensive, but it may be possible to estimate incidence using serologic tests for recent infections or using prevalence among new injectors.

Costs. The costs per IDU served vary greatly across the three types of interventions, with drug abuse treatment likely to be by far the most expensive on a per person served basis. We would thus suggest that priority be given to reaching the desired coverage levels for needle/syringe and outreach programs before attempting to reach the desired coverage level for drug abuse treatment.

Conclusions

There is an urgent need to scale up HIV prevention programs for injecting drug users in many areas of the world. Scaling up often requires obtaining new resources and the allocation of scarce resources. It is important to allocate sufficient resources to obtain likely critical level effects in reducing HIV transmission and stabilizing HIV prevalence in populations of IDUs.

There currently are no randomized controlled trials nor yet any well-validated models for scaling up. This survey of experts in the field did find strong agreement with respect to the types of prevention programs that are very important and a moderate agreement on the levels of coverage for needle/syringe programs and drug abuse treatment programs. Needle/syringe programs, community outreach programs and drug abuse treatment (particularly narcotic substitution therapy) were all considered very

important. Needle/syringe programs and outreach may be necessary for stabilizing HIV prevalence among populations of IDUs, while drug abuse treatment programs may be important for a wider variety of reasons.

Coverage estimates were generally in the range of 20% to 33% for needle/syringe programs, (though there was some important variation, with some experts calling for much higher coverage). This 20% to 33% is substantially lower than the 60% coverage previously considered for needle/syringe programs, and may reflect greater consideration of the "relative safety" of injectors re-using their own needles and syringes and of confining sharing within small stable groups. We believe that both the types of interventions and the needle/syringe coverage estimates presented here can be used for planning HIV prevention efforts in many different areas. We would, however, also emphasize the need for obtaining local information and for continuing evaluation of the prevention efforts.

Research Agenda. Finally, this survey of experts also points to the need for additional research on the question of coverage needed for different interventions. One particular topic for additional research is the coverage needed for outreach/community education interventions. There was no central tendency in the estimates of the coverage needed for outreach programs and the estimates ranged widely. We would like to propose a research agenda that would both formulate specific questions for outreach coverage and link outreach coverage to needle/syringe coverage. Diffusion of innovations theory (Rogers, 2003) and social network theory (Latkin, Hua, & Davey, 2004; Latkin & Knowlton, 2005; Friedman et al., 1997; Friedman et al., 2000) would both predict that outreach workers should be able to deliver information about HIV/AIDS to enough injecting drug

users that the information then spreads throughout the population of IDUs. Diffusion of innovation theory suggests that it may be necessary to reach only a modest proportion of the IDU population, perhaps 10 to 20%, in order to set off the diffusion of information. Research of this type needs to consider the level and content of pre-existing HIV/health communication among drug users (and those around them), including the possibility that the users might already be disseminating information and suggestions as good as, or even better than, that provided by the outreach (Friedman et al., 2004b).

Widespread diffusion of accurate HIV/AIDS information within a population of IDUs should then lead to: 1) increased demand for clean injection equipment, 2) the development of new social norms against sharing needles and syringes in general, and 3) new social norms against sharing needles and syringes outside of small networks (sexual partners, close friends, relatives). Based on our own studies of HIV prevention in industrialized countries (Des Jarlais et al., 1995; Des Jarlais et al., 2000a; Des Jarlais et al., 2000b; Des Jarlais et al., 1998; Des Jarlais et al., 2005), we would suggest that HIV epidemics among IDUs can be controlled when approximately 70% of IDUs report no sharing of needles and syringes, 95% report no sharing outside of small social networks, and coverage (in terms of having a clean needle and syringe for each injection is approximately 20%).

There are, of course, potentially important barriers to this community level risk reduction process. First, there may be important divisions among the IDUs that restrict the flow of information and the development of new social norms. These may include racial/ethnic divisions, socio-economic divisions, gender, sexual orientation, and geographic separation. There may also be important limitations on the ability of IDUs to

obtain and use new needles and syringes, such as the lack of outlets, limits on the numbers of needles and syringes that can be obtained from outlets, and law enforcement activities that prevent/discourage drug users from obtaining, carrying and storing new needles and syringes.

Conducting research on the process from outreach/information diffusion to increased demand for clean needles and syringes to the development of social norms against injection risk behavior to coverage of needle/syringe programs and control of HIV transmission would best be done through constructing good case histories of HIV prevention among IDUs in local communities. As HIV prevention programs are implemented in new areas—hopefully on the scale needed to change IDU social norms and to provide needle/syringe coverage of 20% or more—there should be many opportunities to collect such case history data. This would then be followed by mathematical modeling to examine common patterns across sites. While additional empirical data and modeling would certainly be helpful, the task of estimating the needed "coverage" levels for different programs to prevent HIV transmission among IDUs is inherently complex and not amenable to reductionist research designs such as randomized clinical trials. Thus, expert opinion will undoubtedly remain an important component of estimating coverage, and future surveys of agreement and disagreements among experts would also be useful.

References

Ball, A. L., Rana, S., & Dehne, K. (1998). HIV prevention among injecting drug users: responses in developing and transitional countries. *Public Health Reports,* 113(suppl 1), 170-181.

Dalkey, N. (1969). *The Delphi Method: An experimental study of group opinion*. Santa Monica: Rand Corporation.

Des Jarlais, D. C., Choopanya, K., Wenston, J., Vanichseni, S., Sotheran, J. L., Plangsringarm, K., Friedmann, P., Sonchai, W., Carballo, M., & Friedman, S. R. (1992). Risk reduction and stabilization of HIV seroprevalence among drug injectors in New York City and Bangkok, Thailand. In G. B. Rossi, E. Beth-Giraldo, L. Chieco-Bianchi, F. Dianzani, G. Giraldo, & P. Verani (Eds.), *Science Challenging AIDS* (pp. 207-213). Switzerland: S. Karger, Basel.

Des Jarlais, D., Hagan, H., Friedman, S., Friedmann, P., Goldberg, D., Frischer, M., Green, S., Tunving, K., Ljungberg, B., Wodak, A., Ross, M., Purchase, D., Millson, M., & Myers, T. (1995). Maintaining low HIV seroprevalence in populations of injecting drug users. *Journal of the American Medical Association,* 274(15), 1226-1231.

Des Jarlais, D. C., Perlis, T., Friedman, S. R., Deren, S., Chapman, T. F., Sotheran, J. L., Tortu, S., Beardsley, M., Paone, D., Torian, L. V., Beatrice, S. T., DeBernardo, E., Monterroso, E., & Marmor, M. (1998). Declining seroprevalence in a very large HIV epidemic: injecting drug users in New York City, 1991 to 1996. *American Journal of Public Health,* 88(12), 1801-1806.

Des Jarlais, D. C., Marmor, M., Friedmann, P., Aviles, E., Deren, S., Torian, L. V., Glebatis, D., Murrill, C., Monterroso, E. M., & Friedman, S. R. (2000a). HIV incidence among injecting drug users in New York City, 1992-1997: Evidence for a declining epidemic. *American Journal of Public Health,* 90(3), 352-359.

Des Jarlais, D. C., Perlis, T., Friedman, S. R., Chapman, T., Kwok, J., Rockwell, R., Paone, D., Milliken, J., & Monterroso, E. (2000b). Behavioral risk reduction in a declining HIV epidemic: injection drug users in New York City, 1990-1997. *American Journal of Public Health,* 90(7), 1112-1116.

Des Jarlais, D. C., Hammett, T. M., Wei, L., Van, L. K., Donghua, M., & Ngu, D. (2004a). Opiate agonist maintenance treatment for injecting drug user peer educators. *Addiction,* 99,1355-1356.

Des Jarlais, D. C., Perlis, T., Arasteh, K., Hagan, H., Milliken, J., Braine, N., Yancovitz, S., Mildvan, D., Perlman, D., Maslow, C., & Friedman, S. R. (2004b). "Informed altruism" and "partner restriction" in the reduction of HIV infection in injecting drug users entering detoxification treatment in New York City, 1990-2001. *Journal of the Acquired Immune Deficiency Syndromes,* 35(2), 158-166.

Des Jarlais, D. C., Perlis, T., Arasteh, K., Torian, L. V., Beatrice, S., Milliken, J., Mildvan, D., Yancovitz, S., & Friedman, S. (2005). HIV incidence among injection drug users in New York City, 1990 to 2002: Use of serologic test algorithm to assess expansion of HIV prevention services. *American Journal of Public Health,* 95(8), 1439-1444.

Emmanuelli, J., & Desenclos, J. (2005). Harm reduction interventions, behaviours and associated health outcomes in France, 1996-2003. *Addiction,* 100(11), 1690-1700.

Fitch, C. (2004). Rapid assessment: an international review of diffusion, practice and outcomes in the substance use field. *Social Science Medicne,* 59(9), 1819-1830.

Friedman, S. R., Des Jarlais, D. C., Sotheran, J. L., Garber, J., Cohen, H., & Smith, D. (1987). AIDS and self-organization among intravenous drug users. *International Journal of the Addictions,* 22, 201-219.

Friedman, S. R., de Jong, W. M., & Des Jarlais, D. C. (1988). Problems and dynamics of organizing intravenous drug users for AIDS prevention. *Health Education Research,* 3, 49-57.

Friedman, S. R., Jose, B., Deren, S., Des Jarlais, D. C., & Neaigus, A. (1995). Risk factors for HIV seroconversion among out-of-treatment drug injectors in high and low seroprevalence cities. *American Journal of Epidemiology,* 142, 864-874.

Friedman, S. R., Neaigus, A., Jose, B., Curtis, R., Goldstein, M., Ildefonso, G., Rothenberg, R. B., & Des Jarlais, D. C. (1997). Sociometric risk networks and HIV risk. *American Journal of Public Health,* 87(8), 1289-1296.

Friedman, S., Curtis, R., Neaigus, A., Jose, B., & Des Jarlais, D. (1999). *Social networks, drug injectors' lives and HIV/AIDS*. New York: Plenum.

Friedman, S. R., Kottiri, B. J., Neaigus, A., Curtis, R., Vermund, S. H., & Des Jarlais, D. C. (2000). Network-related mechanisms may help explain long-term HIV-1 seroprevalence levels that remain high but do not approach population-group saturation. *American Journal of Epidemiology,* 152(10), 913-922.

Friedman, S. R., Tempalski, B., Cooper, H., Perlis, T., Keem, M., Friedman, R., & Flom, P. L. (2004a). Estimating numbers of injecting drug users in metropolitan areas for structural analyses of community vulnerability and for assessing relative

degrees of service provision for injecting drug users. *Journal of Urban Health,* 81(13), 377-400.

Friedman, S. R., Maslow, C., Bolyard, M., Sandoval, M., Mateu-Gelabert, P., & Neaigus, A. (2004b). Urging others to be healthy: "intravention" by injection drug users as a community prevention goal. *AIDS Education and Prevention,* 16(3), 250-263.

Grassly, N., Lowndes, C., Rhodes, T., Judd, A., Renton, A., & Garnett, G. P. (2003). Modelling emerging HIV epidemics: the role of injecting drug use and sexual transmission in the Russian Federation, China and India. *International Journal of Drug Policy,* 14, 25-43.

Helmer-Hirschberg, O. (1967). *Analysis of the future: The Delphi Method.* Santa Monica: Rand Corporation.

Kaldor, J., Elford, J., Wodak, A., Crofts, J. N., & Kidd, S. (1993). HIV prevalence among IDUs in Australia: a methodological review. *Drug and Alcohol Review,* 12, 175-184.

Kaplan, E. H., & Heimer, R. (1992). A model-based estimate of HIV infectivity via needle sharing. *Journal of the Acquired Immune Deficiency Syndromes,* 5(11), 1116-1118.

Kemp, R., & MacDonald, M. (1999). Injecting drug users have high rates of hepatitis C but HIV remains uncommon. *New Zealand Public Health Report,* 6(3), 17-19.

Kretschmar, M., & Wiessing, L. G. (1998). Modelling the spread of HIV in social networks of injecting drug users. *AIDS,* 12(7), 801-811.

Latkin, C., Hua, W., & Davey, M.A. (2004). Factors associated with peer HIV prevention outreach in drug-using communities. *AIDS Education and Prevention,* 16(6), 499-508.

Latkin, C., & Knowlton, A. (2005). Micro-social structural approaches to HIV prevention: a social ecological perspective. *AIDS Care,* 17(Suppl 1), S102-S113.

Linstone, H., & Turoff, M. (Eds.). (1975). *The Delphi Method: Techniques and Applications*. Cartersville, GA: Addison-Wesley Pub. Co.

Metzger, D., & Navaline, H. (2003). HIV prevention among injection drug users: the need for integrated models. *Journal of Urban Health,* 80(4 Suppl 3), iii59-66.

National Institutes of Health. (1997). *Proceedings on the NIH Consensus Development Conference on Interventions to Prevent HIV Risk Behaviors.* Paper presented at the Proceedings on the NIH Consensus Development on Interventions to prevent HIV Risk Behaviors, Bethesda, MD.

Rogers, E. (2003). *Diffusion of innovations* (Vol. 3). New York: The Free Press.

Santibanez, S., Garfein, R., Swartzendruber, A., Purcell, D. W., Paxton, L., & Greenberg, A. (2006). Update and overview of practical epidemiologic aspects of HIV/AIDS among injection drug users in the United States. *Journal of Urban Health,* 83(1), 86-100.

Stimson, G. V. (1995). AIDS and injecting drug use in the United Kingdom, 1987-1993: the policy response and the prevention of the epidemic. *Social Science Medicine,* 41(5), 699-716.

Stimson, G. V., Adelekan, M. L., & Rhodes, T. (1996). The diffusion of drug injection in developing countries. *International Journal of Drug Policy,* 7(4), 245-255.

Stimson, G. V., Fitch, C., Des Jarlais, D. C., Poznyak, V., Perlis, T., Oppenheimer, E., Rhodes, T., & Group, W. P. I. D. I. C. S. (2006). Rapid assessment and response studies of injection drug user: Knowledge gain, capacity building, and intervention development in a multisite study. *American Journal of Public Health*, 96(2), 288-295.

UNAIDS. (2006). *Uniting the world against AIDS: 2006 Report on the global AIDS epidemic*. Geneva: Joint United Nations Programme on HIV/AIDS.

Vickerman, P. (2001). *Modelling the impact of interventions focused upon different stages of a HIV epidemic amongst IDUs.* Paper presented at the 12th International Conference on the Reduction of Drug Related Harm, New Delhi.

Vickerman, P., Hickman, M., Rhodes, T., & Watts, C. (2006). Model projections on the required coveage of syringe distribution to prevent HIV epidemics among injecting drug users. *Journal of the Acquired Immune Deficiency Syndromes*, 42(3), 355-361.

Vickerman, P., & Watts, C. (2002). The impact of an HIV prevention intervention for injecting drug users in Svetlogorsk, Belarus: Model predictions. *International Journal of Drug Policy*, 13, 149-164.

World Health Organization. (1998). *Rapid Assessment and response guide on injecting drug use*. Geneva: World Health Organization.

World Health Organization. (2004). *Evidence for action: Effectiveness of community-based outreach in preventing HIV/AIDS among injecting drug users*. Geneva: World Health Organization.

Wodak, A. (1995). Needle exchange and bleach distribution programmes: The Austrailian experience. *International Journal of Drug Policy*, 6(1), 46-56.

Wodak, A. (1998). *HIV Epidemiology and Prevention Research in Drug-Using Populations in Australia*: Office of AIDS Research, National Institutes of Health, World Health Organization Substance Abuse Department.

Acknowledgements

We would like to thank the Foundation Open Society Institute (Grant #20015525) for the funding to research this manuscript.