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Dynamics of Methamphetamine Markets in New York City:
Final Technical Report to The National Institute of Justice

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ABSTRACT

Using Respondent Driven Sampling, this study piloted an innovative research design mixing qualitative and quantitative data collection methods, and social network analysis, that addresses a gap in information on retail methamphetamine markets and the role of illicit drug markets in consumption. Based on a sample of 132 methamphetamine users, buyers and sellers in New York City (NYC), findings describe a bifurcated market defined by differences in sexual identity, drug use behaviors, social network characteristics, and drug market behaviors. The larger sub-market is a closed market related to a sexual network of men who have sex with men (MSM) where methamphetamine (referred to as “tina”) is used as a sex drug. The smaller submarket is a less-closed market not denominated by sexual identity where methamphetamine (referred to as “crank,” “speed,” or “crystal meth”) overlaps with powder and crack cocaine markets. Participants in the MSM submarket viewed “tina” as very different from cocaine, due to what they characterized as the drug’s intense sexual effects, whereas participants in the smaller non-sexual-identity-denominated submarket saw “crystal meth” as a cost-effective alternative to cocaine. While majorities of participants in all subpopulations studied reported that their use of methamphetamine primarily centered on sex, almost all (91%) MSM reported this. Many MSM reported that their sexuality had become indistinguishable from their drug use. MSM had denser patterns of social network ties and many more sex partners than other subpopulations. MSM market participants reported higher prices for the drug, which may be an indication that they are accessing purer forms of methamphetamine. Participants were more willing to discuss accessing or purchasing methamphetamine than they were to discuss providing or selling the drug, although all indications are that most market participants do both. Compared with the sometimes highly organized markets that have existed for other illegal drugs (e.g., heroin, cocaine, marijuana), retail methamphetamine markets have remained, by contrast, relatively primitive in their social and technical organization, and distinct patterns of drug use emerged as an outcome of interactions between drug providers and members of their social networks. In this case, those with less structurally advantageous positions within the network must depend on better-positioned network contacts to supply them with methamphetamine. Findings from the study indicate that

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the most striking characteristic of the methamphetamine market in New York City is the extent of the secondary market. Study data suggests this large secondary market has developed because of “bottlenecks” in the chain of distribution, which may be the outcome of the inconsistent supply of methamphetamine available in New York City. Participants reported essentially no violence in connection with methamphetamine markets in NYC. Participants have a lifetime total of 13 methamphetamine possession arrests for the sample of 132; none has ever been arrested for methamphetamine distribution. Study findings may be useful to practitioners, policy-makers and researchers in fields including law enforcement, criminal justice, and public health and substance abuse treatment.

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TABLE OF CONTENTS

ABSTRACT ..... **i**
LIST OF TABLES ..... **vi**
LIST OF FIGURES ..... **ix**
ACKNOWLEDGEMENTS ..... **x**
INTRODUCTION/BACKGROUND AND SIGNIFICANCE **20**
Amphetamine, Methamphetamine and American Culture 24
Illicit Methamphetamine Use and Variations In Use 27
Amphetamine, Methamphetamine Use and Health 33
Methamphetamine Use, Sex, And MSM 35
Drug Markets 39
Methamphetamine Markets 43
The Evolution of Methamphetamine Markets in the US 47
Methamphetamine Markets in New York City 50
Summary 52
METHODS **53**
Overview Of Methods 53
Formative Research 54
Cultural expert interviews 55
Focus groups 56
Study Recruiting: Respondent Driven Sampling 57
Participant Methamphetamine Consumption And Distribution Networks 63
Data Collection And Implementation 66
Variable development 66
Eligibility screening 67
Data collection: Sample demographic and other descriptive characteristics 68
Data collection: Participant market behavior 69
Data collection: Participant consumption behavior 70
Anonymized network elicitation techniques 70
Random-selection network sampling 71
Non-randomized selection network sampling 71
Simultaneous qualitative/quantitative interviewing 71
Follow-up Interviews 72
Analytic Methods 74
Quantitative analysis 74
Network Completion Strategy 78
Inferring Common External Nodes 79
Qualitative Analysis 81
RESULTS **82**
Introduction 82
Recruiting And Sample Demographics 84
Recruiting 84
Sample Demographics 87
Methamphetamine Consumption And Sex 91
Methamphetamine consumption and sex: Quantitative results 91
Methamphetamine consumption and sex: qualitative results 96

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Eroticized injection 100
Other Aspects Of Methamphetamine Consumption Behavior 102
Substitutability with cocaine 102
Mode of ingestion 104
Period of use 106
Concurrent use of other drugs 107
Dependence 108
Methamphetamine Markets 109
Methamphetamine acquisition 109
Technical organization of methamphetamine markets: Location of transactions 110
Technical organization of methamphetamine markets: How were transactions arranged? 111
Technical organization of methamphetamine markets: Packaging 113
Technical organization of methamphetamine markets: Perceived quality 114
Technical organization of methamphetamine markets: Problems with transactions 115
Social organization of methamphetamine markets: Relationships with methamphetamine sources 116
Social organization of methamphetamine markets: The role of “Dealers” 117
Social organization of methamphetamine markets: Other non-concurrent drug use 119
Accounts from “dealers” 121
The Methamphetamine Market And Social Networks 125
Potential limitations of the network analysis 126
Analyzing the network 128
Network analytic measures employed 131
Network variables significantly associated with methamphetamine market participation: Continuous variables 134
Network variables significantly associated with methamphetamine market participation: Categorical variables 140
Exponential Random Graph Methods analysis 148
Methamphetamine Markets and Violence 154
Methamphetamine Markets and Criminal Justice 156
DISCUSSION 162
A Bifurcated Market 162
The “crank” market 162
The “tina” market 165
Sexual Behavior and Methamphetamine Use 166
Methamphetamine Consumption and Distribution Networks 174
Estimating the size of the New York City methamphetamine market 180
Methamphetamine Markets and Violence 187
Methamphetamine Markets and Criminal Justice 189
LIMITATIONS 191
IMPLICATIONS OF FINDINGS AND SUGGESTIONS FOR FUTURE RESEARCH 193
REFERENCES 195

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APPENDIX 1 STUDY INSTRUMENT 212
APPENDIX 2 SHANNON-JENSON DIVERGENCE AS A MEASURE OF INTER-GROUP DIFFERENCE 248
APPENDIX 3 EXPANDING THE NETWORK SAMPLE AND COMPUTING THE STRENGTH OF MATCHES 255
***Expanding the Network Sample: The Matching Relation* 256**
Inferring Internal Links 256
Addressing the Non-Transitivity of the Matching Relation 257
Inferring External Nodes 259
Computing the strength of matches 268
APPENDIX 4 ESTIMATING THE POPULATION SIZE 273

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LIST OF TABLES

Table ES-1 The bifurcated market for methamphetamine in New York City: Some differences between the two submarkets xix

Table 1 Sample demographics 87

Table 2 Crosstab of sexual identity and race 88

Table 3a “Is your use of methamphetamine mostly around having sex or not?” 91

Table 3b “Is your use of methamphetamine mostly around having sex or not?”, Shannon-Jensen ratios by sexual identity 92

Table 4a Participants saying they never or seldom have sex without methamphetamine, by sexual identity 92

Table 4b Participants saying they never or seldom have sex without methamphetamine, Shannon-Jensen ratios by sexual identity 93

Table 5a Percentage of past month sex partners participant used methamphetamine with, by sexual identity 93

Table 5b Percentage of past month sex partners participant used methamphetamine with, Shannon-Jensen ratios by sexual identity 94

Table 6a Number of past month sex partners, by sexual identity 94

Table 6b Number of past month sex partners, Shannon-Jensen ratios by sexual identity 95

Table 7a Participants who seek methamphetamine-using sex partners online, by sexual identity 95

Table 7b Participants who seek methamphetamine-using sex partners online, Shannon-Jensen ratios by sexual identity 96

Table 8a Mode of ingestion, by sexual identity 104

Table 8b Mode of ingestion, Shannon-Jensen ratios by sexual identity 105

Table 9 Period of use, by sexual identity 106

Table 10 Concurrent use of other drugs 107

Table 11a Dependence, by sexual identity 108

Table 11b Dependence, Shannon-Jensen ratios by sexual identity 108

Table 12 Past month methamphetamine purchases, by sexual identity 109

Table 13a Location of last transaction, by sexual identity 110

Table 13b Location of last transaction, Shannon-Jensen ratios by sexual identity 110

Table 14a How last transaction was arranged, by sexual identity 111

Table 14b How last transaction was arranged, Shannon-Jensen ratios by sexual identity 112

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Table 15 Packaging of methamphetamine at last transaction, by sexual identity 113
Table 16 Self-report quality of last transaction, by sexual identity..... 114
Table 17a Problems in course of last transaction, by sexual identity..... 115
Table 17b Problems in course of last transaction, Shannon-Jensen ratios by sexual identity 115
Table 18 Interaction with provider at last transaction, by sexual identity..... 116
Table 19a Was the source of last transaction a “dealer”?, by sexual identity 117
Table 19b “Was the source of last transaction a “dealer”?”, Shannon-Jensen ratios by sexual identity 117
Table 20a “Is your dealer reliable?”, by sexual identity..... 118
Table 20b “Is your dealer reliable?”, Shannon-Jensen ratios by sexual identity 118
Table 21, Non-concurrent past year use of other drugs, by sexual identity 120
Table 22 Significant Correlations Between Network and Study Variables 137
Table 23a Distribution of Input Closeness Centrality Used To Produce Categorical Distribution or “Bins” 142
Table 23b Input Closeness Centrality Categorical Distributions or “Bins”..... 142
Table 24 Categorical Variables Associated with Network Statistics..... 144
Table 25 ERGM Results (all p<.05 results shown) 153
Table 26a Weapons ownership, by sexual identity 154
Table 26b Weapons ownership, Shannon-Jensen ratios by sexual identity 155
Table 27 Weapon carrying, by sexual identity 155
Table 28 Past year methamphetamine possession arrests, by sexual identity..... 156
Table 29 Lifetime methamphetamine possession arrests, by sexual identity..... 157
Table 30a Lifetime non-methamphetamine drug arrests, by sexual identity 157
Table 30b Lifetime non-methamphetamine drug arrests, by sexual identity 158
Table 31 Lifetime methamphetamine possession arrests, by race 158
Table 32 Lifetime non-methamphetamine drug arrests, by race..... 159
Table 33 Police prevented me from buying methamphetamine in the past year, by sexual identity 160
Table 34 Other factors in the community prevented me from buying methamphetamine in the past year, by sexual identity..... 160
Table 35a Police confiscated methamphetamine from me but did not arrest me in the past year, by sexual identity..... 161
Table 35b Police confiscated methamphetamine from me but did not arrest me in the past year, by sexual identity..... 161

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Table 36 The bifurcated market for methamphetamine in New York City: Some differences between the two submarkets 163

Table 37 Amphetamine Use from the National HIV Behavioral Surveillance (NHBS) Study of MSM in New York City: 2004 versus 2008 (note NHBS MSM definition includes MSM/W) 182

Table 38 Estimated total expenditures on methamphetamine in the last year by all participants 186

Table A3-1 Connections Among Research Subjects via Telefunken/Demographics .. 261

Table A3-2 Matches without a Uniquely Identified Subject 263

Table A3-3 Matches of Clique Size 2 or Greater, with No Corresponding Match to a Research Subject 264

Table A3-4 63 New Network Nodes with Final Characteristics Drawn from Earliest Subject Report 266

Table A4-1 Sample Property Distributions 277

Table A4-2 Property Matching Probabilities 278

Table A4-3 Upper and Lower Bounds on Population 282

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LIST OF FIGURES

Figure 1 Fully Expanded Network (3) Showing Seeds (top), Recruits (center) and Inferred Connections (bottom) 130

Figure 2 Fully Expanded Network ((3) in the Discussion Above) 130

Figure 3 k-Core Decomposition, showing distinct 1-, 2-, and 3-cores 139

Figure 4 Network Drawn to Reflect Betweenness Centrality (size of node) And Race (color of node) 147

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The Joint Initiative was funded to encourage methodologically innovative research into retail drug markets, especially methamphetamine markets, in order to address gaps in our knowledge of the functioning of these markets, and the implications of drug markets for law enforcement and drug abuse policy responses. We would like to express our gratitude to NIDA and NIJ for funding our research, and in particular to express our gratitude to our unfailingly-helpful NIJ Program Officer, Dr. Linda Truitt.

The study team would also like to express our gratitude to the methamphetamine market participants who were willing to enter our study and disclose in interviews what were often very private matters.

We would be remiss were we not to acknowledge our gratitude to the staff of the Office of Sponsored Programs at John Jay College of Criminal Justice, Jacob Marini, and the preternaturally-cheerful (and equally helpful) Susy Mendes.

Lastly, we thank our families and loved ones for putting up with us during data collection, analysis, and write-up.

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EXECUTIVE SUMMARY

Specific Aims

New York City methamphetamine markets have received little attention until recently, when concern about growing levels of methamphetamine use and associated HIV risk behaviors in the MSM (men who have sex with men)/gay community began to attract attention (Hirshfield et al, 2004; Morin et al, 2005). But methamphetamine has always been available in New York City and attracted a certain coterie of "insider" users (Curtis & Wendel, 2001, Curtis et al. 2002). Recent attention from federal law enforcement confirms that methamphetamine markets exist in New York City (DEA 2004, 2006). The small body of literature which currently exists on methamphetamine use in New York City focuses on use among MSM, but offers little information about markets and distribution, or use outside MSM communities. This gap in the literature exists in part because methamphetamine markets have remained inaccessible to researchers who employ methods and techniques which are ill-suited to recruit and collect critical information about markets and distribution and the relationship of consumption and use patterns to markets. This study:

Specific aim one: Pilots an innovative research design using mixed qualitative/quantitative data collection methods with 200 participants[1] in New York City methamphetamine markets recruited using Respondent Driven Sampling (RDS),

[1] The study fell short of this traget, recruiting only 132 mthamphetamine market participants; the potential limitations this shortfall may impose on analysis are discussed below in the Results and Discussion sections of the Technical report that follows this Exceutive Summary.

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Specific aim two: Documents, describes, and analyzes the demographics and methamphetamine abuse behaviors of a sample of 200 methamphetamine market participants,

Specific aim three: Documents, describes, and analyzes the social networks of New York City methamphetamine market participants as users, buyers, and sellers of methamphetamine,

Specific aim four: Documents, describes, and analyzes the market behaviors of New York City methamphetamine market participants as users, buyers, and sellers of methamphetamine.

To accomplish these goals, the study team combined several innovative approaches to data collection and analysis. The study piloted an enhanced version of Respondent-Driven Sampling to recruit methamphetamine market participants. To better understand how social networks among methamphetamine users and distributors are structured, function, and evolve over time, the project collected network data from respondents to understand the complexity of linkages in user and distribution networks. To maximize the opportunity to collect data from these inaccessible populations, the project also employed innovative simultaneous qualitative/quantitative interviewing techniques, where digitally recorded interviews with study participants were combined with a structured computer-assisted interview. The research makes use of network analysis techniques to deepen understanding of distribution and consumption as social phenomena; this approach is particularly useful in examining a diffuse, network-based "peer-to-peer" market, such as methamphetamine markets in New York City.

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Background and Significance

This section briefly reviews the relevant public health and law enforcement literature on methamphetamine use and distribution, the literature on drug markets in general, and methamphetamine markets specifically.

Much of the literature on methamphetamine is found in the field of public health and has focused on individual risk behavior, especially hypersexual activity during episodes of use and attendant HIV risk (Anglin et al 2000, Domier et al 2000, Molitor et al 1999, Gay Men's Health Crisis 2004, Latino Task Force on AIDS 2005, Rotheram-Borus et al 1994, Semple et al 2002). Although a number of studies (and law enforcement data) suggest that methamphetamine use is a white working-class phenomenon and that methamphetamine use is popular in rural areas (Booth et al 2006, Herz 2000, Siegal et al 2006, Schoeneberger et al 2005, Wang et al. 2006), the public health literature has principally focused on MSM populations (Colfax et al 2004, Frosch et al 1996, Gorman et al 1997, 2003, Halkitis et al 2001, 2003, Halkitis and Parsons 2002, Koblin et al 2003, Reback & Grella 1999, Shoptaw et al 2002). Far less is known about methamphetamine use and distribution networks, though there has been considerable research about networks involving other (especially injected) drugs (see, for example, Friedman et al 1997).

Law enforcement has not been as sharply focused on specific subpopulations of methamphetamine users as has been the case with health researchers; they have been active in expanding their capacity to address the problem in rural areas, and have more recently expanded their focus to urban areas that feature methamphetamine markets. For example, recent methamphetamine arrests in New York City have involved

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methamphetamine labs (DEA 2006) and distribution located in the heavily gay Chelsea area of Manhattan (DEA 2004). Law enforcement sources cite recent increases in purity, supply and availability of methamphetamine, a development that has been associated with increased use of smokable (ice) amphetamine. Law enforcement sources have also noted an increase in the volume of use among long-term users (MSM and in the night club scene in NYC), "populations [that] have long been on the cutting edge of drug trends that later spread to the general population" (NDIC 2006, p.9). The NDIC 2007 *Methamphetamine Threat* report also notes new groups of users, notably Hispanics (especially Mexicans, a growing population in New York City) and Asians (NDIC 2006, p.9).

Methamphetamine distribution at the import and wholesale level in the New York/New Jersey region is largely controlled by Mexican drug trafficking organizations, according to federal law enforcement (NDIC 2006, p. 9). The vast majority of the methamphetamine consumed in the region is transported from Mexico and the western United States, "transported overland by private and commercial vehicles. DTOs [drug trafficking organizations] also use parcel delivery services and couriers on buses, trains, and commercial aircraft to transport the drug" (NDIC 2006, p. 9). According to the NDIC (2006, p.9) "Caucasian independent dealers and OMGs [outlaw motorcycle gangs] are the predominant retail dealers in rural areas of the region, where most methamphetamine is distributed and consumed" while "Mexican DTOs, along with Hispanic street gangs, control much of the midlevel and retail distribution in the region's cities and towns." Beyond providing an overview of how methamphetamine distribution is structured and how it has evolved over time, the sparse number of law enforcement

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sources about methamphetamine offer few details to provide guidance for policy makers and professionals who are concerned about this issue.

The literature on drug markets generally has not had much focus on methamphetamine markets (Brownstein & Taylor 2006 in press is a recent exception). Much of the literature about drug markets has been focused on evaluating the effectiveness of various types of law enforcement interventions aimed at disrupting or eliminating drug distribution (Moore 1977, Zimmer 1987, Kleiman 1988, Sviridoff et al. 1992). Another group of studies focused on the relationship between drugs and violence. Brownstein and Taylor (2006) argue that "In New York City… much of the violence and violent crime associated with drug markets was the product of uncertain and unstable relationships among market participants (Brownstein et al., 1992 and Goldstein et al., 1992)." Goldstein (1985) suggested that there is a tripartite division of the relationship between drugs and crime; psycho-pharmacological (crime resulting from the effects of the drugs themselves) economic-compulsive (property crime resulting from the financial demands of expensive drug habits) and systemic (crimes within the market itself. Other studies built on Goldstein's (Fagan 1990, Fagan & Chin 1990, Goldstein et al., 1989, 1992). The drug markets literature has remained largely focused on these two issues and has devoted little attention to relationships between markets and drug use; the proposed research will provide new information about this topic.

Methods

To accomplish these goals, this study combined several innovative approaches to data collection and analysis and piloted an enhanced version of Respondent Driven

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Sampling (a chain-recruiting and sample-analysis methodology) to recruit participants drawn from the differing subpopulations who participate in methamphetamine markets in New York City. To better understand how social networks among methamphetamine users and distributors are structured, function, and evolve over time, the researchers for this study collected network data from respondents to understand the complexity of linkages in user and distribution networks.

To accomplish the study goals, the study combined several innovative approaches to data collection and analysis. An initial period of formative research grounded the following substantive data-collection phase of the study in a thorough overview of retail methamphetamine markets in New York City.

Each study participant did a roughly 1- to 2-hour structured interview that recorded participant demographics, drug use patterns and market participation, and also focused on enumerating and describing the members of their drug use and distribution networks (including drug buying, selling, trading, and in-kind transaction partners). Each participant was invited to recruit three additional eligible participants according to the RDS protocol. Participants were instructed to return one month after their initial interview date to collect recruitment incentives and complete a follow-up interview that focused on changes in patterns of use, distribution or network membership since the first interview.

Results

Sample Demographics

Almost all participants (91%) were men, with only 10 women and two transgender women (see Figure 3, the network by sex). Slightly more than half (54%) of

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participants were black, 23% were white, 20% were Hispanic and five persons were of other races (see Figure 4, the network by race). About half (49%) were MSM, 23% were MSM/W, 18% were MSW, 6 WSM, 4 WSM/W (see Figure 5, the network by sexual identity).

Summary of Findings

The retail methamphetamine market in NYC is bifurcated between two largely separate sub-markets: a smaller market for “crank,” “speed” or “crystal meth” that overlaps with powder cocaine and crack markets, and a larger closed, sexual-network-based market among MSM around use of “tina” as a sex drug. Each of these two submarkets displays differing characteristics of both the social organization of the market and the technical organization of the market; see Table ES-1 (also reproduced in the Discussion below as Table 36), summarizing some differences between the two submarkets. The study found that:

- The retail methamphetamine market in NYC is bifurcated between two largely separate sub-markets:
  - A smaller market for “crank”, “speed” or “crystal meth” that overlaps with powder cocaine and crack markets, and
  - A larger closed, sexual-network-based market among men who have sex with men (MSM) around use of “tina” as a sex drug.
- MSM participants agree that “tina” is very different from cocaine or crack because of the intense sexual effects of “tina”, while other participants were much more likely to see “crystal meth” as a cheaper or more cost-effective form of cocaine.

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- The MSM market for “tina” was more characterized by secondary distribution than the non-MSM market for “crystal meth”/”crank” was.
- The average amount spent on the last purchase by participants was $152.
- Participants reported almost no experience of violence connected with buying, selling or using methamphetamine.
- Study participants had comparatively few encounters with law enforcement, especially given their high levels of illicit drug use, most being users of other illegal substances as well as methamphetamine.

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Table ES-1 The bifurcated market for methamphetamine in New York City: Some differences between the two submarkets

	"Tina" market	"Crank" market
Submarket	"Tina" is consumed as a sex drug, with no perceived substitutability of cocaine, among members of a socially-bonded network based on MSM "chem sex."	"Crank" or "crystal meth" is seen as a more efficient, longer lasting alternative to cocaine or "crack" cocaine, with substitution between the two substances.
Social organization of distribution		
Extent of secondary market	Very large secondary market, with peer-to-peer supply a social norm, and large numbers of "semi-dealers".	More limited secondary supply networks.
Open/closed?	To enter this market, a potential buyer must have had sex with an existing market participant or the seller.	This market is fairly porous, with sellers open to new customers.
Degree of social organization	Distributors in this market are typically user/dealers, with dealer/"runner" dyads also noted.	Sellers are freelancers, with both non-user sellers & user/dealers.
Temporal aspects	Most active from Thursday-Sunday in weekly cycles.	Daily market.
Technical organization of distribution		
Sales units	The typical price in this market is $200-240/gram, with sales by weight: half-grams, grams, "teenagers" (1/16 oz.), "eightballs" (1/8 oz.).	This market is dominated by price-denominated sales, with "forty [$40] bags" and "eighty [$80] bags" the most commonly mentioned purchase units.
Street markets	The very limited street market is a MSM sex worker/dealer market in two heavily gay communities late at night.	Limited street markets overlap with traditional hard drug (heroin/cocaine) markets.
Delivery markets	This market is heavily delivery-based (see also below).	Some delivery sales.
Public location indoor sales	Rare.	Legitimate businesses with a "sideline," sometimes. unknown to business owner; dance clubs.
Private location indoor sales	Dealer home sales. Underground sex clubs and parties.	Underground sex clubs and parties.

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INTRODUCTION/BACKGROUND AND SIGNIFICANCE

New York City methamphetamine[2] markets have received little attention until recently when concern about growing levels of methamphetamine use and associated HIV risk behaviors in the MSM (men who have sex with men)/gay[3] community began to arise (Hirshfield et al. 2004, Morin et al. 2005). Methamphetamine has nonetheless always been available in New York City and has attracted a certain coterie of "insider" users (Curtis and Wendel 2000, Curtis et al. 2002). Recent attention from federal law enforcement confirms the existence of methamphetamine markets in New York City (Drug Enforcement Administration (DEA) 2004, 2006, National Drug Intelligence Center (NDIC) 2008a,b). The small body of literature that is currently available on methamphetamine use in New York City focuses on use among MSM but offers little information about markets and distribution in general or about use outside of MSM communities. This study seeks to address this gap in the literature, which exists in part because methamphetamine markets have remained inaccessible to

[2] While this report is primarily concerned with use of methamphetamine, given that it is the most popular form of amphetamine in illegal markets in the United States in recent years, it is important to note the pharmaceutical equivalence of all amphetamines. Just as all narcotics have essentially identical effects and are thus measured in terms of equivalent doses of morphine, different form of amphetamine differ only in that the dosage necessary to produce a given effect may be lower with more potent forms of the drug. In clinical studies, far from being able to distinguish between different forms of amphetamine, drug-naïve research subjects typically cannot distinguish between the effects of cocaine and amphetamine (Julien 2001). Many of the participants in the present study would disagree with this finding (see below); of course, few if any participants could be described as "drug-naïve" with regard to either cocaine or amphetamine.

[3] Because of the contexts within which methamphetamine use and distribution occurs in New York City, there is extensive discussion of MSM sexual activity in this report. Throughout this report, the term "MSM" is used exclusively when referring to behavior; the term "gay" is used only in quotations, and in reference to a cultural identity built or oriented around same-sex sexual behavior, as opposed to the behavior that may underlie that identity.

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researchers who employ methods and techniques that are ill-suited to recruiting users and collecting critical information about markets and distribution and the relationship of consumption and use patterns to markets.

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Amphetamines and Methamphetamine: Licit Production and Use

Amphetamine and methamphetamine use have been widespread in the industrialized world since these substances were introduced to the market in the 1930s, following their initial discovery in 1887 and 1893, respectively. Amphetamine was patented in the US in 1932 and marketed under the trade name Benzedrine (Brecher 1972). Methamphetamine was first marketed in Europe in 1938 under the trade name Pervitin, and shortly after in the US under the names Methedrine (by Burroughs-Wellcome) and Desoxyn (by Abbott Laboratories), as out-of-patent competitors with Smith, Klein and French's wildly-successful Benzedrine (Rasmussen 2008, 112). This was a lucrative market: total sales were estimated at two million doses daily in 1945, with Smith, Klein and French alone selling three times that by the end of the decade (Rasmussen 2008, 112).

Amphetamine and methamphetamine were widely used by both the Axis and Allied military forces in World War II. By the end of the war, American consumption was estimated to be one million 5-10 mg amphetamine tablets daily based on production figures from pharmaceutical manufacturers (Rasmussen 2008). Military use continued to be common for much of the remainder of the twentieth century (Rasmussen 2008, Cornum et al. 1997) and continues today. For example, in the US war in Iraq, combat pilots were prescribed Dexedrine by military medical personnel (Buncombe 2002).

Legal use remained common in the US prior to the Drug Abuse Control Amendments of 1965 (DACA), which banned or greatly restricted some

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amphetamine formulations, including Methedrine (a trade name for methamphetamine). The FDA estimated 1962 production at eight billion 10 mg tablets (Rasmussen 2008, 177). The Act followed an initial 1962-3 crackdown on loose prescribing practices around injectable amphetamine; the first illicit amphetamine labs in California sprang up immediately following this crackdown (Brecher 1972). Pharmaceutical production actually increased following the DACA; by 1969, the FDA estimated that production might have been as high as ten billion tablets annually (Rasmussen 2008). A 1970 survey found that 5% of adults in the US had used amphetamines medically in the previous year (Rasmussen 2008).

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Amphetamine, Methamphetamine and American Culture

The "speedfreak" amphetamine-injector subculture of the late 1960s to early 1970s, a spin-off of the hippie psychedelic-based counterculture, attracted near-universal condemnation (Brecher 1972, Grinspoon and Hedblom 1975, Jenkins 1999), with anti-amphetamine injection campaigns emerging from both the expected mainstream and the then-burgeoning counterculture uniting around the slogan "Speed Kills!". Widespread injection of methamphetamine led to youth revolutionary Abbie Hoffman's political/harm reduction formulation that "the only dope worth shooting is [then-President Richard] Nixon!" (Hoffman 1969).

Amphetamine use has long been prevalent in sports, particularly baseball. The autobiographical *Ball Four* (1970) by ex-Yankee Jim Bouton, which discussed players' reliance on amphetamine tablets called "greenies", was the first public acknowledgement of the degree to which the sport had become reliant on the drug. Despite the notoriety attracted by these revelations in the early 1970s, amphetamine use was not banned in baseball until 2005 (Curry 2006). The first round of testing in 2006 revealed some notable users, including home run hitters Barry Bonds (Quinn 2007a) and Jason Giambi (Quinn 2007b).

Because of use by writers, artists, and musicians, amphetamine use has been influential on culture. The Beat generation writers, especially Jack Kerouac, were prolific users of Benzedrine; most of Kerouac's *On the Road* (1957) was famously written under the influence. Allen Ginsburg's epic Beat poem "Howl" (1957) begins with a litany of the acts of self-immolation by "angelheaded hipsters"

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> who[4] chained themselves to subways for the endless
> ride from Battery to holy Bronx on benzidrine [*sic*]
> until the noise of wheels and children brought
> them down shuddering mouth-wracked and
> battered bleak of brain all drained of brilliance
> in the drear light of Zoo

William Burroughs, perhaps the most famous drug user in modern literary history, preferred opiates, but his wife, Joan Vollmer, whom he shot in the head while doing a "William Tell routine", was a heavy amphetamine user after being introduced to Benzedrine by Kerouac. Their son Billy was a heavy user of methamphetamine until his early death. His debut novel was the autobiographical *Speed* (1970).

Andy Warhol's "Silver Factory" period of the mid-1960s, during which he produced the majority of his films, was another artistic milieu in which amphetamine use was a creative inspiration: "Since many in his circle were on amphetamines during those years, are we to say that the Age of Warhol is the Age of Speed?" (Danto 2009, 105). Warhol said he made his film *Sleep* (1963) because "I could never finally figure out if more things happened in the sixties because there was more awake time for them to happen in (since so many people were on amphetamine), or if people started taking amphetamine because there were so many things to do that they needed to have more awake time to do them in... Seeing everybody so up all the time made me think that sleep was becoming pretty obsolete, so I decided I'd better quickly do a movie of a person sleeping" (Warhol and Hackett 1980, 33).

[4] Among *many* other things, though early on the list.

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Musicians have also been frequent users of amphetamine. One webpage on amphetamine culture (http://scahr.info/culture/songs.htm) lists a total of 95 songs about amphetamine use, ranging from early 1960's Mods the Small Faces' "Here Comes the Nice" (about meeting one's dealer) to three different recent techno songs called "Speedfreak". One curious absence is the song "Dr. Robert" by the Beatles, about a Manhattan doctor known as "Dr. Feelgood" for his B12/methamphetamine injections: "If you're down, he'll pick you up" (*Revolver* (1967), Parlophone Records). Many bands, from 60s bands like Australia's Purple Hearts (a slang term for Dexamyl, a dextroamphetamine and amobarbital formulation), to the UK's hugely influential Motorhead (slang synonym for "speed freak") in the 1970s, to the more recent US act REO Speeddealer (a pun on the name of 1970s act REO Speedwagon), have had names referring to amphetamine use. The English musician Lemmy Kilminster of the1960's psychedelic act Hawkwind and later the punk/heavy metal Motorhead is perhaps the most outspoken advocate of amphetamine use in current popular culture. He described bonding with one of his bandmates in Hawkwind: "[We] discovered we had a mutual interest in how long the human body could be made to hop around" (*Hawkwind: Do Not Panic* [BBC documentary, 2007]).

The impact of amphetamine and methamphetamine on American culture has been evident in a number of areas, and while its influence has not always been acknowledged, it has nevertheless been substantial.

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Illicit Methamphetamine Use and Variations In Use

Following up on the 1965 DACA, The Comprehensive Drug Abuse and Control Act of 1970 created the current system of regulating substances on a series of Schedules. Initially, most amphetamine formulations, including methamphetamine tablets, were listed on Schedule III, allowing, for example, re-fillable prescriptions, with only injectable liquid methamphetamine on the severely-restricted Schedule II, meaning "high potential for abuse…[but having] a currently accepted medical use" (21 U.S.C. 812). Eventually, methamphetamine and amphetamine were placed under Schedule II. After the 1970 Act, amphetamine prescriptions declined drastically; Benzedrine was withdrawn from the market. With the very large decline in licit manufacture and availability, use did not disappear: Drug Abuse Warning Network (DAWN) mentions of amphetamine for 1977 (at the height of the so-called "disco culture" that glamorized cocaine use) ran higher than for cocaine (1.6% v. 1%, cited in Jenkins 1999).

Many media sources (cited in Jenkins 1999) argued there was a resurgence of use in the 1990s. The question, however, is whether use ever really decreased in the 1980s. Jenkins (1999 unpublished, see also Jenkins 1999) argues that in fact amphetamine use has remained more or less at the same rate since at least the 1950s, though attention to this has varied over time:

> [A]mphetamines represent a vital and largely unwritten chapter in the long history of the American encounter with drugs and substance abuse. Since the late 1980s, the mass media have discovered what appear to be the growing menace of methamphetamine and other cognate drugs, which seem to be growing rapidly in use in areas of the west and south-west. However, a convincing case can be made that amphetamines and

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> especially methamphetamine have been popular in these precise areas at least since the 1950s, and that what is now being noted by the media is really a very old-established problem. Certainly some very early case-studies indicate widespread methamphetamine use in trucking centers and near military bases at least through the 1950s, and it is hard to deduce when, if ever, this usage declined. The fact that these drugs were so thoroughly neglected in years gone by partly reflects law enforcement priorities, but also demonstrates the Eastern biases of the media. It further reflects the racial assumptions and prejudices of journalists and editors, who tended to classify drug abuse as a strictly urban and minority phenomenon, so that predominantly white users were not taken seriously. The implication is that some "new" drug menaces might in reality represent not new phenomena, but the sudden discovery of pre-existing circumstances.

Some recent data suggest a rather drastic decline in methamphetamine use between roughly 2000 and 2009 and show, unsurprisingly, considerable regional variation in use (DAWN 2009, ADAM II 2009). DAWN (2009) reports that the national estimate of methamphetamine-related emergency room visits dropped from 132,576 in 2004 to 66,308 in 2008. Similarly, ADAM II (2009) data show significant declines in those testing positive for methamphetamine upon arrest in recent years. Regional variations are also significant in ADAM II data, with use concentrated in Portland, Oregon and Sacramento, California, the only two western sites in which the study collects data. Even in these western locations with high numbers of methamphetamine-positive arrestees relative to other areas, "the proportion of arrestees testing positive for methamphetamine … was significantly lower when compared to earlier ADAM collections. In Portland, over 20 percent of arrestees tested positive from 2000 to 2007, significantly higher than found in 2009. In Sacramento use reached a high point in 2003 at 46

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percent positive, significantly higher than found in 2009 (31 percent)" (ADAM II 2009).

It is important to note, however, that ADAM II's sample—i.e. arrestees—may not be representative of methamphetamine-using populations in all areas. Indeed, a key finding of the present study is the existence of a closed network of MSM methamphetamine users in New York City who are relatively shielded from law enforcement. The nature of this network, and presumably of others like it, perhaps complicates ADAM II's (2009) finding that "what is a serious problem in Sacramento…can be virtually non-existent in New York (0 tested positive)" (viii). Clearly, ADAM II data contain valuable information about regional variations in rates of illicit drug use; however, as Jenkins (1999) points out, what appears to be a "non-existent" problem in a particular area may in fact be an invisible problem. Besides largely missing methamphetamine use in the Northeast, ADAM II data may also significantly underestimate the overall prevalence of methamphetamine use nationally because it does not collect any data from southwest border counties where methamphetamine use is known to be prevalent.

The very latest data on methamphetamine seizures by law enforcement indicate that methamphetamine availability is, yet again, on the rise in the US, which will likely lead to increasing use in years to come. The Justice Department's *National Methamphetamine Threat Assessment 2010* notes that

> After gradually declining since 2006, domestic methamphetamine availability has rebounded and is at a 5-year high as a result of increasing large-scale production of the drug in Mexico and, to a

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> lesser extent, the increasing prevalence of small-scale production in the United States. (NDIC unpublished 2010, 1)

This uptick in availability is attributed to Mexican DTO's increased ability to acquire the precursor chemicals ephedrine and pseudoephedrine, use alternative precursors such as phenylacetic acid, and open new smuggling routes (NDIC unpublished 2010). Increased production has led to significant declines in price. Data from System to Retrieve Information from Drug Evidence (STRIDE), reported in the National Methamphetamine Threat Assessment 2010,

> show that in 2009, the price per pure gram for methamphetamine reached its lowest point since 2005—a year in which methamphetamine availability was very high. The recent decline in methamphetamine prices was very sharp, with a 37 percent decrease ($175.81 to $110.87) from the first quarter of 2009 to the fourth quarter of 2009. (NDIC 2010 unpublished, 1).

The salient point to make here is that with increased production, wider availability in the US, and lower market prices, methamphetamine use will likely rise in the US in the next few years. Data trends in the literature show, for instance, that the number of people entering substance treatment for methamphetamine at publicly funded facilities rises and falls with levels of availability of the substance (NDIC unpublished 2010).

In addition to noting temporal and regional variations in methamphetamine use, the literature also shows considerable variation in use by subpopulation. Studies carried out in the 1990s found "an enormous diversity of user groups", including "homosexual and bisexual men, college students, white-collar businessmen, young adults and youth in the rave or club culture and living on the street and longtime user groups such as outlaw motorcycle gangs" (Pach and

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Gorman 2002, 88). In a recent ethnographic study, researchers found that "user groups and associated patterns of use varied according to age, gender, sexual preference, ethnicity, occupation and residence" (Pach and Gorman 2008, 96). A review of epidemiological data from a range of sources on amphetamine and methamphetamine use in North America found "different types of users at various times" (Maxwell and Rutkowski 2008, 229). Maxwell and Rutkowski (2008) note that a "US survey of young men newly diagnosed with HIV in the southeastern United States found that the number using methamphetamine and other 'club drugs' such as ecstasy increased from 12% in 2000 to 22% in 2005" (233). Reported use also varies considerably by race (Pach and Gorman 2002, DAWN 2010). Overwhelmingly, methamphetamine users, according to the literature, are white (Maxwell and Rutkowski 2008, DAWN 2009), and are often working-class whites from rural areas (Booth et al. 2006, Herz 2000, Siegal et al. 2006, Schoeneberger et al. 2005, Wang et al. 2006). DAWN (2009) reports that of the 66,308 people visiting emergency departments for methamphetamine-related issues in 2008, 37,789 were white; 3,217 were black; and 8,056 were Hispanic. Data tend to show methamphetamine use to be distributed more equitably by gender (Brecht et al. 2004), though males continue to be represented at significantly higher rates than females in some studies. In 2008, 39,210 males visited emergency departments for methamphetamine-related issues, while only 27,095 women did (DAWN 2010).

Since the Comprehensive Drug Abuse and Control Act of 1970 began to regulate methamphetamine according to the current Schedule system, illicit use

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has continued virtually unabated. According to the narrative contained in the literature, methamphetamine use exploded during the 1990s, declined throughout the first decade of the twenty-first century, and is likely again on the rise. However, the presumed explosion of use in the 90s can perhaps be attributed to increased attention from law enforcement and the media during the period, and studies reporting declines in recent years may suffer from methodological concerns related to sampling and study design. The high diversity of methamphetamine-using populations render estimating the scope of the methamphetamine problem difficult, to say the least. Clearly, more research focusing on “hidden” populations of methamphetamine users is called for in order to assess the breadth of illicit methamphetamine use in the US today.

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Amphetamine, Methamphetamine Use and Health

Amphetamine use has been associated with a variety of health risks (Grund et al. 2010). The media, in particular, portrays amphetamine and methamphetamine as drugs that have led to a cascade of bad outcomes for users and their families, all the more so as their popularity has increased. Advertisements for methamphetamine prevention campaigns have focused on "meth mouth" as one of the primary negative health consequence of use. The drug itself does not affect the teeth; rather, it contributes to poor dental hygiene and grinding of teeth, which can lead to problems. As disgusting as the images of rotten teeth may be, the message delivered by the campaign is not one that portrays using the drug as life-threatening per se, as was so often the case with crack, heroin, and amphetamine according to the anti-speed campaigns of yesteryear.

As compared with some other illegal drugs (heroin and cocaine, in particular), methamphetamine appears to be associated with fewer serious health problems for users and less incidents of deaths by overdose. Methamphetamine can be passed via the placenta and breast milk to children, but there has been little research or prevention work around the issue of the drug's impact on children and neonates (Chomchai et al. 2004, Horton et al. 2003, Wouldes et al. 2004), which is somewhat surprising given the extraordinary amount of scrutiny that "crack babies" received when that drug was popular.

The threat to public health posed by illegal methamphetamine labs has generated some interest by researchers (Hohman et al. 2004, Santos et al. 2005) and coverage in the media, but it is not clear that the problem has the potential to

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affect large numbers of people given that labs are typically located in sparsely populated areas. Recent media coverage, however, has noted that the general public should be increasingly concerned because "the latest public safety hazard to emerge from the ever-shifting methods of producing methamphetamine" involves discarding toxic chemicals used in the manufacture of methamphetamine out the windows of moving cars that operate as mobile labs (Saulny 2010).

As methamphetamine markets mature and a cadre of core users emerges to sustain the market, the impact of long-term use on health is increasingly of interest to researchers (Guilarte et al. 2003, Kalechstein et al. 2000, Rawson et al. 2002, Thomas and Kuhn 2005, Urbina and Jones 2004). Some researchers have noted that the effects of methamphetamine extend well beyond the immediate impact the drug has on individual users and must be viewed in a community context that draws attention to increased levels of violence, child neglect and abuse, and other public health consequences (Watanabe-Galloway et al. 2009). Clearly, more research is needed to understand the wider health implications associated with the growth of methamphetamine markets.

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Methamphetamine Use, Sex, And MSM

One topic that is not often discussed in the literature of methamphetamine prior to the 1990s is the use of methamphetamine as a sexual stimulant. There are exceptions: Jenkins (1999, 40) quotes one 1960s account that is very similar to some of the discussions of methamphetamine and sex from study participants quoted below: "On Methedrine [the former trade name for methamphetamine] you are capable of any form of erotic behavior… Meth orgasms are like a winding spring building for hours… Methedrine enforces a concept of sex as conquest and achievement, of endurance and power." A more typical 1960s sentiment as to sex and amphetamine use, characteristic of hippie anti-amphetamine attitudes, is

> If you don't like sleeping, and don't want to screw,
> Then you should take lots of amphetamine, too!
>
> The Fugs, "New Amphetamine Shriek", *Virgin Fugs,* (1967), ESP Disc.

Clearly many of the participants in our study quoted below would disagree with this sentiment.

Much of the literature on methamphetamine is found in the field of public health and has focused on individual risk behavior, especially hypersexual activity during episodes of use and attendant HIV risk (Anglin et al. 2000, Domier et al. 2000, Molitor et al. 1999, Gay Men's Health Crisis 2004, Latino Commission on AIDS 2005, Rotheram-Borus et al. 1994, Semple et al. 2002). Shrem and Halkitis (2010) provide a survey of the psychological literature on methamphetamine abuse, sexual risk taking and treatment issues.

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Osborne (1997) contends that MSM have been using methamphetamine for as long as the rest of American society, but “gay/MSM” methamphetamine use is, and has always been, primarily around use during sex, whereas non-MSM use, he argues, has been associated with work contexts. One 1961 study, “Amphetamine addiction and disturbed sexuality”, found that “overt perverse sexuality including homosexuality was present in 29% of the cases prior to addiction. In 36% of cases, sexual drive was markedly increased while using amphetamines. Some addicts used amphetamines for this very purpose and were thereby enabled to perform extraordinary feats” (Bell 1961). In a 1976 study on the effects of amphetamine on sexuality and aggression, 26% of the users studied were “practicing homosexuals”, with a large majority of those MSM users reporting that they used the drug in “marathon” sex sessions (Angrist and Gershon 1976).

It is important to note that many of the cultural figures cited as using amphetamine above were open MSM at a time when societal homophobia made this a risky identity to publicly assume: Allen Ginsberg embraced the gay liberation movement, while Andy Warhol and William Burroughs, who both rejected the “gay” cultural identity, were both nonetheless famous for their open MSM lifestyles. The use of amphetamine by these culturally-prominent MSM from the 1950s onwards is an indication that use of amphetamine by MSM is not a recent phenomenon; it is likely that use by these culturally-prominent MSM was matched by use among less-famous MSM. Given the extremely underground nature of MSM culture prior to the 1970s, it is hardly surprising that only limited

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evidence is available concerning amphetamine use among MSM in this period, especially use in the context of sexual acts that were also the subject of criminal laws until very recently.

Although a number of studies (and law enforcement data) suggest that methamphetamine use is a white working-class phenomenon and that methamphetamine use is popular in rural areas (Booth et al. 2006, Herz 2000, Siegal et al. 2006, Schoeneberger et al. 2005, Wang et al. 2006), the public health literature has principally focused on MSM populations (Colfax et al. 2004, Frosch et al. 1996, Gorman et al. 1997, Gorman and Halkitis 2003, Halkitis et al. 2001, 2003, Halkitis and Parsons 2002, Koblin et al. 2003, Reback and Grella 1999, Shoptaw et al. 2002). An interesting parallel to the present study is Reback (1997), which, in approaching methamphetamine use among MSM from a public-health, rather than a criminal-justice, perspective, reaches very similar conclusions to the present study.

The literature suggests that there are both broad and fine-grained distinctions that methamphetamine users employ and that structure their cultural environment. For example, Koblin et al. (2007) argue, citing Diaz et al. 2005, Halkitis, Fischgrund and Parsons 2005, Kurtz 2005, Semple, Patterson and Grant 2002, that HIV negative men use methamphetamine for social reasons whereas HIV positive men use the stimulant to enhance sex and to deal with negative physical effects and self-image problems caused by their HIV status. This distinction is reminiscent of that between “party use” and marginalized use noted by Grund et al. (2010) with regard to stimulant substances including

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amphetamine and cocaine: “[In] western EU [European Union] countries […] a division between integrated (party) and marginalised users of amphetamine seems to exist, similar to that between cocaine snorters and smokers or injectors.” Researchers have generally focused their attention on individual-level risk behavior, and far less is known about methamphetamine use and distribution networks; although there has been considerable research about networks involving other (especially injected) drugs (see, for example, Friedman et al. 1997), more work is necessary to understand whether the lessons learned from examining those drugs apply to methamphetamine or not.

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Drug Markets

Drug markets have been variously conceptualized in the literature as places (see e.g. Eck 1995), as economic relationships (Reuter et al. 1990, 2004, Caulkins et al. 1998), as social relationships contingent on particular historical factors (Dorn, Murji and South 1992, Curtis and Wendel 2000, Curtis et al. 2002, Murji 2007), and of course, as targets for extermination. One strand of the economic drug market literature is summed up by the wonderfully-titled "The numbers game: Let's all guess the size of the illegal drug industry!" (Thoumi 2005). Estimating the overall size of methamphetamine markets has been less of a focus than calculating the breadth of heroin and cocaine markets, perhaps reflecting the status of methamphetamine as "something of a poor relation in the burgeoning literature on narcotics" (Jenkins 1992).

It is certainly true, however, that despite the relative lack of overall attention as compared to heroin and cocaine, law enforcement puts considerable resources into determining the scope of methamphetamine markets, and interdicting those markets, especially in western states. There are law enforcement efforts to discover clandestine labs, track precursor chemicals, chart seizures, and test for contents and purity, all of which help in projecting availability and determining the shape, size, and character of the overall methamphetamine market (see Hunt et al 2006). For example, the DEA operates STRIDE, a system that uses drug evidence to form various data sets. STRIDE data, however, are not routinely made available and are generally intended for law enforcement purposes, though references to the data occasionally appear in law enforcement reports, as in the National

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Methamphetamine Threat Assessment 2010, discussed above.

Much of the literature about drug markets has been focused on evaluating the effectiveness of various types of law enforcement interventions aimed at disrupting or eliminating drug distribution (Moore 1977, Zimmer 1987, Kleiman 1988, Sviridoff et al. 1992).

Another group of studies focused on the relationship between drugs and violence. Brownstein and Taylor (2007) argue that "In New York City… much of the violence and violent crime associated with drug markets was the product of uncertain and unstable relationships among market participants" (Brownstein et al. 1992, Goldstein et al. 1992). Goldstein (1985) suggested that there is a tripartite division of the relationship between drugs and crime: psycho-pharmacological (crime resulting from the effects of the drugs themselves); economic-compulsive (property crime resulting from the financial demands of expensive drug habits); and systemic (crimes within the market itself). Other studies building on Goldstein's include Fagan 1990, Fagan and Chin 1990, and Goldstein et al. 1989, 1992. Recent studies examining the links between drug markets and violence include Naylor 2009, Friman 2009, and Andreas and Wallman 2009. Another approach to drug market violence, "training" markets to avoid undesired behavior, has been developed recently (Curtis and Wendel 2007, Kennedy 2008). Research specifically linking methamphetamine and violence, discussed below, also appears with some regularity in the literature (Cohen et al. 2003, Caulkins et al. 2006, Baskin-Sommers and Sommers 2006).

The drug markets literature has remained largely focused on these two

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issues and has devoted less attention to relationships between markets and drug use, that is, between distribution and consumption (but see Wendel and Curtis 2000, Wendel et al. 2003, Curtis et al. 2002). This relative absence in the literature is unfortunate considering that in nascent markets where roles between sellers and buyers are not always clearly defined, patterns of drug use often emerge as an outcome of interactions between drug sellers and members of their social networks (Hamid 1992). Sales and Murphy (2007, 944) argue that "The role of the social characteristics of sellers and types of sales settings in understanding drug markets is pivotal" and that "the nature of buyer-seller relationships [in their case, social networks of friends selling Ecstasy] plays a major role in drug sales practices and social arrangements." Compared with the sometimes highly organized markets that have existed for other illegal drugs (e.g., heroin, cocaine, marijuana), retail methamphetamine markets have remained, by contrast, relatively primitive in their social and technical organization. Indeed, Eck (1995) argues that methamphetamine dealers typically sold through their social networks rather than through markets featuring elaborate distribution structures. Cocaine and heroin dealers, on the other hand, typically sold to strangers in high volume, rendering social networks inconsequential. As a result of inter-network selling, methamphetamine dealers faced lower risks than sellers of these other substances. While methamphetamine dealers typically sold the drug from their homes, like dealers of other drugs, those homes were less concentrated in high poverty areas of their communities. Several researchers have commented on the "closed" nature of

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methamphetamine markets (Eck 1995, Pennell et al. 1999, Rodriguez et al. 2005, 686) and have noted that these markets are typically formed among people who know each other: most transactions were arranged on the phone, took place indoors, and involved a customer purchasing from one steady source. Studies centered explicitly on understanding the social networks of methamphetamine sellers and users in order to draw conclusions about the character of methamphetamine markets do not exist.

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Methamphetamine Markets

As discussed above, the initial development of illicit production of methamphetamine can be seen as a reaction to evolving controls on pharmaceutical production and distribution of amphetamine, while the subsequent evolution of illicit production has largely occurred as a response to controls on precursor chemicals and trafficking methods. Outlaw biker gangs had long been major consumers of amphetamine (Thompson 1967), but became producers only in the wake of the 1970 Act (Jenkins 1999, Jenkins 1992) as diverted pharmaceutical amphetamine became very scarce. Illicit “speed labs” became more common after the 1966 DACA when the restrictions on licit amphetamines raised prices to the point where illicit manufacture was potentially profitable (Brecher 1972), but illicit production became more profitable still when the 1970 Act largely eliminated diverted licit amphetamine formulations from drug markets.

Most production of illicit amphetamine up to about 1990 probably used the P2P (phenyl-2-propanone) synthesis. After P2P was listed on schedule II of the Controlled Substances Act in 1980, the price of P2P went to $10,000 per gallon, an amount that would produce 8 pounds of methamphetamine worth $9-15,000 per pound (Jenkins 1992). After the crackdowns on P2P reduced availability, and thus increased black market prices during the 1980s, many clandestine labs shifted to various syntheses using red phosphorus (often collected from matchheads) and ephedrine or pseudoephedrine (NDIC 2005). The colorfully-named “Nazi Method”, or Birch reduction, became widely used during the 1990s because it reduced lab set up time, was faster than the ephedrine reduction

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method, and involved chemicals that were easier to obtain (Drug Identification Bible 2001, 684). Techniques of methamphetamine manufacture that had been the jealously guarded secrets of bikers and other outlaw producers became more widely available in the 1980s and 1990s, as underground books (see, e.g., "Uncle Fester" 1996, 1998; the first has gone through many editions since some time in the mid-1980s) and then websites spread methamphetamine "recipes" (these sites tend to be ephemeral, but generally involve discussions of the "dreams" of "SWIM" ["Someone Who Isn't Me"] about detailed chemical procedures).

Jenkins (1992) provides a comprehensive examination of methamphetamine production and wholesale distribution in Philadelphia, the alleged "Speed capital of the world" from 1970 to 1990 (a title that has been disputed by San Diego, and Portland, Oregon, among others, Jenkins 1999). He identifies an interlinked web of network contacts among individuals and small "crews" drawn from members of the Mafia/Cosa Nostra families, officials and members of unions including the Teamsters and construction trades unions, outlaw motorcycle gangs, most prominently the Pagans and the Warlocks, and independent operators, such as a former burglary "crew", and argues that the structure of the methamphetamine industry in Philadelphia bears little resemblance to conventional narratives of (highly-) organized crime "syndicates."

Rodriguez et al. (2005) argue that "the individual and community level predictors of methamphetamine markets are significantly different from [those for] marijuana, cocaine and opiate use…" (686) because methamphetamine markets,

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unlike other drug markets, take place in "communities or niches where a portion of the population maintains particular social or cultural norms tolerating or even fostering their [*sic*] use" (686). They further note that, in addition to differing market locales between methamphetamine markets and other drug markets, methamphetamine markets are characterized by different types of social relationships: "[M]ethamphetamine users have established personal relationships with their sources…" (687). The study found that methamphetamine users are different from users of other drugs in age, race and employment status: older members of the sample, which consisted of arrestees, were more likely to use cocaine and opiates than methamphetamine (681, 682); Latino/Hispanic, black, and Native American respondents were more likely to use cocaine and opiates than methamphetamine as compared to whites (681, 683); and arrestees from neighborhoods with higher unemployment rates were more likely to use cocaine and opiates than methamphetamine (681, 683, 684).

The literature on methamphetamine often explicitly links methamphetamine use and markets to violence. Baskin-Sommers and Sommers (2006) found in a study of 106 methamphetamine-using young adults between the ages of eighteen to twenty-five that "38 percent of males and 30 percent of females committed methamphetamine-related violence, respectively" and concluded that "methamphetamine use is a risk factor for violence" (p. 661). In a large study of 1,016 methamphetamine users in treatment, researchers report that "[p]ast and current interpersonal violence is a characteristic of the lifestyles of the majority entering treatment for methamphetamine dependence" (Cohen et.

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al. 2003). One article from the economic literature on illicit drug markets reflects the seemingly indissoluble connection between methamphetamine and violence: "The logic we develop pertains in markets in which there is a ubiquitous presence of potential violence—violence in which sellers impose substantial externalities on each other. The markets for expensive illegal drugs such as cocaine, heroin, and methamphetamine, often fit the bill" (Caulkins et al 2006). This claimed linkage between methamphetamine use and violence is particularly interesting in light of the present report's finding of a near-total *absence* of violence in the methamphetamine user networks discovered through the research.

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The Evolution of Methamphetamine Markets in the US

Much of the available literature and empirical data about methamphetamine *markets*, as opposed to *use*, today comes from law enforcement sources. For more than a decade, law enforcement agencies have been active in expanding their capacity to address the problem in rural areas, and have more recently expanded their focus to urban areas that feature methamphetamine markets, including New York City.

According to the NDIC (2006, 9), "Caucasian independent dealers and OMGs [outlaw motorcycle gangs] are the predominant retail dealers in rural areas of the [New York/New Jersey] region, where most methamphetamine is distributed and consumed." Law enforcement has also reported a growth in the number of very small labs/"cooks", including mobile labs in moving vehicles.

So-called "cold cook" methods for small-scale production of methamphetamine, discussed below, have been the subject of much attention from law enforcement. Others are more skeptical, with some even dismissing "cold cook" methamphetamine as mythical (i.e., law enforcement sources cited in Boeri et al. 2009, although methamphetamine users in that study accepted "cold cook" products as getting them high). From the NDIC's Methamphetamine Threat Assessment 2009, 13):

> "One-Pot" or "Shake and Bake" Methamphetamine Production: A one-pot methamphetamine laboratory actually uses a variation of the lithium ammonia method of production; however, in the one-pot method, a combination of commonly available chemicals is used to synthesize the anhydrous ammonia essential for methamphetamine production. Cooks using this method are able to produce the drug in approximately 30 minutes at nearly any location by mixing, or "shaking," ingredients in easily found containers such as a 2-liter plastic soda bottle, as opposed to using other methods that require

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> hours to heat ingredients. Producers often use the one-pot cook while traveling in vehicles and dispose of waste components along roadsides. Discarded plastic bottles may carry residual chemicals that can be toxic, explosive, or flammable.

This process allegedly allows production in a 2-liter soda bottle with commonly available ingredients. Electrolytic production (the “Festerlytic Method”, named after its inventor “Uncle Fester”, the Timothy Leary of illicit methamphetamine production) is another comparatively recent method offering the promise of small-scale “tabletop” production (“Uncle Fester” 1998). It is difficult to assess the validity of claims regarding “cold cook” methamphetamine and whether small producers have any impact on the market, but the longer-term effects of efforts to control production through precursor regulation (Hunt et al. 2006) have led to the expansion of production, smuggling and trafficking by large drug trafficking organizations, and to a decrease in the number of large-scale labs/“cooks” within the United States (NDIC 2008a,b, 2010, 2010 unpublished).

Law enforcement has identified Mexican drug trafficking organizations (DTOs) as controlling most of the wholesale methamphetamine distribution in the United States, with Mexico “the primary source of methamphetamine consumed in the United States” while “Mexican DTOs, along with Hispanic street gangs, control much of the midlevel and retail distribution in the region’s cities and towns” (NDIC 2010, 2010 unpublished). Most recently, “[f]rom mid-2008 through 2009, methamphetamine availability increased in the United States. Drug availability indicator data show that methamphetamine prices, which peaked in 2007, declined significantly during 2008 and 2009, while methamphetamine purity increased... Methamphetamine seizures also increased in 2008 after

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dropping in 2007, and 2009 data indicate that seizures continue to rise" (NDIC 2010). While much of the activity in the market is often attributed to Mexican DTOs, domestic production of methamphetamine continues to present problems to law enforcement, and law enforcement reports note that a recent increase in local production "was realized primarily in small-scale methamphetamine laboratories throughout the country, especially in the Southeast Region; however, methamphetamine superlabs in California also increased in scale and number during the same period" (NDIC 2010).

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Methamphetamine Markets in New York City

The New York/New Jersey Region is not seen by law enforcement as being among the most problematic areas for methamphetamine, and the threat posed by methamphetamine in this region is considered relatively low. Law enforcement does note, however, that "the methamphetamine abuser population is expanding, particularly in New Jersey" (NDIC 2008b). Methamphetamine distribution at the import and wholesale level in the New York/New Jersey region is largely controlled by Mexican DTOs, according to federal law enforcement (NDIC 2006, 9; NDIC 2010, 2010 unpublished). In New York City, a recent report identifies the Federation, Gulf Coast, Tijuana Mexican drug trafficking cartels as dominating the market, with the Juárez cartel operating in neighboring Newark, New Jersey (NDIC 2008b). The vast majority of the methamphetamine consumed in the region originates in Mexico and the western United States, and is "transported overland by private and commercial vehicles. DTOs also use parcel delivery services and couriers on buses, trains, and commercial aircraft to transport the drug" (NDIC 2006, 9; NDIC 2010).

Recent methamphetamine arrests in New York City have involved methamphetamine labs (DEA 2006) and distribution located in the heavily gay Chelsea area of Manhattan (DEA 2004). Law enforcement sources cite recent increases in purity, supply and availability of methamphetamine, a development that has been associated with increased use of smokable (ice) amphetamine. Law enforcement sources have also noted an increase in the volume of use among long-term users (MSM and in the night club scene in NYC), "populations [that] have long been on the cutting edge of drug trends that later spread to the

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general population" (NDIC 2006, 9). Law enforcement reports also note new groups of users, notably Mexican Hispanics (NDIC 2007), a growing population in New York City, Asians (NDIC 2006, 9), and younger and more affluent users (NDIC 2008b). As evidence of a greater number of users in the area over the last several years, the NDIC (2008b) notes that "the number of amphetamine-related (including methamphetamine-related) admissions to publicly funded treatment facilities in the New York/ New Jersey Region increased 15 percent overall from 2002 (685) to 2006 (787)."

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Summary

Beyond providing an overview of how methamphetamine distribution is structured, how it has evolved over time, and the activity level of law enforcement units in various jurisdictions across the country, the sparse number of law enforcement sources about methamphetamine markets offer few details to provide guidance for policy makers and professionals who are concerned about this issue. Little is known about the relationship of consumption to distribution or the role of social networks in methamphetamine markets, beyond the fact that social networks are more important with regard to methamphetamine than with many other illicit drugs. By focusing attention on networks and on connections between sellers and buyers, this study will improve our knowledge about how consumption affects market structure, how methamphetamine markets operate, and the role of social networks in methamphetamine markets.

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METHODS

Overview Of Methods

To accomplish the study goals, the study combined several innovative approaches to data collection and analysis. An initial period of formative research grounded the following substantive data-collection phase of the study in a thorough overview of retail methamphetamine markets in New York City.

Using insights provided by the formative research, the data collection phase of the study used Respondent-Driven Sampling (RDS) to recruit 132 methamphetamine market participants. Each study participant did a roughly 1- to 2-hour structured interview that recorded participant demographics, drug use patterns and market participation, and also focused on enumerating and describing the members of their drug use and distribution networks (including drug buying, selling, trading, and in-kind transaction partners). Each participant was invited to recruit three additional eligible participants according to the RDS protocol. Participants were instructed to return one month after their initial interview date to collect recruitment incentives and complete a follow-up interview that focused on changes in patterns of use, distribution or network membership since the first interview.

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Formative Research

The formative stage of the research process provided an overview of the state of methamphetamine retail markets in New York City and defined relevant market attributes to lay the foundation for data collection. The major goals of the formative research were to:

- Guide the recruitment of RDS "seeds" (see below for a discussion of RDS procedures employed) so that they were broadly representative of the underlying population of methamphetamine users and distributors in New York City
- Formulate questions related to methamphetamine buying, selling and use to be addressed in the data collection phase of the project
- Assist in the development of field plans to operationalize and optimize data collection, including identifying research locations and formulating study logistics
- Identify key stakeholders and cultural experts who could provide detailed information about New York City retail methamphetamine markets and broker entrée to networks of distributors and users
- Identify potential seeds to begin respondent-driven sampling recruitment
- Develop eligibility screeners to ensure that RDS recruits were in fact market participants

To accomplish these goals, the project conducted:

- Secondary data review
- Cultural expert interviews
- Focus groups

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Secondary data review

The research team reviewed available data about methamphetamine markets and use in New York City, including public health records (including emergency room, treatment admission and mortality data), criminal justice records (including records of arrests, prosecutions and convictions for methamphetamine possession and distribution) and traditional substance abuse measures (National Survey of Drug Use and Health, Drug Abuse Warning Network, e.g.). In addition, online news databases were searched and reviewed on an ongoing basis for references to methamphetamine use and distribution locally; these compiled data were used to help guide recruitment strategy and contextualize and triangulate data that the project collected.

Cultural expert interviews

The research team conducted formal interviews of 20 “cultural experts”. Among these 20 were users and distributors of methamphetamine, users of other stimulant drugs (especially powder cocaine, crack and Ecstasy), sex workers, service providers (outreach workers, community health workers and drug counselors) and local activists. The interviews were semi-structured and open-ended to allow for in-depth discussion of issues or topics in detail. The interviews elicited participants’ perceptions and understandings of methamphetamine use and distribution in New York City, and their descriptions of distribution and use networks, their members, and linkages that may exist between distinct groups of users and distributors. Interviews took place in a variety of settings (e.g., in participants’ homes, in parks, on the street, and in our

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Lower East Side project office) to maximize the comfort of the respondent. Procedures were followed to obtain informed consent, and all interviews were digitally recorded for selective transcription. Incentives were offered to all cultural experts. Some key informants also became seeds for the RDS recruitment described below.

Focus groups

The research team conducted two focus groups during the Formative Research phase of the study. One was conducted with participants in an MSM-oriented HIV service organization; the other was conducted with staff at a community organization for gay, lesbian, bisexual and transgender New Yorkers. The focus groups were helpful in exploring community practices and norms around methamphetamine use among MSM in New York City. Procedures were followed to obtain informed consent, but the focus groups were not recorded. Incentives were offered to the participants at the HIV service agency, but not to the staff members at the community center, who participated in the regular course of their employment.

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Study Recruiting: Respondent Driven Sampling

The study recruited 132 current methamphetamine users and distributors (persons who had used or sold methamphetamine in the previous thirty days) over a 33-month data collection period, using Respondent Driven Sampling. Respondent Driven Sampling (RDS) is a methodology that is used to recruit samples of hard-to-reach groups by taking advantage of intragroup social connections to build a sample pool (Heckathorn 1997, 2002, Heckathorn et al. 2002, Abdul-Quader et al. 2006, Robinson et al. 2006). RDS was designed for use among hard-to-reach populations—where participation in the study may be stigmatized, or where no ordinary sampling frame that would allow random sampling existed (Heckathorn 1997, 2002, 2007). RDS has been used nationally and internationally in studies of groups including injection drug users, commercial sex workers, and men who have sex with men (Abdul-Quader et al. 2006, Johnston, et al. 2006, Simic et al. 2006), and has been previously used by the research team to recruit 500 injection drug users in New York City in both 2005 and 2009, and 500 heterosexuals at elevated risk for HIV in both 2006-7 and 2010 (CDC National HIV Behavioral Surveillance), more than 300 teenage prostitutes in New York City (Evaluation of the OJJDP's Commercial Sexual Exploitation of Children demonstration Programs, NIJ Grant 2005-LX-FX-0001,CFDA#16.560) and nearly 200 drug dealers in Rochester, New York (Controlling Drug Markets and Related Harms in Rochester, New York (funding by the City of Rochester)). RDS has been expanded to include population proportion estimates and error estimation functions. More than simply a recruiting/sampling method, RDS also provides a powerful set of

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analytic/statistical tools for creating weighted population estimates (Heckathorn 2002, Salganik and Heckathorn 2004).

Following the initial interview, initial "seeds" and subsequent waves of study participants were given 3 numbered coupons that they were instructed to pass along to other people they know who currently participate in retail methamphetamine markets, as buyers, sellers, and/or users. The numbers on these coupons allowed the research team to prevent duplication, to identify who recruited each participant and to keep track of subsequent recruitment patterns using the RDS Coupon Manager software. In order to reduce the likelihood that too many respondents would come from a small number of well-connected people, the researchers limited the recruitment potential of each participant with the rationing of coupons (Heckathorn 2002). Researchers also included a thirty-day expiration date on the coupons in an attempt to ensure a reasonable pace of sample recruitment. Brief recruiter training sessions were conducted with the seeds and each subsequent eligible respondent, explaining: recruitment criteria; incentives for interviews and recruiting ($50 and $20 respectively); how recruits should contact the project; the time limit and sample size limit on recruiting; and discussion of appropriate recruiting techniques to avoid coercion and ensure participation was voluntary. When necessary, researchers selected new seeds because recruitment chains were slow to develop; many participants did not recruit.

RDS aims to improve on prior peer referral/snowball sampling methods by countering tendencies toward "volunteerism," "masking," and homophily-induced

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sample bias (see Erickson 1979). The key to the RDS method is the long sampling chains made possible by participant recruitment, which are critical for overcoming bias because they mimic first order Markov chains (Heckathorn 1997), such that a degree of randomness enters the process at each iterative step, and thus that a large number of steps ensures that the final state is independent of the starting position (following Kemeny and Snell 1960). In other words, as recruitment chains go through many waves of referral, the biasing effects of initial seed selection are minimized (Heckathorn 2002, Salganik and Heckathorn 2004).

Later studies have shown that RDS can control for differential recruitment based on differences in individual network size, and provide population proportion estimates for the study population as a whole (Heckathorn 2002). RDS has also been modified to analyze and produce estimates across continuous variables, like age, (in addition to discreet variables like race/ethnicity or gender considered in previous versions, see Heckathorn 2007). Salganik and Heckathorn (2004) have proposed models for determining confidence intervals associated with the population estimates of earlier versions of RDS, which are now incorporated in RDS analysis software. Still further, by resampling the RDS sample based on recruiting patterns apparent in the original sampling trees, Salganik subsequently argued that bootstrapping methods can produce more accurate confidence intervals than those drawn from treating RDS populations as though they were the result of random sampling, though these methods do not produce intervals as high as those produced under pure random sampling

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conditions. Salganik initially argued that confidence levels approaching the range of 0.9 were possible (2006), though in more recent work he has been less certain (Goel and Salganik 2010).

Because RDS has become common, there have been a number of evaluations (e.g., Gile and Handcock 2010, Goel and Salganik 2010, Johnston et al. 2008, Magnani et al 2005, Platt et al. 2006, Robinson et al. 2006, Semaan et al. 2002, Simic et al. 2006, Wang et al. 2005). Some have argued that RDS may not gather an adequate sample, because of factors such as geographical clustering, or inadequate incentives (Simic et al. 2006). Other studies found that RDS provides better estimates of female sex worker populations than time-location and better network information (allowing for better post hoc correction of sampling biases, see Johnston et al. 2006; see also Robinson et al. 2006). Platt et al. compared RDS and chain recruiting by indigenous fieldworkers and found that “no consistent trend emerges from the analysis of the effect of recruitment method on sample characteristics” (2006, 50) among injecting drug users in nine separate sites in Russia and Estonia.

Recent assessments (Gile and Handcock 2010) have found that RDS occasionally performs worse than expected (Goel and Salganik 2010). In particular, RDSAT-generated confidence interval estimates may be too small, and design effects of 5-10 may be more likely than the previous assumed value of 2. Both large design effects and incorrect confidence intervals occur when the underlying network has significant bottlenecks. For example, a network bottleneck between street-based and brothel-based sex workers could cause

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poor performance for the RDS estimate of HIV prevalence, if the street-based and brothel-based groups differ in infection rate. The reason for this is that the RDS sample can get "stuck" in one group leading to too high or too low an estimate.

Scott (2008a) started a heated debate about RDS when he claimed that RDS promotes “the violation of federal guidelines governing the protection of human research subjects” (2008, 50), though, despite this, he continues to support the use of RDS (Scott 2008b). Critics of Scott point out that many of the problems that Scott cites apply to Scott’s own research, and similar problems were typical of other recruitment methodologies and typical of most research with injection drug users (IDUs) (Broadhead 2008, Ouellet 2008; see Scott 2008b for his reply; see more generally Semaan et al. 2008). While the recruitment incentives will mean that people will always try to “game” the system, RDS screening methods seek to ensure that eligibility for participation (and non-duplication) can be supplemented with questions about the links between participants to clarify the basis of their connection (Heckathorn 2007).

There are two main reasons why the research team chose RDS in doing research with this population, neither of which is based in the analytic strategies associated with RDS. First, and of paramount importance, is the issue of trust and building rapport with research participants. The peer-driven network recruiting method used by RDS facilitates building rapport and thus eliciting more truthful information. Following the methodology, the researchers are always introduced to each new participant by an associate who can describe the non-

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threatening nature of participation in the study beforehand, and vouch for the researchers' good faith. For methamphetamine users and distributors who are renowned for their distrust of outsiders, the importance of rapport and trust cannot be underestimated. Second, and almost equal in importance, are the savings of time (and hence, money) that RDS affords the data collection phase of the project (Abdul-Quader et al. 2006, Robinson et al. 2006). Using traditional ethnographic methods or recruiting eligible respondents from venues where methamphetamine use and distribution are prevalent is likely to take much longer and recruit fewer study participants than RDS methods, which have been shown to recruit large numbers of study participants in a very short amount of time (Abdul-Quader et al. 2006, Robinson et al. 2006, Wang et al. 2006). Instead of making estimations directly from the sample to the population, RDS outlines a methodology for making indirect estimates by way of the social networks connecting the population (Salganik and Heckathorn, 2004).

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Participant Methamphetamine Consumption And Distribution Networks

One major substantive focus of this research is on the social networks of study participants in their respective and overlapping roles as methamphetamine users, buyers and sellers. Social Network Analysis (SNA) has long been recognized as a significant research tool for tracking and understanding flows of information, goods and diseases across systems of human relations (Wasserman and Faust 1994, Brandes 2005). More recently, advances in computer-based analysis have dramatically outstripped previous abilities, and, at present, the analytical potential of SNA greatly exceeds available data (Newman 2006). Past SNA approaches to drug user networks have shown the virtue of parameterization of network topologies for understanding the spread of diseases (Klovdahl et al. 1994, Friedman et al. 2000), the evaluation of law enforcement strategies (Curtis and Sviridoff 1994), and the framing of prevention and intervention strategies (Friedman et al. 1999).

Previous research on the accuracy of drug users' descriptions of their drug use and sex partners (Goldstein et al. 1995; see also, Hser et al. 1992) demonstrated a high degree of concordance in their responses about each other, and it suggests that the data gained by linking respondents in this fashion is a reliable source of information about network structure and dynamics, thereby allowing the research team to perform far more detailed and powerful analyses of network data than would otherwise be available via traditional RDS methods. Collecting network level data from drug-using populations is challenging in part because of both the constraints imposed by human subjects protections, and the participants' own wariness about disclosing information about third-party

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contacts. In the tumultuous world of the street drug user, information is often a currency to be exchanged for drugs and other valuable resources, or guarded zealously in order to preserve access to resources, such as drug-purchase connections and illicit income generating opportunities. Distrust of outsiders further limits their willingness to provide extensive and accurate data regarding their contacts; indeed, data may be systematically missing vs. missing at random. Successful collection of SNA data from drug-user populations demands the development of methods that protect the confidentiality interests of third parties, and do so in a way that is apparent to interview participants, so that they will feel confident in sharing information.

Traditional social network studies usually depend on having a complete census of the network members; this completeness will seldom be obtained in studies of illegal drug users because the population is often transient, wary of disclosing information, and busy; studies will seldom succeed in collecting data from all network members or about all network ties**.** Absent this completeness, traditional SNA methods require supplementation; application of SNA methods to clandestine social networks requires the development of methods that allow analysis of a network from a sample of that network.

RDS has proved extremely useful in quickly recruiting large numbers of people from hidden populations, allowing researchers to describe the salient characteristics of the population and, in some instances, make population estimates. However, it has been far less successful in helping researchers understand how the branches of the recruitment tree are connected. This is

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because, although RDS uses network connections to recruit representative samples of individuals within hidden populations, it does not aim to characterize network topologies themselves. The spanning tree graphs discovered via the RDS method may or may not characterize the networks themselves (and, for drug using populations, likely do not). Expansion of the RDS method is necessary to ascertain actual network topologies as well as population data during the research phase.

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Data Collection And Implementation

Variable development

Based on the existing drug markets literature and the formative research phase of the study, the research team developed an interview instrument (see Appendix 1, "Study Instrument") to collect data that screened participants for eligibility and focused on five topic areas:

- Participant demographics,
- Consumption behavior,
- Market participation, including participants' methamphetamine use, distribution and consumption networks,
- Involvement with violence, and
- Involvement with the criminal justice system.

The instrument elicited extensive information about consumption practices and routines because of the posited connection between consumption practices and the social organization of markets (Wendel and Curtis 2000, Curtis and Wendel 2000, Curtis et al. 2002). Questions as to consumption behavior were primarily derived from the review of existing literature and formative research activities. Because both the literature review and formative research activities agreed that much methamphetamine use, especially among MSM, took place in sexual contexts, a series of questions exploring this topic was included.

Questions about market participation were based in part on the instrument used in a UK Home Office study, "The Illicit Drug Trade in the United Kingdom" (Matrix Knowledge Group 2007), which conducted interviews with 222 persons imprisoned for serious drug offenses. This study focused on dealers, including wholesale dealers and larger-scale traffickers (questions from the Home Office

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study focused on non-retail transactions were not used in our study), and many questions required some adaptation for use with non-distributor participants. For example, questions intended to elicit information directly as to distributor practices from distributors were adapted to elicit customer information as to distributor practices. Because formative research confirmed that methamphetamine markets were deeply embedded in social networks, questions elicited information about network contacts in methamphetamine use and distribution and consumption.

The extensive literature cited above about the posited connection between drug markets and non-drug criminal activity, and especially connections between drug markets and violence, was used to design questions to elicit participants' experience of violence in the course of their participation in NYC methamphetamine markets, and other criminal activity engaged in, in connection with drug use. Further questions explored the participants' experience of the criminal justice system, including arrest, and of other market interventions, such as those by non-governmental actors.

Eligibility screening

Eligibility screening is an especially important concern in a social recruitment process like RDS, which provides an ideal medium for recruiters coaching their peers in what to say to pass the screener, a process the researchers have observed in other studies. To reduce the likelihood that ineligible individuals would be included in the sample and that non-productive recruitment chains would develop from non-user referrals, during formative research, the research team developed an eligibility screener that asked potential

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participants about drug use and preparation techniques, folkloric beliefs related to methamphetamine use, and market conditions and prices. For example, the researchers asked potential participants about whether they held in inhaled methamphetamine fumes when smoking or exhaled them immediately, and then probed a bit on this issue. It is widely believed that holding in inhaled methamphetamine fumes should be avoided, because “it will crystallize in your lungs and fuck them up”; other users say they hold in inhaled fumes with no ill effects. The goal of the probing is to determine whether or not the interviewee has ever heard this fact/myth, which is so commonly discussed by users that it would be difficult for a user to avoid hearing it; conversely, this is something few non-users appear to be familiar with.

Data collection: Sample demographic and other descriptive characteristics

Interviews collected a variety of information about sample demographic characteristics, and other descriptive characteristics, including age, race/ethnicity, gender, sexual identity, birthplace, years resident in New York City, level of formal education, income, income sources, drug use history, current drug use, drug sales history, current drug sales, and criminal justice experience**.** Interviews eliciting this data produced a wealth of other information for subsequent coding and analysis. RDS-specific data relating to the characteristics of participants’ methamphetamine using/buying/selling networks were also collected and recorded in the RDS Coupon Manager software program, which tracks recruitment and participants’ incentives. Physical descriptions, and a coded unique identifier (created from participants’ initials, birth month, birth year,

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race/ethnicity, and gender) were also recorded for each participant both to ensure correct payment of RDS incentives and to eliminate participants recruiting themselves (sample duplication), and to facilitate linking of network participants.

Data collection: Participant market behavior

To learn more about buying and selling methamphetamine, detailed questions were asked about: how often participants buy or sell methamphetamine; the locations where these transactions take place (bars, clubs, restaurants, hotels, apartments, on the street); how transactions are arranged: by phone/pager/internet or meeting at a fixed location; relationships between buyers and sellers; quantities (actual (weighed), putative or dollar-denominated) that are bought and sold; packaging and handling the drug: Is the purchase pre-packaged? Is it sealed against tampering?; perceived quality as compared to other transactions: Does the quality vary between dealers and between purchases from the same dealer?; problems that have accompanied buying or selling: Is the buyer/seller reliable? Is the product always available or intermittently available?; interactions with law enforcement or others outside the market: Have the police prevented you from buying or selling? Have the police confiscated your drugs? Have neighbors or other community residents prevented you from buying or selling methamphetamine?; changes in the market: Are there any new groups of buyers or sellers that you have noticed in the recent past? Are there any new ways of buying or using the drug that you have encountered in the recent past?

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Data collection: Participant consumption behavior

Participants were interviewed about each episode of methamphetamine consumption during the previous 30 days, and related events including: generating money and buying methamphetamine: income sources (legitimate employment, other income sources); mode of ingestion and drug preparation: Do participants sniff, smoke or inject methamphetamine?; companions and activities during use; cycle of use; post-use "crash" and recovery period; effects on other life activities; involvement in other criminal activity: Has methamphetamine use led to other illegal behaviors to make money, get drugs or avoid the police?

Anonymized network elicitation techniques

To supplement the RDS recruitment tree network data, the research team included an extensive set of questions that asked study participants to describe people in their use and distribution networks, using an anonymized social network data collection protocol developed by the research team. Building upon the techniques initially employed by Friedman et al. (1997, 1999) to collect network data among injection drug users, the research team asked study participants to describe up to ten people they have used methamphetamine with or bought methamphetamine from or sold methamphetamine to in the last thirty days. For each of these network members, participants provided a brief physical description (race, sex, height, weight, hair and eye color), limited information about the last three digits of each network contact's cellphone number (Is each of the last three digits even or odd, and 0-4 or 5-9?)[5], and some information about

[5] The research team developed the informal term "telefunken code" (after the German electronics manufacturer) for the phone digit data collected.

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the nature of their relationship with that network member. This technique was developed through formative research interviews, where the research team determined that study participants were comfortable with divulging this information about themselves and their network contacts. This data is used to construct the expanded network discussed below and in the Results section on Social Network Analysis results.

Random-selection network sampling

Where participants had a very large number of network contacts, the research team elicited a random selection of their network contacts. Participants were presented with a list of the letters of the alphabet arranged in random order and asked to name network members whose names began with the letters on the list (proceeding to the next letter on the list if they did not have a network contact whose name began with any given letter) until at least five network members had been obtained.

Non-randomized selection network sampling

The research team also asked participants to provide similar network data about the person in their network who they would be most likely to obtain methamphetamine from if normal sources were unavailable, whether that person was a dealer or not.

Simultaneous qualitative/quantitative interviewing

The research team employed a novel approach to data collection in order to collect both qualitative and quantitative data and to facilitate the integrated analysis of both. This method was based on the research team's past experience, when the effort to elicit answers to a quantitative data-gathering

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instrument often produced a gush of rich qualitative information, which the interviewers struggled to fit into the available coded answers. The researchers' data-collection process tried to take advantage of this observation: the interviewer conducted an open-ended, but structured interview, entering data on a computer database form, while simultaneously employing a high-quality stereo recorder to record the entire interview for subsequent selective transcription and analysis.

This provided a number of advantages over traditional interview techniques. Traditional quantitative data collection is limited by the initial choice of questions and coding of possible responses; there is little flexibility to vary this as new ideas, themes and hypotheses are developed during data collection and analysis. On the other hand, traditional qualitative data collection approaches produce data of great depth, but uncertain generalizability. By preserving the full audio recording of the participant interviews and reviewing and selectively transcribing those recordings, additional quantitative data can be generated from material already gathered, and material can be recoded as understanding deepens or new themes emerge.

Follow-up Interviews

Participants were also invited to return for a one-month follow-up interview (timed to coincide with payment of recruitment incentives in order to maximize follow-up rates), which 1) explored changes in the membership of their consumption and distribution networks since the initial interview, 2) described their drug use and distribution activities over that time, and 3) allowed the researchers to ask follow-up questions to clarify unresolved issues raised during

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the initial interview. By comparing responses on the initial interview with those on the 30-day follow-up, the research team hoped to gain insight into the short-term dynamics of the market, a much better picture of rates of change in networks of users and distributors, and a more accurate view of the stability of consumption routines.

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Analytic Methods

Quantitative analysis

The analysis of the study sample employed bivariate analysis, grouping participants by sexual identity (MSM, MSM/W, Others (all those who do not participate in MSM sexual activity), and, for some criminal justice variables, by race. The study reports on distributions, *p*-values, and likelihood ratios (*G*).

To evaluate and correct population estimates for RDS biases, the research team uses Heckathorn's techniques, as implemented in the RDSAT analysis package. The degree to which selection probability can be accurately measured for each participant depends on relatively precise measurement of network size; this study collected more extensive network information than is typical of other RDS studies. Heckathorn's technique for correcting RDS biases and providing confidence intervals on population proportions can be used (Heckathorn 1997, 2002, Salganik 2006), provided the Markov chain is mixing (Goel and Salganik 2009). Frequency analyses of the following variables have been conducted, using both the sample statistics, and an analysis that corrects for RDS sampling bias (as implemented by RDSAT).

Recall the recent criticism of RDS analysis by Goel and Salganik (2010), which points out that network bottlenecks between sub-populations can result in design effects much larger than had been previously estimated, and incorrect confidence intervals. The RDSAT software tries to account for bottlenecks along the trait being estimated, but does not account for bottlenecks on other dimensions. Thus, when bottlenecks are present, this can cause the estimated confidence intervals and presumed design effects to be too small. RDSAT fails to

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produce adjusted univariate (respondent bivariate) measures of population proportion whenever a subcategory (relative to the property being investigated) recruits entirely within themselves. For example, if all black-haired individuals recruit only black-haired individuals, then this would render impenetrable the sampling biases that RDS introduces in quantifying the proportions of the population with respect to hair color. Fortunately, in the present study's data set, such extreme levels of homophily and pure within group recruitment does not frequently occur.

In order to measure the relative magnitudes of differences between subpopulations, the research team has provided the Shannon-Jensen divergence between the two distributions where comparisons of sub-populations within the study population have been carried out (see Appendix 2, "Shannon-Jenson Divergence As A Measure Of Inter-Group Difference", on interpreting Shannon-Jensen divergence scores and ratios). Shannon-Jensen divergence is a well-established method of measuring the difference between two probability distributions. It is also known as total divergence to the average, or the information radius. The Shannon-Jensen divergence is 0 when the two distributions are identical, and is 1 when they are maximally different (with respect to their individual and joint entropy). Two distributions are said to be significantly different if their Shannon-Jensen distance exceeds 0.000136[6].

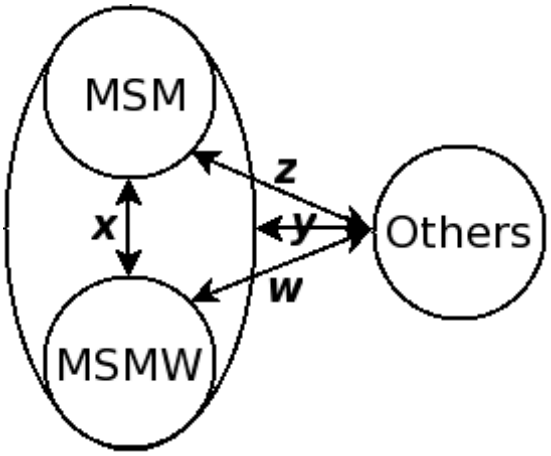
In the present analyses, for each variable, the research team considers three subpopulations:

[6] The Shannon-Jensen divergence between a 50-50 distribution and a 45-55 distribution is 0.000136. This value has been chosen as a threshold value because of its straightforward and intuitive definition.

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i. MSM: men who have sex with (only) men
ii. MSM/W: men who have sex with men and women
iii. Others, i.e. everyone else – including men who have sex only with women, women regardless of their sexual identity, and transgender persons.
iv. The union of sets (i) and (ii).

Between these four sets, the research team computes the four Shannon-Jensen distances depicted in the following diagram.



X represents the distance of the variable distributions manifested by the MSM and MSM/W populations.

Z represents the distance of the variable distributions manifested by the MSM and Others populations.

W represents the distance of the variable distributions manifested by the MSM/W and Others populations.

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Y represents the distance of the variable distribution manifested by the MSM+MSM/W and Others populations.

When any of these quantities approach 0, the corresponding pair of distributions become identical.

To help evaluate the significance of these numbers, the research team constructs a ratio table, in which the (row I, column J) entry has the quotient of the variable associated with row I and the variable associated with column J:

	Bigger	**X**	**Y**	**Z**	**W**
Smaller		X	Y	Z	W
X	X	*X/X*	*Y/X*	*Z/X*	*W/X*
Y	Y	*X/Y*	*Y/Y*	*Z/Y*	*W/Y*
Z	Z	*X/Z*	*Y/Z*	*Z/Z*	*W/Z*
W	W	*X/W*	*Y/W*	*Z/W*	*W/W*

Note that the diagonal entries of the table all must necessarily be 1, and that the value of entry I,J is the reciprocal of the value in entry J,I. In light of these structural facts, the visual congestion will be minimized by showing only those entries in the table that are >1. A ratio that is >2 has been used as a rule of thumb for reporting Shannon-Jensen divergence ratios as significant.

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Network Completion Strategy

Because the RDS recruitment chains represent a sampling of a network by a "random walk", but provide only limited information about the structure of the overall network from which the RDS recruitment network was drawn, the research team gathered information from study participants about their participation in social networks of methamphetamine use and distribution. By matching participants' descriptions of their network contacts, it becomes possible to supplement the RDS recruitment network, or partially complete the underlying network, by inferring common links between participants (internal matching), and common third party links (external matching).

Network Link Matching

The strength of a hypothetical arc from subject A to subject B is computed by measuring the extent to which one of A's described contacts matches the self-reported data about B. The strength of this match is quantified as a number ranging from 0 to 7, with 0 representing a high likelihood of non-match and 7 representing a high likelihood of match. The way in which this computation is carried out is described in Appendix 3, "Expanding The Network Sample: Computing The Strength Of Matches", and below in the Results section which discusses the Social Network Analysis component of the study.

A link of strength 7 is formed from individual A to individual B, when A reports having a methamphetamine-using contact whose seven attributes, gender, race, telephone number statistics, height, weight, hair color and eye color, all agree with the data collected about subject B. A link of strength 6 is

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formed from individual A to individual B, when A reports having a methamphetamine-using contact whose description differs from B in at most one of the following: height, weight, hair color, eye color.

It should be noted that the notion of matching is one that is prone to false positives more than false negatives. This is because of a fundamental asymmetry that arises in finite categorical descriptions: when descriptions disagree, they are more likely to be conclusive evidence of difference, but when descriptions agree, they merely increase the likelihood of sameness. For example, if A describes a contact as a male with black hair, but B is a female with blond hair, then the disagreement is likely to be conclusive evidence that B is not A's contact. If, on the other hand, A describes a contact as a male with gray hair, and B is indeed a male with gray hair, then the agreement merely increases the likelihood that B is A's contact.

Inferring Common External Nodes

Even if two subjects are not directly connected by an inferred link, they may provide matching reports. For example, suppose Individual A is a blonde Caucasian male with a telephone number code of 61, height between 5ft 4in and 5ft 8in, and weight between 145 and 165 pounds, and Individual B is a Hispanic male with black hair, and a telephone number code of 41, height between 6 ft 2 in and 6 ft 4 in, and weight between 205 and 225. Suppose further that both A and B report knowing one other methamphetamine-using individual who is a gray-haired black man, having height between 6ft 1in and 6ft 4in, and weight between 175 and 195 pounds. In this case, clearly, no link can be inferred between A and B; and perhaps there is no subject within our study who is gray-

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haired, black, with height and weight close to the specified range. As a consequence, a link from A (or B) to any other subject within the study cannot be inferred, since no subject matches the provided description. However, the possibility that both A and B are referring to the same individual could be deduced, though the individual did not participate in the study.

The above thought experiment, when conducted on the survey data, yields many new individuals (or more accurately, equivalence classes of individuals) who lie in the ambient population, outside the sample of individuals surveyed. The researchers assign a new, unique ID to each peripheral node which connects with strength 7 to more than one individual within the set of surveyed individuals. The example of the previous paragraph, for instance, would result in the creation of a peripheral node for C and links between it and the two surveyed individuals A and B. For the data gathered here, this required making thirty-four (34) peripheral nodes, which were then assigned IDs sequentially from 133-166.

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Qualitative Analysis

Analysis of qualitative data was done using the DevonThink Pro software. The DevonThink Pro software represents an improvement over older software because it facilitates systematic analysis of qualitative data by offering a variety of tools for uncovering and exploring the data beyond coding and searching functions and automates a great deal of the coding and indexing of data, which was formerly a very labor intensive process. Qualitative coding and indexing of qualitative content accommodates the complexity of open-ended responses to interview questions. The DevonThink Pro software's coding and indexing systems are flexible and accommodate recoding segments of text during the analysis process. This software employs powerful artificial-intelligence based coding and automatic semantically-based indexing of all data entered, with powerful features to facilitate correction, editing and expansion of the initial generated indexing. As the qualitative answers recorded in the text fields of the study database are supplemented by selective transcription of the recorded audio interviews, the autoindexing and subsequent editing and expansion of the initially generated indexing continue in an iterative process, facilitating the integrated management of all data relating to each study participant.

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RESULTS

Introduction

In this section, study results are offered with regard to selected issues. Because markets occur in the context of consumption, the report begins, after an overview of the sample, by describing the consumption activities described by study participants, and then turns to a discussion of the market and the role of social networks in the market, and concludes with data concerning methamphetamine markets and violence, and interactions of methamphetamine markets with the criminal justice system:

- Recruiting and sample demographics
- Methamphetamine consumption and sex:
  - Quantitative results
  - Qualitative results
- Other aspects of methamphetamine consumption behavior:
  - Substitutability with cocaine
  - Mode of ingestion
  - Period of use
  - Concurrent use of other drugs
  - Dependence

Methamphetamine Markets

- Methamphetamine acquisition
- Technical organization of methamphetamine markets: Location of transactions
- Technical organization of methamphetamine markets: How were transactions arranged?

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- Technical organization of methamphetamine markets: Packaging
- Technical organization of methamphetamine markets: Perceived quality
- Technical organization of methamphetamine markets: Problems with transactions
- Social organization of methamphetamine markets: Relationships with methamphetamine sources
- Social organization of methamphetamine markets: The role of “Dealers”
- Social organization of methamphetamine markets: Other non-concurrent drug use

The Methamphetamine Market And Social Networks

- Potential limitations of the network analysis
- Analyzing the network
- Network analytic measures employed
- Network variables significantly associated with methamphetamine market participation: Continuous variables
- Network variables significantly associated with methamphetamine market participation: Categorical variables
- Exponential Random Graph Methods analysis

- Methamphetamine markets and violence; and
- Methamphetamine markets and criminal justice.

In general, quantitative material on each topic is presented first, supplemented where useful by illustrative quotations and vignettes from study participants.

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Recruiting And Sample Demographics

Recruiting

In order to initiate the RDS sample chains (see discussion of RDS in the Methods section above), the research team placed 33 ads on craislist.org from February 2008 (to recruit Formative Research interviewees) through September 2009 (to recruit RDS seeds to initiate new recruitment chains). This drew many, many phone calls to the toll-free number the research team set up and 105 emails from potential participants. The researchers scheduled more than 300 appointments over the data collection period, with many no-shows and repeated re-schedulings around potential participants' often busy schedules. The research team also regularly placed flyers on bulletin boards at local MSM-oriented organizations, although no participants were recruited as a result of these flyers. Seeds were also recruited through a local harm-reduction program's Crystal Meth Support Group, the members of which proved to be prolific recruiters.

Figure 1 shows the RDS referral tree. Of the 132 subjects interviewed, 28% (37 individuals) were seeds in the RDS process. Of these 37 seeds, 38% (14 individuals) produced referrals.

More than seventy persons attempted to participate in the study who were in fact not eligible, as far as could be determined after screening. It is possible that some of those who did not pass the screener were persons who had in fact used or distributed methamphetamine in the previous thirty days, but the research team preferred to adopt a conservative approach to eligibility screening, in order to maximize the chances of gathering factual information. Many of the non-eligible participants were crack users unable to imagine a drug with such

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long-lasting effects, since the effects of crack are transitory. Examples of answers that failed the screener include would-be participants' claims to have bought methamphetamine in an "underground club" located at the corner of Crosby Street and13th Street (Crosby Street does not run nearly that far north) and a report from a person claiming to have smoked an "eightball" (3.5 grams) and being high for almost two hours (rather than the expected two *days*).

The project was unable to make the original sample target of 200 participants; after 20 months of recruiting, it was necessary for logistical reasons to end recruiting. It is possible that additional participants might have changed the results below. Possible limitations introduced by sample recruitment are discussed in the Limitations sub-section of the Discussion section below.

Recruiting in this study was much slower than in most RDS studies, with 24 seeds recruiting no one, although most of these had expressed near certainty that their network contacts would participate. In follow-up interviews with unsuccessful recruiters, the reason most often cited for non-participation was fear that the research team was in fact part of a secret law enforcement data-gathering operation, rather than a legitimate research study. The next most frequently cited reason was that potential recruits were too busy. Figure 2 adds links between participants discovered in follow-up interviews, where participants disclosed that their recruiter knew someone they recruited, for example.

However, one unexpected reason given by unsuccessful recruiters after additional probing in follow-up interviews was that some of their network contacts were unwilling to join the study because they were uncomfortable with being

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identified as MSM, more so than with being identified as illegal drug users and thus criminals. Given the importance of MSM activity in NYC methamphetamine markets, this unwillingness to be recruited because by so doing one might be "outed" as a participant in MSM activity might have influenced results; this is discussed this in the Limitations sub-section in the Discussion section below.

Because of issues arising from recruiting patterns and recent concerns about RDS analysis raised in evaluations, the present study presents results below analyzing all 132 study participants as a convenience sample, although RDS weightings and other RDS analysis results for all variables have been included in the Data Report Appendix.

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Sample Demographics

Almost all participants (91%) were men, with only 10 women and two transgender women (see Figure 3, the network by sex). Slightly more than half (54%) of participants were black, 23% were white, 20% were Hispanic and five persons were of other races (see Figure 4, the network by race). About half (49%) were MSM, 23% were MSM/W, 18% were MSW, 6 WSM, 4 WSM/W (see Figure 5, the network by sexual identity).

Table 1 Sample demographics

	Count	%
Age		
18-29	21	16
30-39	25	19
40-49	60	46
50-59	22	17
59+	3	2
Race		
Black	71	54
White	30	23
Hispanic	26	20
Other/Asian	5	4
Sex		
Male	120	91
Female	10	8
Transgender	2	2
Sexual Identity		
MSM	65	49
MSM/W	31	24
MSW	24	18
WSM	6	5
WSM/W	4	3
TG (M->F)	2	2
Birthplace		
NYC	54	41
Other US	64	49
Outside US	14	11

That study participants were predominantly male is not surprising, given that methamphetamine use in New York City seems predominantly tied to use among MSM as a sex drug. The first participant interviewed for the Formative

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Research stage of the study, when asked if he'd ever encountered any women when buying methamphetamine, replied, "No, but I never see women anywhere I go," and clarified that he didn't mean he didn't notice women, but that he lived in an all-male sub-culture. No participants were recruited who were women who have sex exclusively with other women, although 4 of the 10 female participants were women who have sex with both men and women; participants agreed they'd heard little about use among women who have sex with women only: "Why would lesbians do crystal? Do they even *have* sex?" (white MSM).

Table 2 Crosstab of sexual identity and race

	MSM	MSM/W	MSW	WSM	WSM/W	TG (M>F)	Total
Black	39	18	10	2	0	2	71
(% of *n*=132)	30	14	8	2	-	2	
White	15	5	8	0	2	0	30
(% of *n*=132)	11	4	6	-	2	-	
Hispanic	10	8	5	2	1	0	26
(% of *n*=132)	8	6	4	2	>1	-	
Other/Asian	1	0	1	2	1	0	5
(% of *n*=132)	>1	-	>1	2	>1	-	
Total	65	31	24	6	4	2	132

As can be seen in Table 2 above, the largest single group in this study was black MSM, followed by black MSM/W, and white MSM. It would not be reasonable to conclude from this that black MSM make up the largest group of methamphetamine market participants in New York City; by all indications that is simply not true- all other indications including qualitative data gathered in the

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present study[7], agree that white MSM are the largest group of users. This is one reason only bivariate analyses are presented below, and no data on, for example, participant incomes, education, or employment status is presented: there is every reason to believe that our sample, in addition to being blacker than the overall methamphetamine market participant community, is also poorer, less educated, and less likely to be employed. The accounts of methamphetamine use and market participation presented below represent the data that the study team believes provides the most accurate picture of the market, based on all data gathered, after "triangulation" among the qualitative, quantitative and social network data.

For purposes of analysis below (with one exception), differences are reported on among three subpopulations:

i. MSM: men who have sex with (only) men
ii. MSM/W: men who have sex with men and women
iii. Others, i.e. everyone else – including men who have sex only with women, women regardless of their sexual identity, and transgender persons.

The rationale for the Others category is that this category consists of all persons who do not engage in MSM sexual activity. The research team has adopted this typology because it is believed that the data indicate that the most important analytic distinction among members of the methamphetamine-using population in NYC is between those who use it as a sex drug in MSM activity (potentially, MSM

[7] Black MSM agreed that white MSM are the largest subgroup.

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and MSM/W), and those using the drug for other reasons or in other contexts. Initial analyses that binarized the study population by whether or not they participated in MSM sex (i.e., MSM and MSM/W constituted one analytic category, and all others (MSW, WSM, WSM/W, and Trans participants) constituted the other category), proved less analytically useful, as MSM/W often differ from MSM. Thus, the data below is presented according to the tripartite typology described above.

The data presented below also include analysis by race for some criminal justice variables, given that race is generally seen as a very important analytic category in US criminal justice research.

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Methamphetamine Consumption And Sex

Because of the importance of sexual activity in methamphetamine use as discussed in both the previously published literature and the formative research in the present study, it is useful to begin by examining what participants reported about methamphetamine use and sex. While majorities of participants in all sub-populations said their use of methamphetamine was centered around sex, participants who engaged in MSM sex (MSM and MSM/W) also often said that their sexuality centered around their use of methamphetamine.

Methamphetamine consumption and sex: Quantitative results

MSM use is centered around weekend-long bouts of "chem sex", with 91% of MSM reporting that their use of methamphetamine "is primarily around having sex", v. 61% of MSM/W, and 56% of Others (see table 3a).

Table 3a "Is your use of methamphetamine mostly around having sex or not?"

			Yes	Total
	Others	Count	20	36
		%	56%	
	MSM	Count	58	64
		%	91%	
	MSMW	Count	19	31
		%	61%	
Total		Count	97	131
		% of Total	74%	100%

The likelihood that participants would answer that their use of methamphetamine was primarily around having sex was very significantly (p=0, G= 0) associated with sexual identity in bivariate analysis**.** Almost all (91%) MSM said their use was centered primarily around having sex, while 61% of MSM/W and 56% of Others said this.

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Similarly, analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM population is very different from the MSM/W and Others populations: they are much more likely to say their use is primarily around having sex (see Table 3b).

Table 3b "Is your use of methamphetamine mostly around having sex or not?", Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0269758	0.0166714	0.0360389	0.0006731
X	0.0269758			*1.3359743*	
Y	0.0166714	*1.6180912*		*2.1617282*	
Z	0.0360389				
W	0.0006731	*40.074048*	*24.766248*	*53.537897*	

The majority (59%) of MSM participants reported they seldom or never have sex without using methamphetamine, while larger majorities of MSM/W and Others said the opposite (see Table 4a). Answering that one seldom or never has sex without using methamphetamine was significantly (p= .032, G= .031) associated with sexual identity in bivariate analysis.

Table 4a Participants saying they never or seldom have sex without methamphetamine, by sexual identity

				Total
	Others	Count	13	36
		%	36%	
	MSM	Count	38	64
		%	59%	
	MSMW	Count	11	30
		%	37%	
Total		Count	62	131
		% of Total	48%	100%

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Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM population is very different from the MSM/W and Others populations (see Table 4b).

Table 4b Participants saying they never or seldom have sex without methamphetamine, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0176028	0.0186161	0.033248	0.0058494
X	0.0176028		*1.0575617*	*1.8887873*	
Y	0.0186161			*1.785983*	
Z	0.033248				
W	0.0058494	*3.0093393*	*3.182562*	*5.6840017*	

Most MSM (57%) used methamphetamine with 80% or more of their sex partners (see Table 5a). The percentage of sex partners a participant used methamphetamine with was not significantly associated with sexual identity in bivariate analysis using a *p*-test (.061), but was significantly associated with sexual identity using a *G*-test (.04).

Table 5a Percentage of past month sex partners participant used methamphetamine with, by sexual identity

			0 to 20%	21 to 40%	41 to 60%	61 to 80%	81 to 100%	Total
	Others	Count	10	1	5	2	16	34
		%	29%	3%	15%	6%	47%	100%
	MSM	Count	2	4	12	9	36	63
		%	3%	6%	19%	14%	57%	100%
	MSMW	Count	6	2	6	3	13	30
		%	20%	7%	20%	10%	43%	100%
Total		Count	18	7	23	14	65	127
		% of Total	14%	6%	18%	11%	51%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM population is very different from the MSM/W and Others populations (see Table 5b). MSM are more likely to have used

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methamphetamine with all or almost all partners during the past month than are MSM/W or Others.

Table 5b Percentage of past month sex partners participant used methamphetamine with, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0176028	0.0186161	0.033248	0.0058494
X	0.0176028		*1.0575617*	*1.8887873*	
Y	0.0186161			*1.785983*	
Z	0.033248				
W	0.0058494	*3.0093393*	*3.182562*	*5.6840017*	

The number of past month sex partners was significantly (p= .001, G= .002) associated with sexual identity in bivariate analysis, with MSM and MSM/W having much larger numbers of partners than Others, and MSM/W having somewhat more partners than MSM. Almost half of Others had not had sex with more than one partner in the past month, where only 11% of MSM, and 16% of MSM/W, had only one partner.

Table 6a Number of past month sex partners, by sexual identity

			0-1	2-3	4-9	10 +	Total
	Others	Count	17	11	5	3	36
		%	47%	31%	14%	8%	100%
	MSM	Count	7	22	22	13	64
		%	11%	34%	34%	20%	100%
	MSMW	Count	5	8	10	8	31
		%	16%	26%	32%	26%	100%
Total		Count	29	41	37	24	131
		% of Total	22%	31%	28%	18%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the Others population is very different from the MSM/W and MSM populations (see Table 6b).

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Table 6b Number of past month sex partners, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0032186	0.0394421	0.0421801	0.0361886
X	0.0032186		*12.254497*	*13.105159*	*11.243646*
Y	0.0394421			*1.0694163*	
Z	0.0421801				
W	0.0361886		*1.0899042*	*1.1655614*	

Many MSM (37%) made use of internet hookup sites (craigslist, manhunt, adam4adam) to seek "P'n'P" ("Party [use drugs] and Play [have sex]") partners, and also sought partners through social networking with past and ongoing partners. Few MSM sought partners in any public place, including bars or clubs.

Table 7a Participants who seek methamphetamine-using sex partners online, by sexual identity

				Total
	Others	Count	4	36
		%	11%	
	MSM	Count	23	63
		%	37%	
	MSMW	Count	9	31
		%	29%	
Total		Count	36	130
		% of Total	28%	100%

Although majorities of all groups said they did not seek methamphetamine-using sex partners on the internet, MSM (37%; see Table 7a) and MSM/W (28%) were more likely to do so than Others (11%). Internet methamphetamine-using partner-seeking was significantly (p= .025, G= .016) associated with sexual identity in bivariate analysis.

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the Others population is very different from the MSM/W and MSM

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populations: MSM and MSM/W are much more likely than Others to seek partners online (see Table 7b).

Table 7b Participants who seek methamphetamine-using sex partners online, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0013888	0.0169215	0.0201264	0.0111694
X	0.0013888		*12.18461*	*14.492293*	*8.0426855*
Y	0.0169215			*1.1893933*	
Z	0.0201264				
W	0.0111694		*1.5149927*	*1.8019221*	

Methamphetamine consumption and sex: qualitative results

Many MSM and MSM/W said that it was essentially impossible to distinguish between their sex lives and their use of methamphetamine:

> It's a metamorphosis – you all don't start that way, it morphs itself into an addiction, the crutch that it becomes is that you become unable to get excited about sex or interested without it. It's like watching porn. It's part of the act, as much as kissing and touching. (MSM)

> Sex and meth is like the chicken and the egg, I wouldn't do it without the sex (MSM)

> It makes you horny. Without it, seems like I have no sex drive. (MSM)

> Because I don't have no sex drive, because I'm too tired. I don't care for sex without it, with crystal my sex drive is not dead, o yeah. (MSM)

> My sex is primarily around using crystal, at first it was the other way around. (MSM/W)

> I only do it because my boyfriend does it. Of course, if I broke up with him, I'd probably find another boyfriend who does that. (MSM)

> I had a normal sex drive before coke and crystal, but now I can't have a normal relationship. (MSM)

> If I want to have sex, I have to use crystal. (MSM/W)

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One MSM commented that “After about 3 years of use my interest shifted, it was less oriented to sex”, although he never has sex without methamphetamine.

Some MSW, WSM and WSM/W expressed similar sexual responses to crystal use:

> I’m in a steady relationship. If I get it [methamphetamine] I'm trying to have sex, my girl doesn't do it, but she likes to have sex with me when I do. (MSW)
>
> I do it for my boyfriend, for the relationship, you can’t drive a car without keys. (WSM/W)
>
> I become antisocial and look at porn on-line and masturbate compulsively. (MSW)

However, many more said it had little effect or made them less interested in sex:

> I feel like maybe more adventurous or it loosens me up, but not much effect, no major effect. (MSW)
>
> I wish it would happen [sex while using crystal] but the reality is it never came up. (MSW)
>
> I don't like sex on crystal. I don't have the sex drive that I have when I’m straight. (MSW)
>
> I don't really like being around too many people when I do that and I feel very awkward around females. (MSW)

Many MSM and MSM/W said they used methamphetamine during sex because of reasons related to self-esteem about appearance: “It makes me feel like a goddess.” (MSM); “It makes me feel more comfortable in my own skin” (MSM). One participant contrasted “drug gays” from “bar gays” and went on to say that the reason he preferred meeting men online was that “in gay bars, there’s too much S and M [usually an abbreviation for sado-masochism, of which he was an enthusiastic practitioner], you know, Stand and Model, with crystal it’s not

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so much about looks" (MSM). Four more participants (all MSM) went on to make the exact same joke during the course of the study.

One central reason for use of methamphetamine during sex given by MSM and MSM/W was lowered inhibitions and a sense of greater freedom:

> 'Cause your inhibitions are lowered, you have more sex and I get freakier. (MSM)
>
> It makes you lose your morals. It turns [heterosexual] guys gay and into intense bottoms [persons with a great desire for anal penetration]. (MSM/W)
>
> When you're high you'll have sex with people you wouldn't ever have sex with otherwise. (MSM)
>
> After crystal, there's no going back to the regular sex. The guys just don't act the same without it with it. They're more freaky [with crystal]. (MSM)
>
> I'm a sex addict when I'm on crystal. My morals go out the window. It's a must-have thing. You have sex with people, with people you wouldn't normally have sex with. (MSM/W)
>
> Dude, it brings the animal out in me. I smoke it, in 15 minutes I'm ready to go: "Who's first?" Three at one time, one, I don't care. I don't smoke crystal with my 2 steady partners. (MSM/W)

Another reason participants gave was that it made sex last much longer, making sexual encounters more worth the effort involved or more fulfilling because they were less ephemeral:

> With all the websites these days, I can find someone to [have sex with] any time, right away. But half an hour later, they're walking out the door zipping up their fly, and then where am I? With tina [the most common term for methamphetamine in the MSM community, most likely derived from the typical practice of selling the drug by the sixteenth of an ounce or "teener"], once you start, you're in for the long haul, for a session [of sex]. (MSM)

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> Do you know how long it takes me to get ready for sex? If I want to have sex on the weekend, I stop eating Wednesday night. I give myself enemas all day Friday so I have a clean [anus for sex], never mind my hair or whatever. After all that, do you think I want to have sex last just half an hour, fifteen minutes? (MSM)

Sex workers[8] who catered to MSM sex markets said it was useful to them in their work:

> I'm able to perform [with sex work "dates"] it makes me more freakier; it's either that or be a contortionist. (MSM)
>
> Sometimes I don't have a choice, the client wants me to be on the same level with them. (MSM)
>
> 'Cause it's like a stimulant. It's like a sex booster, makes your sex drive a whole lot better. You can keep going and go from partner to partner without resting. It's better than Viagra and it's actually cheaper, $10 [worth of crystal] will last 2-3 days, where a Viagra lasts way less for more money. (MSM/W)
>
> I depend on crystal for sex work to get my head in that frame. (MSM)
>
> My dates like it, I wouldn't spend my own money on it. (MSM)

One MSM sex-worker said he could only obtain crystal through his customers: "I want to find a way to get it without a [sex-work] date, but I don't know how to buy it." (MSM)

Although the interviewers did not ask participants any questions about their HIV status or condom use in this criminal justice study of methamphetamine markets, 34 participants spontaneously self-identified as HIV positive. Of those 34, 18 were MSM, 11 were MSM/W, and one was transgender. One participant said that "crystal makes my mind clearer, so condoms are going to be used"

[8] 30 participants disclosed doing sex work in the recent past: 18 MSM, 5 MSM/W, 4 MSW, 2 WSM/W, and 1 TG.

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(MSM); other participants said the opposite, that crystal use made them less likely to use condoms.

Eroticized injection

Four of the six MSM injectors reported on an interesting phenomenon, apparently hitherto unreported in the drug abuse or harm reduction literature: eroticized injection practices among some crystal-using MSM:

> For some guys, shooting up is a fetish… I first found out about this when I was online [video-]chatting with this guy in Germany and he wanted me to shoot up so he could watch and [masturbate]. (MSM)
>
> I always inject, usually it's during sex or right before, there's a point where I want to feel like I'm being controlled or controlling them and the drugs help with that… someone had tapes of a guy slamming [that we watched]. (MSM)
>
> For me, it's a fetish. Years ago, people would get squeamish when you would shoot up in front of them, now they like it. When I shoot up, I get hard. (MSM)

Further investigation as to eroticized injection online revealed that these participants were not alone in their behavior (however rare this behavior may be; it has been observed that the Internet fosters the development of micro-subcultures by connecting people who otherwise would have been isolated). One participant provided the name of a Google News group, "Gay Chem Slammers" (http://groups.google.com/group/gaychemslammers; the group has subsequently become a private "members only" newsgroup). The group's description says it is for "Gay men who like hardcore party favors. Guys slamming tina, crystal meth, and other chems." This newsgroup featured an extensive archive of user-posted "slam vids" of men (either naked or in fetish attire) injecting and then masturbating or having sex. Another site mentioned by participants was the

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"Chem Slammers" subsite on a site devoted to "barebacking" which featured some of the same videos, as well as additional similar videos, and a forum devoted to discussion of sado-masochistic "chem sex" among self-described "pigs", including use of Nazi, "White Power", and Satanist imagery as fetish stimuli, and also including discussion of deliberately "breeding" others with HIV through sexual activity. Google searches on "chem slammer" and similar terms turned up many other sites devoted to injection of methamphetamine as a sexual fetish.

The eroticization of injection within this small sub-sub-culture may be a reaction against "safe sex" anti-HIV campaigns, as "chem pigs" embrace a transgressive litany of the forbidden in a nihilistic semiotic collage, sharing syringes during condomless group sadomasochistic sex in Nazi/biker leather gear, systematically violating every taboo of both mainstream culture and a mainstream gay culture which deplores crystal use and unsafe sex. The inversion of mainstream values and embrace of the forbidden and transgressive is reminiscent of the 1970s punk culture's simultaneous rebellion against both the mainstream and the hippie counterculture (Hebdige 1979).

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Other Aspects Of Methamphetamine Consumption Behavior

Substitutability with cocaine

One issue with regard to consumption with important implications for market structure is the degree to which participants considered methamphetamine and cocaine to be similar substances and the degree to which they would be willing to substitute one for the other if their preferred substance was not available. Almost all participants agreed that one difference between the two was that the methamphetamine high is much longer lasting, producing less of a desire to repeat use soon after initial use as a consequence, and almost all agreed that this was one advantage of methamphetamine use over cocaine or, especially, crack use. However, MSM participants almost universally said the two substances were completely different because cocaine, while it might have some sexual effects, simply did not produce the overwhelming and long-term sexual response central to why they used methamphetamine:

> They're totally different. Don't send a boy to do a man's job. I never heard of anyone doing cocaine and wanting to have sex. (MSM)

> They're totally different because coke gives me an "I'm fiending" [wanting more drugs right away, like a "dope fiend"] thing. Crystal doesn't have me fiending. I'm like, "I've gotta get me a date, I've gotta get me a boy." Even the ugliest thing looks cute to you. You're fiending for sex, not drugs [on methamphetamine]. (MSM)

> When I first did tina, I was doing it like coke, setting up shot after shot, and it's the opposite of coke sexually. With coke you couldn't get it up with a crane. They're diametric opposites. (MSM)

> They're totally different. Coke is a high you can go out and party and dance with and it would numb me for sex. With crystal, I get a rush for sex and want to have sex. It gets me more freaky [sexually]. (MSM)

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Non-MSM study participants, on the other hand, often spoke of methamphetamine as cheaper or better than crack or cocaine (or, sometimes, the crack or cocaine currently available), not as a qualitatively different kind of drug:

> I use it for like a better crack high and then there's the sex element. (MSW)

> Coke you just have to shoot it and shoot it because the rush doesn't last. There's no use to shooting coke. The crystal you're up more, more, more [for a long time]. It's that crazy rush, that's why [I do methamphetamine], but it makes me pick my skin. They both cause a sense of euphoria, energy. The difference is the meth high is longer and the crash is not as severe. I'm not fiending wanting to go stealing things to get more. (MSW)

> [Methamphetamine] lasts longer and you don't have to spend so much money. The [immediate] rush lasts for 20 minutes, [the overall high] lasts longer. It's a better high. Nowadays, the crack is garbage, that's why a lot of people are going to tina. You can't get [good crack] unless you have a real good connect [source]. (MSM/W)

> It's about the same, but crystal give you a better feeling in [*sic*] and lasts longer. (MSW)

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Mode of ingestion

Mode of ingestion was not significantly associated with sexual identity in bivariate analysis (see Table 8a). Most participants (67%) smoked methamphetamine, with sniffing the second most prevalent consumption method. The popularity of sniffing varied by sexual identity, with MSM/W more likely to sniff (32%) than Others (22%) or MSM (18%). Injection was rare among all groups (8%), and slightly higher among MSM (10%; see discussion of injection of methamphetamine as a sexual fetish among a small subculture of MSM in the section on Methamphetamine Consumption and Sex above) and lower among MSM/W (3%). Only MSM reported any other means of ingestion besides smoking, sniffing or injection, with 5% reporting rectal ingestion of methamphetamine solution, usually done with a syringe with the needle removed, and known as “boofing” or “booty bumps”. The MSM who preferred this mode of ingestion all identified as “bottoms” (men who prefer a receptive anal sex role) and said that “boofing” greatly increased their desire for, and enjoyment of, prolonged anal penetration.

Table 8a Mode of ingestion, by sexual identity

			Inject	Other	Smoke	Sniff	Total
	Others	Count	3	0	25	8	36
		%	8%	0%	69%	22%	100%
	MSM	Count	6	3	42	11	62
		%	10%	5%	68%	18%	100%
	MSMW	Count	1	0	20	10	31
		%	3%	0%	65%	32%	100%
Total		Count	10	3	87	29	129
		% of Total	8%	2%	67%	23%	100%

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Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM population is different from the MSM/W and Others populations: they are the least likely to sniff, and more likely to inject or ingest the drug by "Other" means (see Table 8b).

Table 8b Mode of ingestion, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0157423	0.0049671	0.0079751	0.0048266
X	0.0157423				
Y	0.0049671	*3.169281*		*1.6055804*	
Z	0.0079751	*1.9739161*			
W	0.0048266	*3.2615575*	*1.0291159*	*1.6523284*	

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Period of use

Period of use was not significantly associated with sexual identity in bivariate analysis with this categorical variable (see Table 9). MSM were less likely than other groups to use for more than two days at a time, but also less likely to use for fewer than 6 hours. MSM were most likely to use for periods of more than 24 but fewer than 48 hours; this is consistent with the accounts of prolonged bouts of sexual activity typically taking place on the weekends that MSM participants described in response to qualitative questions about periods and timing of use.

Table 9 Period of use, by sexual identity

			Fewer than 6 hours	6-12 hours	12-18 hours	18-24 hours	1-2 days	Over 2 days	Total
	Others	Count	7	5	3	3	8	9	35
		%	20%	14%	9%	9%	23%	26%	
	MSM	Count	5	9	6	11	20	12	63
		%	8%	14%	10%	18%	32%	19%	
	MSMW	Count	3	5	1	6	7	9	31
		%	19%	16%	3%	19%	27%	29%	
Total		Count	15	19	10	20	35	30	129
		% of Total	12%	15%	8%	16%	27%	23%	100.0%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM and MSM/W are most similar; the Others population is different. Here, the ratios are <2, and thus the differences are not large.

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Concurrent use of other drugs

Most participants did not use any other drugs when they were using methamphetamine (see Table 10), although they were prolific users of other drugs at other times (see discussion of non-concurrent drug use below). Many participants (43%) drank alcohol sometimes while using methamphetamine, with a third smoking cannabis while using methamphetamine. Significant numbers (21%) reported that they preferred to use the drug without any other substances to complicate or alter the high. There was little variance in concurrent use of other drugs by sexual identity.

Table 10 Concurrent use of other drugs

	Count	%
Alcohol	57	43
Cannabis	43	33
GHB	7	5
Heroin	3	2
Cocaine/crack	11	8
Nothing else	21	16

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Dependence

Participants' self evaluation as to whether or not they were dependant (however they might choose to define that term) on methamphetamine at present was not significantly associated with sexual identity in bivariate analysis**.** A majority of MSM/W said they were not dependent, while MSM were almost evenly divided; those who are neither MSM nor MSM/W were slightly more likely than not to answer that they considered themselves dependant on methamphetamine use at present (see Table 11a).

Table 11a Dependence, by sexual identity

				Total
	Others	Count	19	36
		%	53%	
	MSM	Count	31	63
		%	49%	
	MSMW	Count	12	30
		%	40%	
Total		Count	62	129
		% of Total	48%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM/W population is very different from the MSM and Others populations: they are by far the least likely to consider themselves dependent on methamphetamine use (see Table 11b).

Table 11b Dependence, Shannon-Jensen ratios by sexual identity

	Bigger	**X**	**Y**	**Z**	**W**
Smaller		0.0018624	0.0009467	0.0002816	0.0035864
X	0.0018624				*1.9256557*
Y	0.0009467	*1.9673204*			*3.7883817*
Z	0.0002816	*6.6137836*	*3.3618233*		*12.73587*
W	0.0035864				

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Methamphetamine Markets

Methamphetamine acquisition

The frequency of methamphetamine acquisition was not significantly associated with sexual identity in bivariate analysis**.** Majorities of participants in all groups had acquired methamphetamine from 1-4 times in the last thirty days (see Table 12; participants had to have acquired methamphetamine at least once in the past thirty days to be eligible to participate in the study).

Table 12 Past month methamphetamine purchases, by sexual identity

			1-4	5-9	10-19	20-29	≥30	Total
	Others	Count	24	6	3	1	2	36
		%	67%	17%	8%	3%	6%	
	MSM	Count	41	12	9	2	1	65
		%	63%	19%	14%	3%	2%	
	MSMW	Count	18	5	3	3	1	30
		%	60%	17%	10%	10%	3%	
Total		Count	83	23	15	6	4	131
		% of Total	63%	18%	12%	5%	3%	100%

Shannon-Jensen divergence ratios between all subpopulations were all <2.

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Technical organization of methamphetamine markets: Location of transactions

Most transactions occurred in private locations, with sales from the supplier's home most common (37%), delivery to the purchaser second most common (35%), another supplier-controlled location (17%) third most common. Sales in public locations, such as on the street (7%) or in bars and clubs (5%), were rare. There was little variation by sexual identity in locations of transactions (see Table 13a).

Table 13a Location of last transaction, by sexual identity

			Bar/Club	Delivery	Other	Street	Supplier home	Total
	Others	Count	2	9	7	3	15	36
		%	6%	25%	19%	8%	42%	
	MSM	Count	2	23	12	4	24	65
		%	3%	35%	19%	6%	37%	
	MSMW	Count	2	14	3	2	10	31
		%	7%	45%	10%	7%	32%	
Total		Count	6	46	22	9	49	132
		% of Total	5%	35%	17%	7%	37%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM/W population is different from the MSM and Others populations (see Table 13b); note they are the most likely to buy via delivery.

Table 13b Location of last transaction, Shannon-Jensen ratios by sexual identity

	Bigger	**X**	**Y**	**Z**	**W**
Smaller		0.006208	0.0046647	0.0034891	0.0117226
X	0.006208				*1.8883047*
Y	0.0046647	*1.3308409*			*2.5130331*
Z	0.0034891	*1.7792542*	*1.3369398*		*3.359774*
W	0.0117226				

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Technical organization of methamphetamine markets: How were transactions arranged?

The very large majority (78%) of transactions are arranged by cellphone (see Table 14a). MSM are slightly more likely to report a source who hangs out in a public place, while Others are somewhat more likely to report a source who hangs out in a public place. There is no significant association between sexual identity and location of transactions.

Table 14a How last transaction was arranged, by sexual identity

			(s)he hangs out in private	(s)he hangs out in public	Cellphone	Other	Total
	Others	Count	4	2	29	1	36
		%	11%	6%	81%	2.8%	100%
	MSM	Count	5	8	48	4	65
		%	8%	12%	74%	6%	100%
	MSMW	Count	3	2	26	0	31
		%	10%	7%	84%	0%	100%
Total		Count	12	12	103	5	132
		% of Total	9%	9%	78%	4%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM population is different from the MSM/W and Others populations (see Table 14b). This reflects that MSM show a different pattern with regard to the roughly 20% of all transactions not arranged by cellphone: MSM are more likely in this case to report contacts who hang out in public places, while MSM/W and Others are more likely to report contacts who hang out in private places.

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Table 14b How last transaction was arranged, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0121623	0.0023489	0.005147	0.0042943
X	0.0121623				
Y	0.0023489	*5.1779501*		*2.191263*	*1.8282602*
Z	0.005147	*2.362998*			
W	0.0042943	*2.8321736*		*1.198551*	

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Technical organization of methamphetamine markets: Packaging

There is not great variation in methamphetamine packaging (see Table 15). A majority of purchasers bought their drugs in plastic Ziploc-type bags among all groups; Others were more likely to get their drugs in glassine bags like those in which heroin is sold in New York City (Wendel and Curtis 2000). No participants reported any distinctive packaging, logos, or "brand names" associated with any particular type of methamphetamine or source of the drug. Sexual identity was independent of packaging type at last transaction.

Table 15 Packaging of methamphetamine at last transaction, by sexual identity

			Foil	Glassine	None	Other	Plastic Ziploc	Total
	Others	Count	5	5	4	3	18	35
		%	14%	14%	11%	9%	51%	
	MSM	Count	7	0	6	10	42	65
		%	11%	0%	9%	15%	65%	
	MSMW	Count	1	2	3	3	22	31
		%	3%	7%	10%	10%	71%	
Total		Count	13	7	13	16	82	131
		% of Total	10%	5%	10%	12%	63%	100%

Shannon-Jensen divergence ratios between all subpopulations were all <2.

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Technical organization of methamphetamine markets: Perceived quality

Perceived quality of the drug obtained varies by sexual identity (see Table 16). MSM (82%) and MSM/W (84%) were more likely than Others (64%) to report that the quality of their last purchase was “Good” or “Excellent”; no MSM reported that their last purchase was of “Poor” quality.

Table 16 Self-report quality of last transaction, by sexual identity

			Poor	Fair	Good	Excellent	Total
	Others	Count	1	12	12	11	36
		%	3%	33%	33%	31%	
	MSM	Count	0	12	32	21	65
		%	0%	19%	49%	32%	
	MSMW	Count	2	3	14	12	31
		%	7%	10%	45%	39%	
Total		Count	3	27	58	44	132
		% of Total	3%	21%	44%	33%	100%

Shannon-Jensen divergence ratios between all subpopulations were all <2.

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Technical organization of methamphetamine markets: Problems with transactions

About half of all transactions were concluded with no problems across all groups (see Table 17a), with MSM slightly more likely to report problems in the course of the last transaction. The problems were primarily delays, not an inability to conclude the transaction.

Table 17a Problems in course of last transaction, by sexual identity

			No	Total
	Others	Count	19	36
		%	53%	
	MSM	Count	28	64
		%	44%	
	MSMW	Count	15	30
		%	50%	
Total		Count	62	130
		% of Total	48%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that MSM and MSM/W are most similar; the Others population is different (see Table 17b).

Table 17b Problems in course of last transaction, Shannon-Jensen ratios by sexual identity

	Bigger	**X**	**Y**	**Z**	**W**
Smaller		0.0001149	0.0010958	0.0005651	0.0001704
X	0.0001149				
Y	0.0010958				
Z	0.0005651		*1.9392807*		
W	0.0001704		*6.4308359*	*3.3160934*	

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Social organization of methamphetamine markets: Relationships with methamphetamine sources

About half of MSM (49%) got high and had sex with the person who supplied them with methamphetamine in the immediate aftermath of their last transaction. Sexual identity was independent of the social interactions surrounding the last transaction (see Table 18).

Table 18 Interaction with provider at last transaction, by sexual identity

			Get it and go	Got high and had sex	Got high together	Had sex	Socialize but not use	Total
	Others	Count	13	12	8	0	3	36
		%	36%	33%	22%	0%	8%	
	MSM	Count	20	32	11	1	1	65
		%	31%	49%	17%	2%	2%	
	MSMW	Count	15	10	6	0	0	31
		%	48%	32%	19%	0%	0%	
Total		Count	48	54	25	1	4	132
		% of Total	36%	41%	19%	1%	3%	100%

Shannon-Jensen divergence ratios between all subpopulations were all <2.

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Social organization of methamphetamine markets: The role of "Dealers"

About half of all methamphetamine transactions among all groups involved getting the drug from someone the participant did not consider to be a dealer; majorities of both MSM and Others reported getting the drug from someone who was not a "dealer", but rather from friends, sex partners, and other persons who were not perceived by participants as "dealers", although they performed that role— supplying drugs— and presumably would be chargeable with distribution offenses as a result (see Table 19a).

Table 19a Was the source of last transaction a "dealer"?, by sexual identity

			Yes	Total
	Others	Count	15	35
		%	43%	100%
	MSM	Count	26	65
		%	40%	100%
	MSMW	Count	16	31
		%	52%	100%
Total		Count	57	131
		% of Total	44%	100%

Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that Others and MSM are most similar; the MSM/W population is different: a small majority do purchase directly from dealers (see Table 19b).

Table 19b "Was the source of last transaction a "dealer"?", Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0029496	5.217E-05	0.0001882	0.0016507
X	0.0029496				
Y	5.22E-05				
Z	0.0001882	*15.676538*			*8.7731834*
W	0.0016507	*1.78687*			

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Almost everyone in all groups said their dealer was reliable: if they contacted him/her, they were pretty certain a transaction would take place more or less as planned (see Table 20a). Participants know an average of one dealer, although this number is skewed by the many who know no dealers and obtain methamphetamine solely through network contacts, and, on the other hand, by a small number of participants who know many dealers.

Table 20a "Is your dealer reliable?", by sexual identity

			Yes	Total
	Others	Count	18	19
		%	95%	
	MSM	Count	38	40
		%	95%	
	MSMW	Count	18	21
		%	86%	
Total		Count	74	80
		% of Total	93%	100%

Analysis of Shannon-Jansen divergence ratios among the subpopulations indicates that Others and MSM are most similar; the MSM/W population is different (see Table 20b).

Table 20b "Is your dealer reliable?", Shannon-Jensen ratios by sexual identity

	Bigger	**X**	**Y**	**Z**	**W**
Smaller		0.0176028	0.0186161	0.033248	0.0058494
X	0.0176028		*1.0575617*	*1.8887873*	
Y	0.0186161			*1.785983*	
Z	0.033248				
W	0.0058494	*3.0093393*	*3.182562*	*5.6840017*	

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67% report that their dealer sometimes sold other drugs as well as methamphetamine: 21 also sold cannabis, 12 sold ecstasy, 17 sold cocaine, 8 sold crack, 3 sold heroin, 6 sold GHB. Other drugs mentioned by participants included Viagra, Vicodin, Oxycontin and psilocybin mushrooms. Of course, given that more than one participant could be describing the same dealer, it is difficult to estimate the extent to which dealers in the methamphetamine market sell other substances other than to say it appears to be common, probably reflecting the fact that methamphetamine in New York City is a comparably unpopular drug with limited and uncertain wholesale availability. Distributors may be hedging by selling other substances that are both more popular and more easily available. Most likely, of course, availability and popularity are highly related, unless sanctions on the market are very effective.

Social organization of methamphetamine markets: Other non-concurrent drug use

Methamphetamine users in the sample were prolific users of other drugs, in addition to their methamphetamine use (see Table 21). In the discussion of concurrent drug use in the section on Methamphetamine Consumption above, drugs used at the same time as methamphetamine were discussed; here drugs used by participants in the last year, even if not used concurrently with methamphetamine, are discussed. Other non-concurrent drug use was not significantly associated with sexual identity in bivariate analysis, except in the case of ketamine (p=.05, G=.013). The very high levels of use of other drugs by most participants indicate that their participation in methamphetamine markets are not their only contacts with illicit drug markets.

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Table 21, Non-concurrent past year use of other drugs, by sexual identity

			Cocaine	Crack	Heroin	Ecstasy	Ketamine	Cannabis
	Others	Count	26	8	8	8	0	27
		%	72%	22%	22%	22%	0%	75%
	MSM	Count	47	11	11	22	9	51
		%	72%	17%	17%	34%	14%	79%
	MSMW	Count	20	8	8	10	2	23
		%	65%	26%	26%	32%	7%	74%
Total		Count	93	27	27	40	11	101
		% of Total	71%	21%	21%	30%	8%	77%

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Accounts from "dealers"

The research team was only able to interview three persons who were willing to self-identify as being current or past methamphetamine dealers in addition to being users. They represent three different aspects of the market: one dealer, a white MSM, worked in a socially-bonded (Curtis and Wendel 2000) dyad selling exclusively to MSM; another dealer, a Hispanic MSM/W, acted as a middleman when he provided methamphetamine to guests at his regular MSM sex parties (parties which drew both MSM and MSM/W guests, but no women); the third dealer, a black freelance/franchise (Curtis and Wendel 2007) dealer provided pre-packaged methamphetamine to a network of fellow users who were heterosexual or had sex with persons of both sexes.

The white MSM discusses his business, which was a part-time supplement to a legitimate business:

> I worked for my ex-lover and ex-boss [at a legitimate arts business]. He is a dealer too. I've known him for years, he was my boyfriend years ago… Normally we delivered. I was a runner for him for a few years. I took care of about 10 steady customers, all white gay men. We sold by weight, the price depends on the customer and the amount, but around $200 a gram. A new customer had to be an existing customer's sex partner and you had to show your penis or have sex with me, you [perform oral sex on me], I [perform oral sex on you]. Why would I want to sell you drugs if I didn't want to have sex with you?

This MSM distributor explicitly cited the closed sexual network nature of the MSM market as a security measure against law enforcement: "… I don't think the police are going to [perform oral sex on me] to arrest me for drugs!" The

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methamphetamine they sold came from a variety of sources, but primarily from a MSM "cook" running a small-scale lab in suburban New Jersey[9].

The MSM/W sex party promoter[10] mentioned above has weekly weekend-long sex parties where men use drugs and have sex. This participant self-identified as HIV positive, and explained that his HIV status entitles him to housing from the New York State HIV AIDS Services Administration (HASA); the sex parties are held in his HASA-provided apartment, or that of an associate; they rotate from apartment to apartment to avoid attracting too much attention to their activities. He describes how this all works: *"*At my sex parties, the dealer makes three deliveries of eight or nine bags [$20 bags] per delivery a night for 2-3 nights each weekend. We also get krills [crack] and weed from the same guy. We go all weekend. The people I be using with, I'm not attracted to these people, I'm high, [I'm erect because of the drugs], let's go! Something about smoking, getting money, something about that turn me on [sexually] too."

The freelance/franchise dealer is a black MSW low-level dealer, who gets fronted a few pre-packaged $20 bags by a Puerto Rican distributor and "flips them the same day", so he can pay his supplier. He mostly sells to finance his own use. Most of his customers are drawn from his network of acquaintances and their associates, most of whom are persons who do not participate in MSM sexual activity (Others). He finds new customers "because I knew they get high and they can't get it".

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[9] This is the only account or indication of local production the study team found. Most participants had no idea of the source of the methamphetamine they used; those who climed to know the source of the methamphetamine they consumed or distributed most oftened mentioned California as the source, often via express delivery sevices.

[10] He is the outlier in the purchase figures in the discussion section below.

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Although participants were very willing to discuss in detail their methamphetamine buying behavior, they were much more reticent about discussing supplying others with methamphetamine. This was especially notable given that so many had obtained their last methamphetamine purchase through the secondary market (i.e., through someone they identified as not being a dealer). Participants also indicated that the majority of their methamphetamine-using network contacts would be willing to supply them with the drug, even though they were not dealers per se. It seems likely that some of this reticence in discussing supplying others was grounded in a lingering fear that this wasn't really a legitimate research project, but a law enforcement effort to trick people into confessing their crimes. Participants were apparently willing to "confess" to drug buying and use, but not to supplying others.

Often in conducting qualitative research on topics where there may be perceived social pressures to give socially desirable responses, participants will contrast their own virtuous norm-regarding behavior with the less-virtuous behavior of their peers: for example, *they* don't provide their friends with drugs, but their peers do. Whether this is in fact true, or whether discussing "those other people" provides a narrative frame through which participants can discuss their own behavior without fearing that their interviewer will think less of them[11] is a difficult question.

Because so few participants were willing to discuss supplying others in this secondary market (while making clear that they themselves often depended

[11] Compare Maher's (1997) gradual realization that the "$5 girls" universally excoriated by the Bushwick sex workers she studied were in fact all of them when sufficiently desperate.

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on others to do just that), the research team did not engage in extensive quantitative analysis of participants' accounts of supplying others. See the Discussion section on the secondary market for more on this issue.

When interviewers asked participants to characterize the members of their social networks who use or distribute methamphetamine, it was found that the average study participant knows seven other methamphetamine users' phone numbers. MSM had many more methamphetamine-using contacts, with an average degree of 18 v. 5 for non-MSM. 60% of participant methamphetamine-using phone contacts would provide methamphetamine, even though they are not "dealers": 88% of male contacts, 11% of female contacts, and 1% of transgender contacts. Of participant network contacts that were male, 80% were MSM or MSM/W and 20% were men who do not have sex with other men. 48% of participant contacts were white, 26% were black, and 3% were Asian/Other race.

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The Methamphetamine Market And Social Networks

This section will explore the role of social networks in methamphetamine markets in New York City using Social Network Analysis techniques[12]. The SNA component of the network analysis is based on:

1) The RDS recruitment network, supplemented by linkages discovered through follow-up interviews (the RDS network is discussed in the section on Recruitment above);
2) The RDS network plus follow-up links, expanded by adding links between participants discovered through the matching procedures discussed in the Methods section above and in Appendix 3;
3) The expanded network in 2 above, expanded still further by the addition of the expanded network of third-party contacts (those outside the sample) of participants discovered through matching.

Figure 1 provides a visual representation of the fully expanded network (3). In it, each arrow represents a network connection or link; the direction of the arrow for each connection indicates the direction of the report, i.e., an arrow from node (participant) A to node B indicates either that A gave an RDS coupon to B, or that a report by A of a close contact in the network matched the description of B, as described above in the Methods section and in Appendix 3.

A second view of the network is provided in Figure 2. Here the network has been "energized" with a Kamada-Kawai algorithm, which moves well-connected individuals to the center of the diagram, and those with fewer ties to the edges. In the diagram below, color indicates the recruitment class of each

[12] This section necessarily uses a considerable amount of SNA terminology. Some more technical material on procedures employed in generating the expanded network appears in Appendix 3 in order to make this section more reader-friendly.

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individual: i.e. whether they were a RDS "seed", a "recruit" brought into the study via coupon referral from a previously interviewed subject, or an "external" member of the network, inferred through the matching process but never interviewed by the research team.

Social Network Analysis was undertaken on this network to determine whether the patterns and form of connectivity were related to other research variables, and if so, to determine what those relationships were.

Potential limitations of the network analysis

Before discussing the results of that analysis, however, some words of caution are required. As noted earlier in this report, while the research team has high confidence in the data collected in this study, there remain strong and valid reasons to doubt the representativeness of the network discussed and analyzed here for the actual network of methamphetamine use in New York City. Several reasons for this have been discussed thus far, including the question of the reliability of coupon recruitments as indicators of co-use, and the cap on "out degree" reports that were used to produce the matching links. Given the average higher co-use degree of MSM subjects in the study, this cap on out degree reports is likely to introduce a systematic bias in the connections of this sub-population—namely, a systemic failure to discover actually existing links among this group. For this reason, the network as analyzed below is likely to be less dense, and to contain fewer MSM connections than actually exist in the New York use network. These "false negatives"—where an existing connection among network members is missing in our sample network—are also supplemented by "false positives" or, as they are referred to later in this section,

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"false matches". As discussed in more detail below, such a situation could occur when a matching report from one research subject identified (by description) another research subject—and thus a connection was made between them in the expanded network (3). However, because the matching system used to connect subjects in the study involved standardized descriptions of individuals, and given the size of the methamphetamine use network in NYC, it is likely (indeed certain) that reports intended to describe a connection outside the 132 research subjects also matched a subject within that group. In this case, a connection between the subject making the report, and the inferred contact within the group, represents a connection in the representative network that does not exist in the actual user network. So, while the risk of "false negatives" implies that some connections that exist in the actual network are missing from our diagram, the risk of "false positives" implies that some of the lines in our diagram may not exist in the actual network. These concerns are added to more standard concerns about network sampling[13].

[13] Missing data pose serious problems for social science research, now and in the past (Little and Rubin, 2002). Yet as Huisman (2009) has recently pointed out, the problem is perhaps more acute in social network analysis, as the absence of a small number of edges or vertices can seriously distort research results (though see Borgatti, Carley, and Krackhardt 2006), while the extent of the missing data is often unknown. Burt (1987); Stork and Richards (2002); Ghani, Donnelly, and Garnett (1998); Butts (2003); Costenbader and Valente (2003); Kossinets (2006); Huisman and Steglich (2008) and Huisman (2009) have recently discussed the manifold factors that limit the reliability of network data: factors such as network boundary specifications, inherently incomplete data collection methods, imposed limits on vertex degree in data collection, and various forms of response error (including especially non-response). Together they show that, in most cases, even where the extent of the missing data are known, the problems associated with them remain significant and undermine confidence in analyses that ignore the issue. And while experiments have shown some parameters to be more resilient in the face of missing data than others (Costenbader and Valente, 2003; Kossinets, 2006), the limits presented by the general incompleteness of network data remain a major barrier to the vast majority of network analysis protocols. Ethical issues around name generators in sensitive contexts, as was encountered in this research, and the rising costs of complete network surveys only make matters more complex (Borgatti and Molina, 2003; Harris, 2008). Large networks in particular represent

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Given these limitations, the discussion below must be treated as highly speculative, not primarily because of the analytical methods used, but mainly because of concerns over the representativeness of the network upon which the analysis was carried out.

Analyzing the network

While the survey variables are discussed elsewhere in this report, the purpose of this section is to discuss the results of the network analysis undertaken and the relationship between network-based variables and those arrived at through the interviews. A network-based variable is a characteristic of an individual research subject that is based upon their place in the network. An example would be "degree"—the total number of connections of any individual in the network. A person with 3 outgoing connections, and 2 incoming connections would have a total degree of 5, an output degree of 3, and an input degree of 2. As above, subjects were limited in their listing of total output degree connections (how many connections they could identify) to a maximum of 5. But their input degree is, at least in theory, limited only by the size of the network; that is, the number of people who could potentially identify him/her as a connection was limited only to the number of people interviewed. In actuality no one was identified by every person in the network, though several people were identified by more than 5 others. Other network-based individual variables beyond degree will be discussed below.

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daunting problems for both cost and reliability, and represent challenges out of scale with their increase size, as they pose radically different challenges to boundary specification and traditionally more reliable methods such as in-group rosters.

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In the following section, all analyses were done on the expanded network—and all network-based variables were calculated using all of the nodes and connections depicted above in Figure 1. However, in determining the relationship of the network-based variables to other variables obtained directly in the interview, comparisons and correlations were measured only for those subjects interviewed in the project. None of the relationship testing involved the network-based measures of those 63 inferred individuals added to the network via the matching process discussed above. So while their presence in the network does influence the value of network-based measures for all 195 nodes, the correlations and other analyses mentioned below are determined only for the 132 research subjects.

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Figure 1 Fully Expanded Network (3) Showing Seeds (top), Recruits (center) and Inferred Connections (bottom)

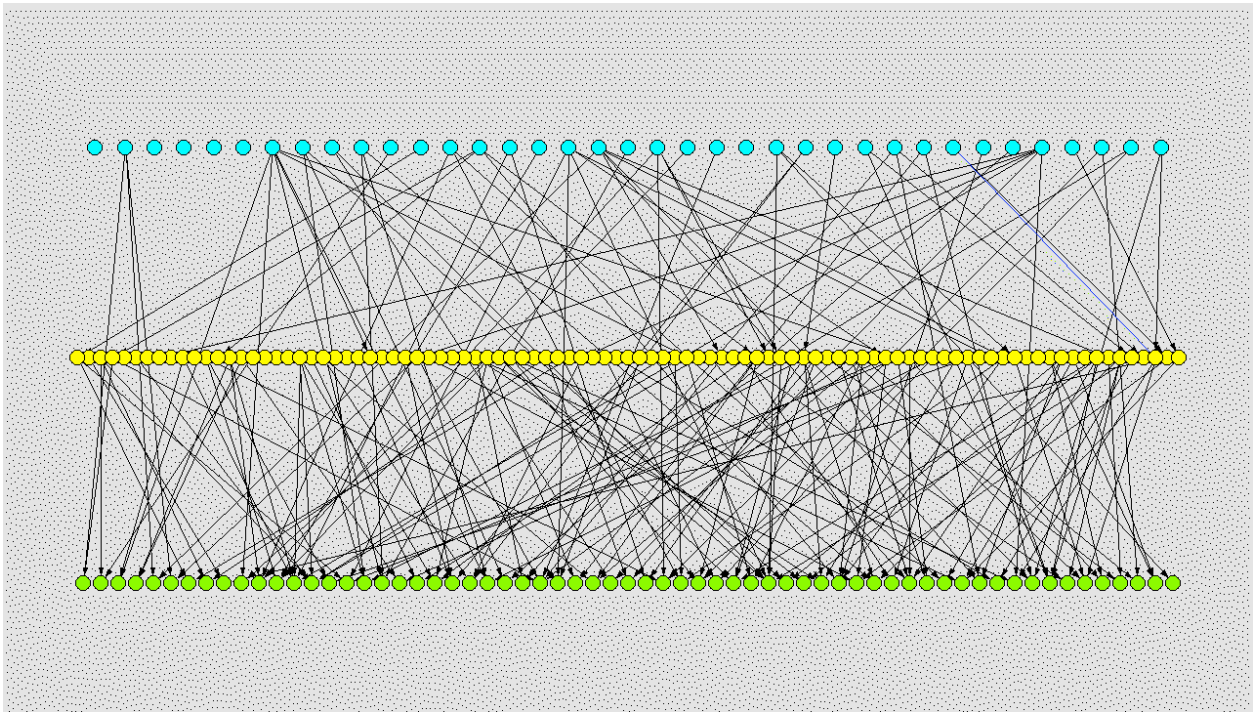
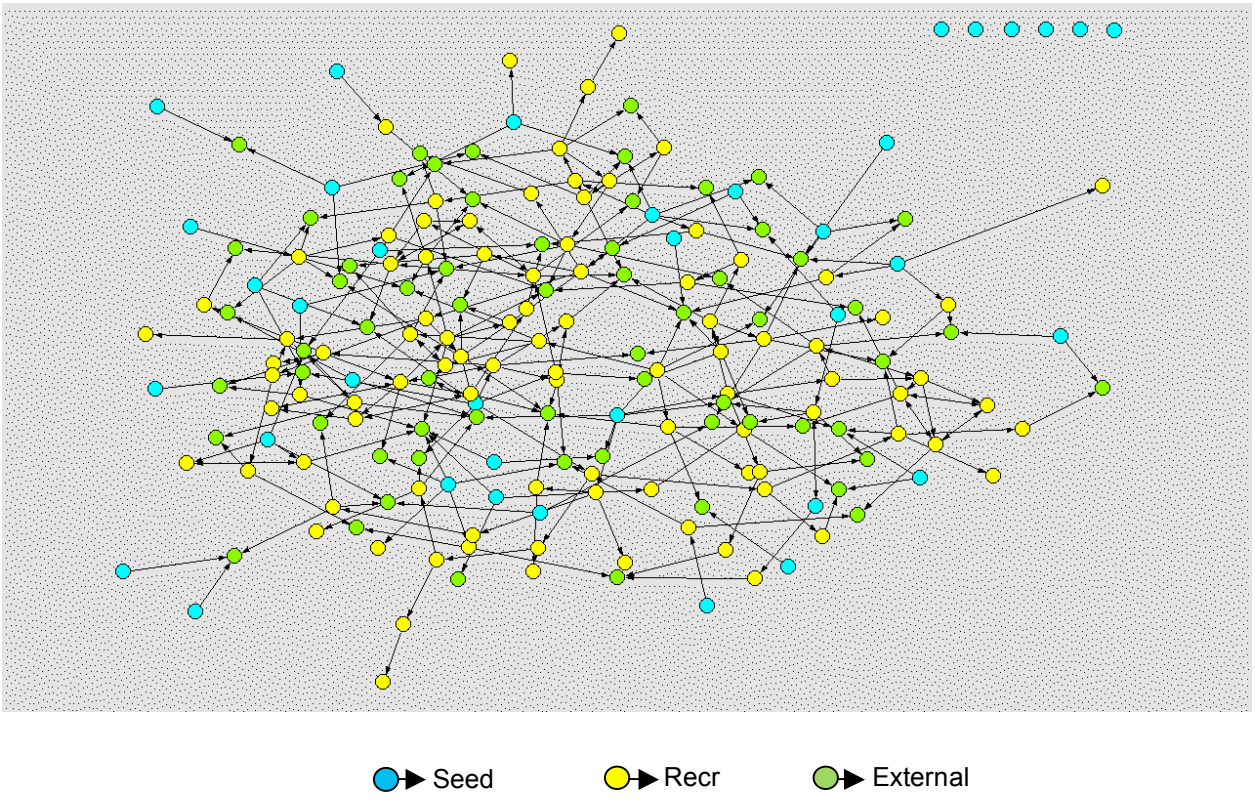


Figure 2 Fully Expanded Network ((3) in the Discussion Above)



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Network analytic measures employed

The network was analyzed for several network-based measures:

- **Total Degree**—a count of total number of connections incident with a particular network node, the total of their input degree and output degree combined
- **Input Degree**—the total number of connections leading "into" a particular node
- **k-Core Membership**—where the network is divided into groups such that all members of the group contain at least a minimum number of connections to others in the same group; thus all members of the "1 core" have at least 1 connection to someone else in the same group who also has at least 1 connection to someone in the group. This measure seeks to find groups of highly connected subnetworks who share a great many connections to one another.
- **Input k-Core Membership**—similar to k-core membership, but here using only in-coming connections in determining connectivity.
- **p-Clique Membership**—where the network is divided into groups whose individuals are completely connected to one another, meaning that every person in a group is connected to all other members of that same group. This is a more restrictive measure than k-core membership.
- **Strong p-Clique Membership**—similar to p-clique (above) except that each member of a group is connected to all others directly by a connection originating with them and ending in another member of the group. This is a highly restrictive measure of subgroup membership.
- **Strong Component Membership**—where the network is divided into groups whereby every member of the group is "reachable" by every other member of the group via connections whose "direction" is indicated in the diagram with an arrow.
- **All Closeness Centrality**—a measure of how far any particular node in the network is from all others, as determined by the shortest path between them. In this measure, all connections are treated as "two-way" streets,

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meaning that their direction is irrelevant. A high closeness centrality score means that the particular node in the network is very "close" to all the others and thus very "central"; a low score means that the particular node is "far" from most of the other nodes in the graph and thus is very "peripheral", where distance in both cases is determined by the number of network steps necessary to reach from one to the next.

- **Input Closeness Centrality**—similar to All Closeness Centrality, this measure determines distance using the connections as though the direction of their arrows matters. In this measure, the distance is determined by the number of steps to all other nodes while treating connections as "one-way" streets.
- **Betweenness Centrality**—a second centrality measure that treats connections as conduits for information or transaction. A high betweenness centrality score indicates that, should information flow evenly across the network via the shortest possible paths, a large amount of the total information flowing between any two points in the network would necessarily flow "though" that particular node.
- **Aggregate Constraint**— measures how dependent one node is on a particular neighboring node for connection to the rest of the network. A node that is connected to the rest of the network by only one connection is said to be highly "constrained" by the node on the other side of that connection. A node with many connections to the network is seen to have many alternatives when accessing the network, and thus to be relatively unconstrained by any particular one of them. This node would have a low "constraint" score.
- **Input Domain**—a measure of what proportion of the rest of the network flows "into" that particular node. Thus if A→B→C→D; then A,B, and C are all part of the input domain of D, while B's input domain is limited to A only, And A has an input domain of Ø.

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These network variables were compared with other variables collected in the interviews including:

- Self-identified number of people in network;
- Size of MSM network;
- Number of others one uses methamphetamine with;
- Age;
- How often the subject obtained methamphetamine for someone in the last 30 days;
- How often obtained in the last year; how often they use methamphetamine;
- How often they provide methamphetamine for others to use;
- The combined total of how often use and how often provide;
- The number of dealers they reported knowing;
- Their number of sex partners in the last year; sex partners in the last month;
- Their number of sex partners with whom they used methamphetamine in the last month;
- Sex partners with whom use methamphetamine in the last year; and
- An aggregate of their total number of methamphetamine use and sex partners.

In each case a relatively simple measure of association, Pearson's r correlation was used. This measure was chosen for its ability to find broad relationships for further investigation, while still maintaining meaningful error scores.

In addition, in order to determine whether categorical variables, like gender or race, were related to the above network-based variables, the network-based variables were "binned" into relatively uniform sized groups (to the extent possible while maintaining the meaningfulness of the variable itself) and a series of statistical analyses done to determine whether any relationship existed

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between the two sets of categorization. In this case, Cramer's V (with Chi-Square) analysis was undertaken, and as an extension, Rajski's measure of the ability of one set of category memberships to predict placement in the other was also employed.

Network variables significantly associated with methamphetamine market participation: Continuous variables

Altogether, relatively few network variables bore significant relationships with the continuous variables concerning methamphetamine market participation gathered in the interviews. Those that did are available in Table 22.

Before commenting directly on the results shown in the table, it is worth noting that a number of perhaps expected network characteristics did not figure significantly in relation to the material captured in the interviews, including the several "core" measurements aimed at discovering highly connected clusters within the network (including k-cores, p-cliques, strongly connected components). It is not that cores do not exist in the network, however. Figure 3 shows a rendering of the k-cores of the network, including two distinct "3-cores" in the center, which appear at the top of the graph. The network graph has been energized with the Kamada-Kawai algorithm, with three dimensional rendering according to core membership.

From this it can be said with some confidence that, to the extent that the network analyzed here corresponds to the NYC methamphetamine retail/use market, that while significant cores do exist, core members of the network are not distinct from those in the periphery in terms of the variables analyzed here (number of partners, transactions, and self-reported network behavior). Also

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interesting is that constraint was not correlated with a single interview variable. This fact points to the opposite end of the scale, namely that those on the relative margins of the network are not distinct from those in the center in terms of the data collected in the interviews either, or perhaps better, that their marginal position is not reflected in different knowledge of the network or self-identified position within it.

In terms of the correlations that did appear in the network, one can see that while overall degree-related measures were of little significance, those that accounted mainly for input factors appeared as significant quite often—most notably: input degree, input closeness centrality, and input domain. As above, given the limits imposed by the study on output degree, it is possible that distortions in the overall degree resulted from those outdegree limits, and skewed the total degree distribution in a way not reflected in input degree.

Yet just as interesting is the extent to which input related measures (input degree, input closeness centrality, and input domain) were primarily *negatively* correlated with data collected in the interviews. The most clear in this regard is input degree. The negative correlation here with such self-identified data as number of people in network, number of people use with, count of total methamphetamine use partners, the number of dealers known, and the total count of methamphetamine sex encounters in a year, would suggest that those with the highest number of incoming connections (and thus network partners) reported the least number of partners while those with few partners systematically reported higher numbers of connections.

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One possible interpretation of this is that this network includes a number of “semi-dealers”—persons who do not identify as “dealers”, but who often provide methamphetamine for others. The profile of such a person would be that they say they obtain methamphetamine often, say they know few dealers or sources, say they use methamphetamine with few others, are older, and, significantly, they are named as network contacts by more people than they name as contacts. This network of “semi-dealers” is entirely consistent with both the qualitative and the quantitative data on the structure of the market described above, and provides further evidence bolstering the contention that study participants in fact supply others with methamphetamine more often than they were willing to admit.

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Table 22 Significant Correlations Between Network and Study Variables

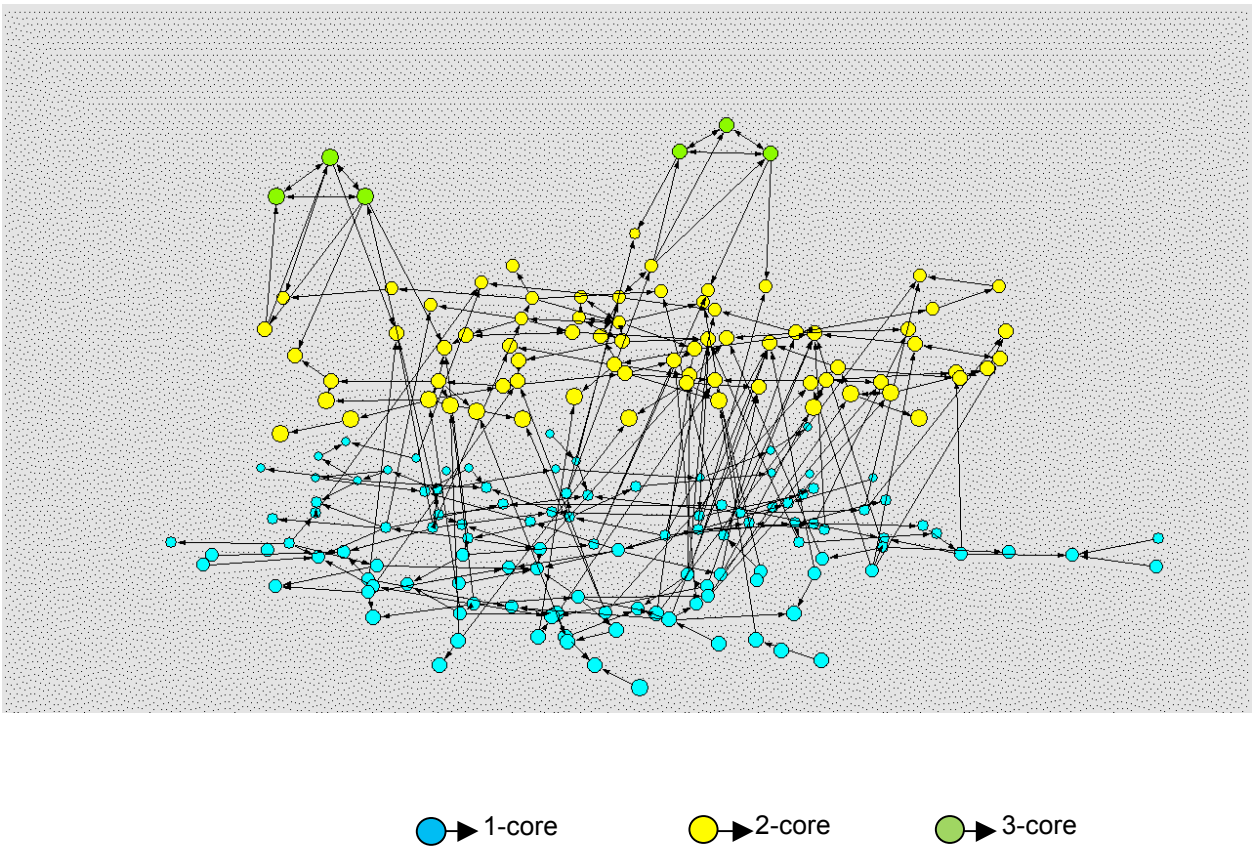
Network Variable	Study Variable	Pearson's Correlation	Sig. (2-tailed)	Confidence Interval
All Closeness	Age	.178	.042	.05 level
All Closeness	MethSex	.223	.01	.05 level
Input Domain	People in Network	-.203	.030	.05 level
Input Domain	# Use With	-.239	.013	.05 level
Input Domain	Age	.210	.016	.05 level
Input Domain	How Often Obtain Month	.310	.000	.01 level
Input Domain	How Often Obtain Year	.261	.003	.01 level
Input Domain	Count Use Meth	-.199	.022	.05 level
Input Domain	Count Dealers	-.283	.001	.01 level
Input Domain	Count Meth Sex Month	.182	.038	.05 level
Input Domain	MethSex	.200	.022	.05 level
Input Degree	People in Network	-.245	.009	.01 level
Input Degree	Number Use With	-.278	.004	.01 level
Input Degree	Age	.232	.008	.01 level
Input Degree	Count Use Meth	-.264	.002	.01 level
Input Degree	Count Provide Meth	-.195	.027	.05 level
Input Degree	Count Dealers	-.254	.004	.01 level
Input Degree	Count Meth Sex Year	-.190	.030	.05 level
Input Closeness Centrality	People in Network	-.256	.006	.01 level
Input Closeness Centrality	Number Use With	-.294	.002	.01 level
Input Closeness Centrality	Age	.255	.003	.01 level
Input Closeness Centrality	Count Use Meth	-.274	.001	.01 level
Input Closeness Centrality	Count Provide Meth	-.221	.012	.05 level
Input Closeness Centrality	Count Dealers	-.334	.000	.01 level

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Network Variable	Study Variable	Pearson's Correlation	Sig. (2-tailed)	Confidence Interval
Betweenness Centrality	Age	.180	.040	.05 level
Betweenness Centrality	How Often Obtain 30 Days	.178	.042	.05 level
Betweenness Centrality	Count Dealers	-.205	.020	.05 level
Betweenness Centrality	MethSex	.184	.036	.05 level

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Figure 3 k-Core Decomposition, showing distinct 1-, 2-, and 3-cores



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It is also worth noting that the answers received from interview subjects on these topics were generally internally consistent. The number of people reported in a subjects network was highly correlated with the number of MSM in their network (r=.700, p=.000), the number of others they use methamphetamine with (r=.594, p=.000), the Count Use Meth (r=.699, p=.000), the number of people they provide with methamphetamine (r=.496, p=.000) and the number of dealers they reported knowing (r=.451, p=.000). Similar results held between these categories as well.

Network variables significantly associated with methamphetamine market participation: Categorical variables

Beyond the analysis with continuous variables, network measures were tested against categorical variables including: race, gender, sexual identity, participation in illegal activity, HIV status, and relationship to methamphetamine source. Three statistical measures were used in this comparison: Chi-Square analysis, Cramer's V, and Rajski's Information Theory Matrix.[14] The Chi-Square test is a common statistical measure of matrix comparison, where expected versus actual overlaps in two categorical distributions is used to produce a measure of fit. The meaning of the Chi-Square statistic is dependent on the number of degrees of freedom in the matrix.[15] Cramer's V is a [0, 1] range post-test on the Chi-Square values. Normally Cramer's V can be used to determine

[14] One common categorical comparison is Spearman's Rank Correlation. However, this measure only makes sense when the two variables are ordinal, i.e. ordered or ranked. It cannot be used for arbitrary categorical encodings such as gender or race, or the other categorical variables used here. See Kendall, M.G., Stuart, A. (1973) The Advanced Theory of Statistics, Volume 2: Inference and Relationship, Griffin. ISBN 0852642156 (Sections 31.19, 31.21).

[15] See: http://www.ma.utexas.edu/users/davis/375/popecol/tables/chisq.html

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the significance of the Chi-Square value, such that a V~1 indicates a high degree of association in the Chi-Square value, and V~0 indicates a low degree of association in that value, somewhat like the Pearson's r (correlation coefficient) used above in the treatment of continuous variables). However, in cases where the categorical distribution of the data is uneven (such that some of the overlapping matrix cells contain low expected/actual values, Cramer's V is known to be less reliable.[16] For this reason, many of the network variables and study variables were binarized. This produces fewer degrees of freedom in the comparison, and allows us to use Cramer's V as a measure of significance.[17]

The binarizing of study and network variables is less radical than it may seem. In the gender category, transgendered and female participants were grouped together, as all transgendered participants in the study were female-to-male transgendered. Likewise, as has been proposed elsewhere in this study, sexual identity can be grouped into those who have sex exclusively with men and those who do not. Many other variables were already [0,1] distributions, such as

[16] See: H. Cramér, Mathematical Methods of Statistics, Princeton University Press, 1999.

[17] Another possible comparison is Rajski's C comparison (a somewhat more obscure statistic implemented in the network analysis program Pajek used here) that tests the functional dependency of one categorical distribution on another. Like Cramer's V, it is a [0,1] range post-test analysis where C~1 indicates that the clustering of nodes within categories in one network is a good predictor of their placement in a second network (i.e. that clustering within distributions is maintained). C~0 indicates the opposite, that the clustering in one categorical distribution is not a good indicator of clustering in another. In most cases Rajski's C is used in time series analysis, to determine to what extent a later distribution reflects an earlier one, while the categories remain constant. That makes it less useful in this case as a raw measure of similarity. One interesting component of the statistic though, is that Rajski analysis usually provides three measures: C1→C2 (the extent to which the clustering of nodes within categories in C1 predicts the clustering in C2); C2→C1 (the extent to which the clustering of nodes within categories in C2 predicts the clustering in C1); and C1←→C2 (the extent to which the two can be said to predict one another. Looked at in this way, Rajski analysis can provide suggestions (but only suggestions) about the relative extent to which one distribution predicts the other, i.e. whether C1 is a better predictor of C2 than vice versa. It use in this analysis will be limited to this function. We note that in all of the comparison's undertaken here, no significant difference was found between C1→C2 and C2→C1 values.

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HIV status and "Was last transaction with a dealer?". Network variables were bifurcated in such a way as to produce meaningful categories of adequate size for comparison. Thus input closeness centrality, for example, originally showed the distribution illustrated in Tables 23a and b.

Table 23a Distribution of Input Closeness Centrality Used To Produce Categorical Distribution or "Bins"

Input closeness centrality (195)	
Dimension	195
The lowest value	0.0000
The highest value	0.0462
Sum (all values)	2.5813
Arithmetic mean	0.0132
Median	0.0127
Standard deviation	0.0089
2.5% Quantile	0.0000
5.0% Quantile	0.0000
95.0% Quantile	0.0257
97.5% Quantile	0.0330

Table 23b Input Closeness Centrality Categorical Distributions or "Bins"

VectorValues	Frequency	Frequency%	Cumulative Frequency	Cumulative Frequency%
...0.000	36	18.4615	36	18.4615
0.000 ...0.015	81	41.5385	117	60.0000
0.015 ...0.031	71	36.4103	188	96.4103
0.031 ...0.046	7	3.5897	195	100.0000
Total	195			100.0000

From this distribution, the measure can be split in two "bins": from >0.000-0.015 (with 117, or 60% of the vertices) in the first bin, and 0.015-0.046 (with 78, or 40% of the nodes) in the second bin.

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By way of example, then, an analysis of the distribution of Race (C1, in four categories: Black, White, Hispanic, Other) to Betweenness Centrality (C2) of the nodes in the network, (where the latter has been "binned" into four roughly even categories) produces the following statistics: Chi Square =17.602, Cramer's V=0.173. These statistics indicate a somewhat significant fit, as the Chi-Square value of ~18 with 9 degrees of freedom gives us a confidence interval of p=.05. However, in this case the V statistic (V=0.173) would seem to indicate that the amount of variation explained by the Chi-Square fit is rather low.[18]

In general, with a 2x2 comparison matrix, a Chi-Square score >3.84 is considered significant to the p=.05 level, the cut off used in the analysis of continuous variables above. Categorical analyses are restricted to that confidence interval as well. Table 24 lists the significant associations for categorical variables.

Before moving on to observations available in Table 24, it is worth noting that no significant categorical association was found between network variables and gender, illegal behavior, or recent arrest. These issues seemed to have no association with network position or role.

[18] A Rajski analysis indicates a poor ability to predict from one distribution to another, with no strong indication of directionality. From the three measures, then, we can conclude that race is not a particularly good predictor of network location or vice versa, when network location is measured by betweenness centrality.

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Table 24 Categorical Variables Associated with Network Statistics

Network Variable	Study Variable	Chi-Squared	Significance	Cramer's V
Betweenness Centrality	Race	13.66	.001	0.265
Input Domain	Race	5.02	.05	0.160
Aggregate Constraint	Sexual Identity	4.75	.05	0.190
Strong Component	Sexual Identity	5.43	.05	0.203
P-Clique Membership	Sexual Identity	6.73	.01	0.226
All Core Membership	Sexual Identity	6.73	.01	0.226
Input Degree	Sexual Identity	3.88	.05	0.172
Input Domain	Meth with Last Sex	9.04	.01	0.262
Input Domain	Source Was Dealer	4.28	.05	0.181
Input Domain	HIV Status	5.16	.05	0.200
Input Closeness Centrality	Source Was Dealer	13.36	.01	0.319

The most frequent individual categorical distinction to figure significantly in association with network variables is Sexual Identity. Of primary interest are its association with aggregate constraint (again, a measure of how many options one has in the network to get or give information), and three cluster memberships (strong component, p-clique, and k-core). These associations would seem to indicate that sexual identity is a primary consideration in determining membership within highly connected network clusters. In each case the significance of Chi-Square statistic is high (95% confidence interval or above). The Cramer's V statistic for each of these is, however, relatively low, though on a par with the correlation scores discussed for continuous variables above. This

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would indicate that while it is clear that an association between these network factors and sexual identity is certain, the association itself is not highly determinative. Many other factors obviously contribute to core membership.

The second most important categorical factor for determining network position appears to be race. In particular, race was strongly associated with betweenness centrality (as above, a measure of how central one is to information or material flows within the network). A diagram of the network depicting betweenness centrality can be found in Figure 4. There the network depicted above is redrawn with the size of each node drawn in proportion to their betweenness centrality (such that larger circles indicate a more significant position on the paths through which information or materials flow), while the color of each node is determined by race. As can be seen there, subjects self-identifying as black play a critical role in network flows, as reflected in high betweenness centrality scores (and thus larger node depictions).

These findings—that sexual identity is a more important determinant of network position than race—are consistent with, and provide additional support for, the argument presented throughout this report that sexual identity is the most important factor with regard to defining a methamphetamine user's relationship to the drug and to the market for the drug.

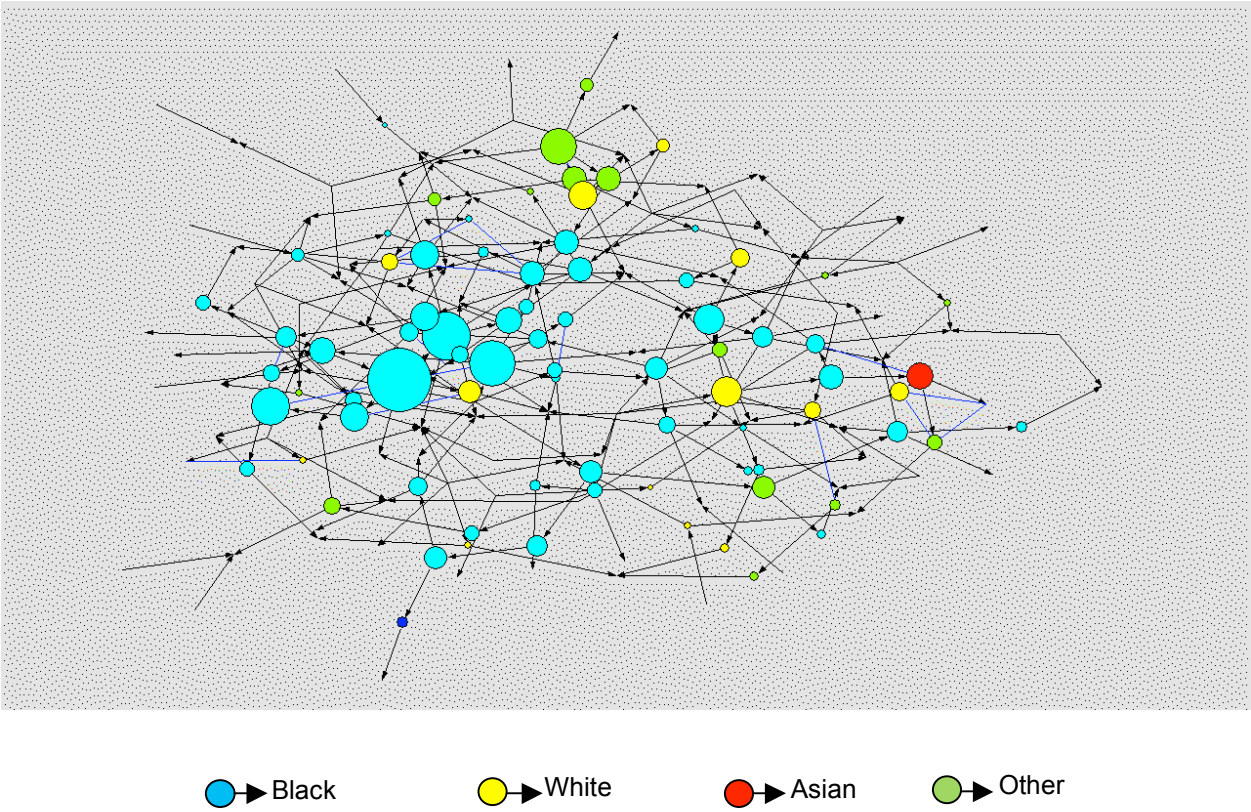
Among the network factors most commonly associated with study variables, Input Domain is the most frequent. As above, input domain is a measure for each individual node of the total number of other nodes in the network that can reach that individual node via network connections. Rather

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than a reflection of association with well other well-connected nodes (as in a core relationship) or along the path of information and material flows (centrality), input domain reflects a position at the apex of a small, pyramid like sub network, where many of the paths in that pyramid point to that apex. Such a structure tends to reflect dependency (of those lower on the pyramid to those above) rather than influence, and uncovers a subtle form of hierarchy within the network itself. In this case, those with less structurally advantageous positions within the network must depend on better-positioned network contacts to supply them with methamphetamine.

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Figure 4 Network Drawn to Reflect Betweenness Centrality (size of node) And Race (color of node)



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Exponential Random Graph Methods analysis

A final form of network analysis was undertaken to determine the extent to which network structural factors played a role in the construction of the network itself. A good example of this is the concept of "triadic closure" or transitivity as it was labeled above, since in many social networks, whenever two individuals share a mutual contact, there is a tendency for the two individuals to become connected directly. To measure this and other structural influences on edge prevalence, the team employed the methodology of the Exponential Random Graph Model (ERGM). ERGM is a statistical technique aimed at determining the extent to which the likelihood of network linkages appears to be biased towards (or against) the creation of specified network substructures (above and beyond what is expected by chance occurrence).

In conventional statistical analysis, questions of this type are usually limited to regression modeling. Multiple data entries (for example, individual's reported number of sex partners versus their age) are treated as distinct samplings from a larger potential body of data about the ambient population. Regression analysis leverages multiple samples (individual cases) to estimate the range of possible answers and their distribution within that range. From these same estimates, the analysis can also determine the likelihood that the particular association between one category and another (in this case between reported number of sex partners and age) is attributable to random chance.

In network analysis, by comparison, multiple samples of a single network are rare. Often it is possible to gain only a single sample of the network—that is, a single list of the connections among the set of individuals in the sample. In

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such settings, conventional regression analysis is infeasible. Nor is it simple to try to estimate the potential variability in a network. Even given a fixed number of persons in the study (n), the total possible number of network configurations is $2^{n(n-1)/2}$. In our case, where the number of network members is 132, that means that there are 2^{8646} different possible network configurations. Such a set is, obviously, impossible to model.

ERGM avoids this difficulty by sampling the set of networks in the "neighborhood" of discovered network. This neighborhood is constructed by "perturbing" the observed network, by the systematic addition and deletion of a single edge (network link} between every pair of nodes. The impact of edge addition (where a particular connection is missing) and edge deletion (where a particular connection already exists) on the network measures of interest are determined, e.g. homophily (the tendency of "like" nodes to connect with one another) or transitivity (the triadic closure discussed above). Finally, logistic regression is used to fit the edge relation to the induced change in network measures. The regression coefficients arising from this analysis are interpreted as estimates of the relative influence of each of the selected network measures on the likelihood of the edge relation.

By considering the difference that each edge makes, the ERGM method samples the space of distributions close to the distribution discovered in data collection. While this is no substitute for sampling within the set of all possible networks, it does allow the estimation of local ranges, and thus local distributions and likelihoods. In effect, by ignoring the vast majority of unlikely networks

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(including those which deviate greatly from the observed network) allows for a regression-like analysis that relates the observed network to selected network substructures.[19]

In this study, ERGM analysis was used to model the likelihood that triadic closure and various forms of homophily were active in the network—that is, to look for a tendency within the network towards the transitivity relationship discussed above as well as the attraction of "like" nodes to one another. In each case, one issue was that the extent to which either or both of these factors would cause the network to contain far more of these sorts of connections than would be likely given a random distribution of the same number of connections over the same set of nodes (as modeled by the variation in the "local area" sampled by the ERGM analysis.

The results of the univariate and multivariate analysis are given in Table 25. In each case the analysis provides a constant factor ("edges") for comparison. In each case, "edges" represents the log odds that a randomly chose pair of nodes in the network will have a connection between them. Such a statistic provides a baseline against which the other "tested" variables can be measured. In each case, the analysis sought to determine what difference (from the base line "edges" value) there would be in the likelihood of there being a connection between a randomly chosen pair of nodes if the nodes were of the

[19] Exponential Random Graph Methods (ERGM) are relatively recently-developed methodologies in Social Network Analysis, though their roots go back to the 70s and 80s (Frank and Strauss 1986). Until recently, the estimating of likelihood errors remained problematic in network terms (Strauss and Ikeda 1990; Handcock 2003). But in the last several years, these problems have been overcome with the use of Maximum Likelihood Estimating procedures for use in network contexts (Morris et al 2008). Since this time, ERGM has been used in a number of innovative network analyses. ERGM is implemented as part of the Statnet package in R (Handcock et al 2003, 2008).

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same type (homophily) or if the connection would make a triangle (such as, those cases where the randomly chosen nodes both happened to be connected to a common third node).

Thus, by way of example, in a univariate analysis of the baseline measure of “edges” (or connection likelihood) in the network above, the log-odds that a particular, randomly chosen pair of nodes in the network will share a connection is -4.21 (model 1). Yet if that pair of randomly chosen nodes both happen to be already connected to a third node, such that their connection would complete a triangle, the log odds of there being a connection between them increase by 1.62 (model 2). A full table of ERGM results is given below in Table 25.

Throughout the analysis, the most important feature in predicting the presence of connections among individuals in the network was triadic closure. As above, the transitivity relationship is a common feature in social networks, and that seems to be true of methamphetamine use networks as well, and remained constant through the multivariate analyses (models 5-7). The second most important factor in predicting the presence and absence of connections among network members is race/ethnicity. This was true in univariate (models 3 &4) and multivariate models (5-7), and it remained true whether race/ethnicity was analyzed in the categories in which the data were collected (i.e. black, white, Hispanic, Asian, and other) and when the data were “binned” into two categories (Black and All Else). This is deeply interesting because race did not play an important part in the explanation of network role.

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Here it is evident that race/ethnicity plays a significant role in overall network connectivity. That is, people tend to form links within the network based on common race/ethnicity, but within the network these factors seem to play little role. Just as importantly, the opposite would seem to be true for sexual identity, which was a significant consideration (discussed above) in network role, but which here plays only a small role in predicting network connectivity, and then only in association with both race and transitivity considerations. In other words, sexual identity plays an important part in defining network role, but race is more important in defining with *which persons* (within the overall network of New York City methamphetamine market participants) an individual market participant will form network connections. This is consistent both with participant qualitative accounts of network sex and drug contacts, and with secondary data on MSM/"gay culture" sexual norms.

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Table 25 ERGM Results (all p<.05 results shown)

Model	Variable	Log Odds	Standard Error	MCMC s.e.	p-value
1	edges	-4.20528	0.06042	NA	<1e-04***
2	edges	-4.35441	0.06579	0.022	<1e-04***
2	Transitive closure	1.61894	0.14898	0	<1e-04***
3	edges	-4.44978	0.08411	NA	<1e-04***
3	Race homophily (BL, WH, HS, AS, Oth)	0.59179	0.12099	NA	<1e-04***
4	edges	-4.50958	0.09907	NA	<1e-04***
4	Race homophily (Black, All Else)	0.53918	0.12505	NA	<1e-04***
5	edges	-4.5595	0.0873	4.401	<1e-04***
5	Transitive Closure	1.5785	0.15	0.004	<1e-04***
5	Race homophily (BL, WH, HS, AS, Oth)	0.5053	0.1217	12.049	<1e-04***
6	edges	-4.6377	0.1026	0.004	<1e-04***
6	Transitive closure	1.4323	0.2284	0.01	<1e-04***
6	Race homophily (Black, All Else)	0.5264	0.1199	0.001	<1e-04***
7	edges	-4.6596989	0.0003602	0.001	<1e-04***
7	Transitive closure	1.5729483	0.1500032	0	<1e-04***
7	Race homophily (BL, WH, HS, AS, Oth)	0.5357433	0.0015322	0.002	<1e-04***
7	Sexual Identity homophily (MSM, MSMW, All Else)	0.2096335	0.001352	0	<1e-04***

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Methamphetamine Markets and Violence

No participants said they had been involved in any violence while selling or distributing methamphetamine. The MSM dealer quoted above described an incident where he was afraid he was about to be robbed or victimized while making a pickup from his supplier, "but nothing actually happened." Two participants disclosed that they had been robbed while selling methamphetamine. Both were black: one MSM and one transgender person.

Participants disclosed experiencing a total of seven incidents of violence that occurred while buying methamphetamine. Five said they had been robbed while buying: three MSM/W (two blacks and one Hispanic), one white MSW, one Other race WSM.

Very few participants owned weapons of any kind[20]. Weapon ownership was somewhat associated (p=.110, G=.135) with sexual identity in bivariate analysis, with Others more likely to own weapons (see Table 26a).

Table 26a Weapons ownership, by sexual identity

				Total
	Others	Count	6	35
		%	17%	
	MSM	Count	3	62
		%	5%	
	MSMW	Count	2	29
		%	7%	
Total		Count	11	126
		% of Total	9%	100%

[20] Weapons owned by participants included two shotguns, a 9mm Glock semi-automatic pistol, a .38 revolver, two .22 pistols, “a revolver I got for three bags of crystal, one krill [bag of crack], and a blunt. I don't even know if the shit work”, a machete, several knives, brass knuckles, and pepper spray.

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Analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the Others population is very different from the MSM and MSM/W populations (see Table 26b). Although weapon ownership is rare among all sub-populations, Others are much more likely to be weapons owners.

Table 26b Weapons ownership, Shannon-Jensen ratios by sexual identity

	Bigger	X	Y	Z	W
Smaller		0.0004369	0.0076074	0.0088781	0.0055019
X	0.0004369		*17.412482*	*20.321044*	*12.59319*
Y	0.0076074			*1.1670389*	
Z	0.0088781				
W	0.0055019		*1.3826904*	*1.6136534*	

No MSM or MSM/W reported carrying a weapon; 14% of others did (see Table 27; see also Discussion section for more detail). Weapon carrying was very significantly associated with sexual identity (p=.001, G=.001).

Table 27 Weapon carrying, by sexual identity

				Total
	Others	Count	5	35
		%	14%	
	MSM	Count	0	62
		%	0%	
	MSMW	Count	0	30
		%	0%	
Total		Count	5	127
		% of Total	4%	100%

Shannon-Jensen divergence ratios between all subpopulations were all <2.

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Methamphetamine Markets and Criminal Justice

Participants had very few contacts with law enforcement or the criminal justice system, especially given that all were current methamphetamine users and almost all were users of other illicit substances, three were self-identified methamphetamine dealers, 30 were sex workers, and many lived off various illicit "hustles", such as "boosting" (shoplifting), "breaking bottles"[21] and other petty property crime.

Only four participants had been arrested for methamphetamine possession in the last year (see Table 28).

Table 28 Past year methamphetamine possession arrests, by sexual identity

				Total
	Others	Count	1	35
		%	3%	
	MSM	Count	3	61
		%	5%	
	MSMW	Count	0	31
		%	0%	
Total		Count	4	127
		% of Total	3%	100%

No participants had been arrested for methamphetamine distribution in the past year. Only one participant (a MSM/W) had ever been arrested for methamphetamine distribution.

Participants had a lifetime total of 13 methamphetamine possession arrests for the entire sample (see Table 29); this should be seen in the context of their heavy drug use and frequent participation in methamphetamine acquisition

[21] This is a recently popular hustle where the hustler contrives to bump into an affluent tourist and drop a gift-wrapped bottle of expensive liquor, breaking it, setting up a demand that the mark compensate the hustler for the value of the broken "gift" (which is in fact a bottle from a bar garbage can refilled with tea or water and a small amount of liquor for the smell).

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discussed above. There was no significant variation by subpopulation of any methamphetamine arrest measure.

Table 29 Lifetime methamphetamine possession arrests, by sexual identity

				Total
	Others	Count	5	34
		%	15%	
	MSM	Count	5	60
		%	9%	
	MSMW	Count	3	31
		%	10%	
Total		Count	13	125
		% of Total	10%	100%

On average, about half (49%) of participants had ever been arrested for any other drug possession offence in their lives (see Table 30a).

Table 30a Lifetime non-methamphetamine drug arrests, by sexual identity

				Total
	Others	Count	14	34
		%	41%	
	MSM	Count	32	60
		%	53%	
	MSMW	Count	15	31
		%	48%	
Total		Count	61	125
		% of Total	49%	100%

Sexual identity was not significantly associated with any of the arrest variables in bivariate analysis.

Shannon-Jensen divergence ratios were < 2 with regard to all arrest variables, with one exception. With regard to lifetime other-drug arrests, analysis

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of Shannon-Jensen divergence ratios among the subpopulations indicates that the Others population is different from the MSM and MSM/W populations (see Table 30b).

Table 30b Lifetime non-methamphetamine drug arrests, by sexual identity

Smaller	Bigger	X	Y	Z	W
		0.0005217	0.0023653	0.0031968	0.001139
X	0.0005217		*4.5335538*	*6.1273973*	*2.1831982*
Y	0.0023653			*1.351566*	
Z	0.0031968				
W	0.001139		*2.0765654*	*2.8066152*	

When the sample was divided by race, rather than sexual identity, there was no association **(***p*=.72, *G*=.59) between race and methamphetamine possession arrests (see Table 31).

Table 31 Lifetime methamphetamine possession arrests, by race

				Total
	Black	Count	8	66
		%	12%	
	Hispanic	Count	3	24
		%	13%	
	Other/ Asian	Count	0	5
		%	0%	
	White	Count	2	30
		%	7%	
Total		Count	13	125
		% of Total	10%	100%

Most black and Hispanic participants had been arrested for drug offenses other than methamphetamine possession at some point in their lives (see Table 32). Only about a third of white participants, and a fifth of Other/Asian participants had ever been arrested for such offenses. Lifetime other-drug arrests

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were somewhat (*p*= .189, *G*= .177) associated with race, with black and Hispanic participants more likely than Other/Asian or white participants to have ever been arrested for drug offenses other than methamphetamine possession. Shannon-Jensen divergence ratios between all subpopulations were all <2 for lifetime other-drug arrests; the differences were not significant.

Table 32 Lifetime non-methamphetamine drug arrests, by race

				Total
	Black	Count	38	69
		%	55%	
	Hispanic	Count	12	23
		%	52%	
	Other/Asian	Count	1	5
		%	20%	
	White	Count	10	28
		%	36%	
Total		Count	61	125
		% of Total	49%	100%

The large majority of study participants said that neither police (see Table 33) nor other factors in the community (see Table 34) had prevented them from buying methamphetamine in the last year. Those that had experienced law enforcement activity preventing them from acquiring methamphetamine were unanimous that in every case the delay was only temporary and easily surmounted. No one reported that any factor connected with anything other than distributors had ever significantly delayed or impeded their efforts to acquire methamphetamine in the last year.

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Table 33 Police prevented me from buying methamphetamine in the past year, by sexual identity

				Total
	Others	Count	9	33
		%	27%	
	MSM	Count	9	62
		%	15%	
	MSMW	Count	5	31
		%	16%	
Total		Count	23	126
		% of Total	18%	100%

Few participants said that other factors (nosy neighbors, nightclub security or any other non-law enforcement factor that might prevent market activity) had prevented them from buying methamphetamine in the past year. Again, in every case, they were prevented only temporarily; the few who cited this as affecting their methamphetamine buying agreed the only effect was to temporarily delay their purchases.

Table 34 Other factors in the community prevented me from buying methamphetamine in the past year, by sexual identity

			Total
Others	Count	3	34
	%	9%	
MSM	Count	10	62
	%	16%	
MSMW	Count	5	30
	%	17%	
Total	Count	18	126
	% of Total	14%	100%

*The modal answer here was "nosy neighbors" of dealer.

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Shannon-Jensen divergence ratios between all subpopulations were all <2 for both variables concerning anything that might have prevented a participant from buying methamphetamine.

Participants were asked if police had confiscated methamphetamine from them without arresting them (see Table 35a). Few participants in any sub-group had experienced this. Differences among sub-populations were not significant in *p*- and *G*-values.

Table 35a Police confiscated methamphetamine from me but did not arrest me in the past year, by sexual identity

			Total
Others	Count	4	35
	%	11%	
MSM	Count	5	59
	%	9%	
MSMW	Count	1	29
	%	3%	
Total	Count	10	123
	% of Total	8%	100%

Here, analysis of Shannon-Jensen divergence ratios among the subpopulations indicates that the MSM/W sub-population is very different from the MSM and Others sub-populations (see Table 35b)- they are much less likely to report confiscation without arrest than the other two sub-population groups.

Table 35b Police confiscated methamphetamine from me but did not arrest me in the past year, by sexual identity

	Bigger	**X**	**Y**	**Z**	**W**
Smaller		0.0026018	0.0002225	0.0005112	0.0053309
X	0.0026018				*2.0488931*
Y	0.0002225	*11.693864*		*2.2975065*	*23.959478*
Z	0.0005112	*5.0898068*			*10.42847*
W	0.0053309				

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DISCUSSION

The following section discusses New York City methamphetamine market participants as users, buyers and sellers of methamphetamine, and the market behaviors of New York City methamphetamine market participants as users, buyers and sellers of methamphetamine. The integration of qualitative data and social network data has allowed the project to produce findings that will be valuable, it is hoped, in understanding and responding to problems caused by methamphetamine use and distribution.

A Bifurcated Market

The retail methamphetamine market in NYC is bifurcated between two largely separate sub-markets: a smaller market for “crank,” “speed” or “crystal meth” that overlaps with powder cocaine and crack markets, and a larger closed, sexual-network-based market among MSM around use of “tina” as a sex drug. Each of these two submarkets displays differing characteristics of both the social organization of the market and the technical organization of the market; see Table 36 (also reproduced in the Executive Summary above as table ES-1), summarizing some differences between the two submarkets.

The “crank” market

In the sub-market where “crank,” “speed” or “crystal meth” is seen as a more efficient, longer lasting alternative to powder cocaine or smoked “crack”

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Table 36 The bifurcated market for methamphetamine in New York City: Some differences between the two submarkets

	"Tina" market	"Crank" market
Submarket	"Tina" is consumed as a sex drug, with no perceived substitutability of cocaine, among members of a socially-bonded network based on MSM "chem sex."	"Crank" or "crystal meth" is seen as a more efficient, longer lasting alternative to cocaine or "crack" cocaine, with substitution between the two substances.
Social organization of distribution		
Extent of secondary market	Very large secondary market, with peer-to-peer supply a social norm, and large numbers of "semi-dealers".	More limited secondary supply networks.
Open/closed?	To enter this market, a potential buyer must have had sex with an existing market participant or the seller.	This market is fairly porous, with sellers open to new customers.
Degree of social organization	Distributors in this market are typically user/dealers, with dealer/"runner" dyads also noted.	Sellers are freelancers, with both non-user sellers & user/dealers.
Temporal aspects	Most active from Thursday-Sunday in weekly cycles.	Daily market.
Technical organization of distribution		
Sales units	The typical price in this market is $200-240/gram, with sales by weight: half-grams, grams, "teenagers" (1/16 oz.), "eightballs" (1/8 oz.).	This market is dominated by price-denominated sales, with "forty [$40] bags" and "eighty [$80] bags" the most commonly mentioned purchase units.
Street markets	The very limited street market is a MSM sex worker/dealer market in two heavily gay communities late at night.	Limited street markets overlap with traditional hard drug (heroin/cocaine) markets.
Delivery markets	This market is heavily delivery-based (see also below).	Some delivery sales.
Public location indoor sales	Rare.	Legitimate businesses with a "sideline," sometimes. unknown to business owner; dance clubs.
Private location indoor sales	Dealer home sales. Underground sex clubs and parties.	Underground sex clubs and parties.

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cocaine (with substitution between the substances[22]), sellers are freelancers, with both non-user sellers and user/dealers described by study participants. This market is fairly porous, with sellers open to new customers. This a very different configuration of the social organization of distribution than that observed in the MSM "tina" market. The technical organization of distribution also differs. This sub-market is dominated by price-denominated sales, with "forty [$40] bags" and "eighty [$80] bags" (of unknown weight) the most commonly mentioned purchase units, although participants also reported buying "twenties" ($20 bags are the most common unit of sale in the retail cocaine market in New York City).

Participants in this sub-market described some limited street markets overlapping with traditional "hard drug" (heroin/cocaine/crack) market areas (Harlem and some predominantly black areas of Brooklyn long characterized by widespread semi-public street sales of heroin, cocaine and crack); participants in this sub-market also described some delivery sales and sales from private locations controlled by the seller, such as apartments and workplaces.

Some also described public or semi-public indoor location sales, for example legitimate retail businesses with a "sideline" business conducted by employees sometimes unknown to business owner, or sales in bars, dance clubs, and group sex locations, such as underground sex clubs and parties.

[22] Even non-MSM methamphetamine users who are participants in the "crank" market almost universally agree that they can readily distinguish between the effects of methamphetamine and cocaine on axes other than simply the fact that the effects of methamphetamine last much longer than those of cocaine. One typical term employed to explain the distinction between the effects of the two substances is that methamphetamine has effects that are "cleaner" or produce less "paranoia".

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The "tina" market

The larger of the two sub-markets is that catering to MSM in search of "party favors" for "chem sex." In this market, "tina" is consumed as a *sui generis* sex drug, with no perceived substitutability of cocaine: "Don't send a boy to do a man's job."

In this sub-market, the social organization of distribution is through networks of sex partners: to enter this market, a potential buyer must have had sex with an existing market participant, or, sometimes, the seller: "Why would I want to sell you drugs if I didn't want to have sex with you?" Distributors in this market are typically user/dealers, with dealer/"runner" dyads also noted, distributing among members of a socially-bonded network based on MSM sexual activity.

The technical organization of distribution in this submarket is also correspondingly different from the non-MSM market. The typical price in this market appears to be $200-240/gram, with sales by weight units almost exclusively: half-grams, grams, "teenagers" or "teeners" (1/16 ounce or 1.75 g), "eightballs" (1/8 ounce or 3.5 g). This market is delivery and indoor (dealer home) sales-based, and rooted in sexual networks among MSM. The very limited street market is a MSM sex worker/dealer market in two heavily gay communities in Manhattan (Chelsea and the West Village) late at night[23]. Unlike the non-MSM market, which revealed no discernable temporal cycles, this market has a definite temporal rhythm, existing from Thursday-Sunday in weekly cycles. This is

[23] Some sources claim that methamphetamine is often available in strongly MSM-identified environments where law enforcement may be uncomfortable (Jacobs 2004, Osborne 2005).

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because the market exists around the consumption pattern of participants in this submarket: 2-3 day "tweakend" marathon sex sessions, followed by "crashing" and recovery from the aftereffects.

Sexual Behavior and Methamphetamine Use

One of the greatest difficulties in conducting this study might be termed stigmatic stratigraphy: the MSM participants in this study primarily identify as gay, engage in behavior which has become very stigmatized within the mainstream gay/MSM community[24], and are criminals because they buy and supply illegal drugs. Thus, they are subject to multiple layers of stigma, and formal and informal social sanctions.

As mentioned above in the Background and Significance section, there has been little discussion in either the scholarly or popular literature about the origins or background of use of methamphetamine by MSM, or about the sexualized pattern of consumption referred to as "chem sex."

In discussing "the social construction of a gay drug", Reback (1997) says that "[i]n the United States, gay identity is both implicitly and explicitly linked to sex. Consequently, communities that place a high priority on sexual functioning are clearly predisposed to embrace a drug that reportedly enhances sex. The identity, social networks, and institutions that mark a gay subculture have easily evolved to maintain and support the use of crystal within gay communities. The creation of social settings where crystal use is common--or, in some social

[24] Although in gay communities"[c]rystal … has come to be positively associated with sex" (Reback 1997); note Reback was writing before the extensive anti-methamphetamine public health campaigns of 2004-5.

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situations, expected--serves to *normalize* [emphasis added] crystal in gay culture."

Reback argues that one reason methamphetamine use became popular among MSM is that among many MSM "gay sex is also associated with other internal dynamics, such as internalized homophobia, guilt, and shame … crystal use is a positive coping mechanism for dealing with negative internal messages, thus permitting gay sexuality without internal disapproval" (Reback 1997). Reback argues that the "disinhibiting effects of meth" helped some men have sex with other men when they at one point were afraid to do so, and allowed others to engage in more extreme sexual acts: "The use of crystal methamphetamine reduces the amount of pain experienced by the receiver [during receptive anal intercourse], relaxes his sphincter, … greatly increases both sexual partners' desires to engage in anal penetration .... [and] increases the stamina of both partners and significantly delays orgasm. … [M]en engaging in sex while using crystal methamphetamine tend to have longer, rougher sex that can last several hours or more" (Reback, 1997; see also Easton 2003).

Reback also argues that two additional factors must be taken into account in understanding the apparent increase in use of methamphetamine among MSM since the mid-1990s: the impact of both HIV and the Internet on MSM communities.

She discusses "the advantages of using crystal to manage certain AIDS-related conditions or effects … as a form of self-medication … to maintain a sense of physical or psychological normality" in the face of HIV, and says that

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"the timing of crystal is perfect. The drug quells feelings of hopelessness and fits neatly into devastated gay communities. In this historical moment, when a gay identity is either directly or indirectly linked to HIV, one's sexual expression becomes infused with death." (Reback 1997). Osborne (1997) says that the growth of methamphetamine as a "gay drug" was in part a reaction to public health campaigns urging "safe sex" on MSM: "The increased use of meth among MSMs in the 1990's-2000's was due, in part, to a singular focus on gay sex clubs, theatres, bars and bathhouses and their contribution to the spread of HIV/AIDS. Thus, MSM meth use in NYC went largely unnoticed until its use was widespread."

The other decisive factor, Reback says, in the construction of methamphetamine as a "gay sex drug" was the widespread availability of the Internet and the advent of MSM-oriented "hook-up" sites. Prior to the Internet, the stigma often associated with MSM activity limited the places where MSM could gather and feel comfortable. Gay bars, bathhouses, sex-clubs, sex shops, and gay bookstores, however, were safe havens for men looking to meet other men looking for sex. Thus, these men were either meeting in establishments geared toward sex and/or drugs and alcohol (Bux 1996). MSM inhibited by public MSM environments such as gay bars or bathhouses are able to find both sex and drugs through "hook-up" sites without the potential awkwardness of face-to-face interactions (Reback 1997). These "under the radar" networks of men who met online, rather than in traditional MSM venues, facilitated the spread of sex and drug practices in MSM communities.

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One MSM methamphetamine recovery website claims methamphetamine use became popular among MSM after ketamine was re-formulated to make it impossible to dry out in a microwave oven (http://www.lifeormeth.com, “Crystal Culture”, first Flash animation page). The same site alternatively claims that it was marketing campaigns for erectile dysfunction drugs that provided the catalyst for the spread of crystal use among MSM in the late 1990s, because Viagra offered a solution to the frequent problem of methamphetamine-induced impotence: “seemingly overnight Viagra transformed ‘Tina’ from a ‘trailer trash’ drug into the ultimate aphrodisiac. And with meth's ability to melt away rational thought, suddenly, years of ingrained safe sex messages seemingly never existed” (http://www.lifeormeth.com, “Crystal And Aids”, first Flash animation page). This site goes on to claim that use of crystal was disseminated across the United States by usage at “circuit parties,” large, sexually-charged dance events held to raise money for anti-HIV efforts in the MSM community, which “provided the geographical network through which crystal, aided and abetted by Viagra, would explode into the new millennium.” The site claims that the use of “tina” was spread by dance club DJs who began playing a harder-edged, more abrasive style of music with faster tempos (referred to as “pots and pans” in the gay dance-music scene), replacing the “feel-good” sounds of ecstasy-fueled house music with the “cold negativity of banging, rhythmless noises and wailing diva vocals that blatantly promoted meth use; ‘I'm Addicted’, an angry, mantra-like homage to ‘Tina’, among them” (http://www.lifeormeth.com, “Pots And Pans”, Flash animation page under heading “Crystal Culture”).

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Reback (1997) makes an important point about the social networks of the methamphetamine users she studied in Los Angeles that is very much in accord with the findings of the present study: “Social networks and sub-communities of crystal users are formed *across class and ethnic differences* [emphasis added]. The demographic patterns indicate that user groups tend to be formed around socioeconomic similarities rather than racial groups; however, these socioeconomically based sub-communities are fluid and easily expanded to include individuals outside of a particular sub-community when crystal and/or sex are factored into the equation. Thus ‘in-group/out-group’ distinctions were temporarily redefined around the use of crystal and activities associated with its use (e.g., sex, dancing, sex work).”

The MSM market for “tina” as a sex drug is unique in that one can only participate in this market by having sex with an existing market participant: the market is structured by participant sexual networks. This is clearly different from most drug markets or indeed markets for any kind of commodity, which are typically organized around profit- market participants are willing to enter into transactions with market entrants provided they are satisfied the new customer is legitimate, i.e. likely to pay, and in illicit markets, not affiliated with law enforcement, or in licit regulated markets, a permitted customer, i.e. a prescription holder in the case of controlled substances. In non-criminalized markets, partially parallel examples of socially-structured markets might include markets in Freemasonic or fraternal regalia only available to members of those organizations, or real-estate transactions conditioned on the social acceptability

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of the potential buyer, such as co-op apartments where buyers must be approved by a board of residents, or anti-minority-buyer covenants on purchase in some post-World War II suburban developments. Clearly, these parallels are rather strained, which serves to underline the uniqueness of the configuration of the MSM methamphetamine market as a sex-partner network.

Within drug markets, one parallel would be Dorn et al.'s (1992) characterization of some drug markets as "trading charities": "those traffickers who, initially at least, are not primarily (and definitely not solely) financially motivated" (3):

> The Trading Charity dealer ties involvement in the supply of drugs to a particular facet of their social life and to socializing within it. This may not amount to a full-blown ideology or world-view but it does mean that a goal of profit accumulation is subsidiary to, or strongly tempered by, a commitment to or enjoyment of the social and cultural aspects of using the drug and the context in which this is done. (10)

Note that Dorn et al. quote a "trading charity" ecstasy dealer who felt safer buying only from other gay contacts (9). While this market configuration might be considered as a mechanism for securing the market against infiltration by law enforcement, clearly this is not the reason the MSM methamphetamine market is organized in this way, but merely a serendipitous benefit of the sexually-networked market structure. The examples Dorn et al. (1992) give involve "ideological commitment" to cannabis and ecstasy use as social goods, in hippie and acid house sub-cultures (10).

The fact that MSM methamphetamine markets take place within a closed network of sexual partners poses difficulties for law enforcement in trying to take

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action against the market, but also for participants within that market trying to stop use. As drug use becomes entwined with sexual activity, to the point that they become essentially the same thing (as many participants told us), the difficulties faced by all recovering drug users are magnified, as the user must now avoid not only drug use but also sex.

The extended network of secondary supply among MSM sex partners also resembles Dorn et al.'s typological category of a "mutual society": "a friendship or acquaintance based network of drug users, some of whom, some of the time, will supply drugs to others" (1992, 10). They distinguish a "mutual society" from a "trading charity" because dealers of the latter type supply their personal usage from sales stocks rather than buying through network contacts.

Even when dealers and sexual network secondary markets fail as sources of supply, participants described using online MSM dating/"hook-up" sites to find sources of crystal. Although the most popular and mainstream sites now generally ban use of most common methamphetamine-related slang in online profiles (references to "tina", "partying", "P'n'P"), participants described more subtle cues. For example, a preference for "long sessions" of sex would be a clue, as would capitalizing the letter "T' (for "tina") in the middle of words. Injectors said they could find fellow injectors by ads that promised to "get to the point" (syringe), offered "slamming" sex ("slam" is the usual term for "inject" in the MSM methamphetamine sub-culture), or capitalized the letter P (for "point") in the middle of words. Because of anti-crystal sentiment and harm-reduction and abstinence-based efforts to deal with methamphetamine use in the MSM

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community, some of the dating/"hook-up" sites have allowed participants to use otherwise forbidden terms, provided they are prefaced by the word "no": "No P'n'P", e.g. Several participants told us phrases like "No P'n'P!" are often used on those sites as a code to indicate that the person *was* in fact interested in "partying"!

Studies estimate from 30% to 82% of MSM have sex with partners met online (Liau et al. 2006), and that use of the internet to meet sex partners has increased in recent years (Rietmeijer et al. 2009, Benotsch et al. 2002, McFarlane 2000). Some studies suggest that the anonymity and efficiency of online partner-shopping facilitates "party n' play" sex with methamphetamine and "barebacking" (condomless) sex (Wilson et al. 2008, Berg 2008, Blackwell 2008).

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Methamphetamine Consumption and Distribution Networks

This section focuses on the overall organization of New York City retail methamphetamine markets. Because this report argues that this is essentially a market bifurcated into two distinct, largely separate sub-markets serving MSM seeking "tina" for use as a sex drug, and others (mostly non-MSM) seeking a better/more cost-efficient version of crack, with the market dominated by the former sub-market, the discussion in this section is based primarily on the observed features of the market among MSM, with additional comments as to the non-MSM market as appropriate, where particular aspects of that market are different from those in the MSM market.

The market for methamphetamine in New York City is clearly a "niche" market, catering to insider groups, as opposed to the much larger markets for substances like cannabis or cocaine. One analogy might be to the pre-crack era "freebase" scene, where knowledge of how to prepare cocaine for smoking was restricted to an insider "elite" coterie of users and dealers (Hamid 1992**).**

Study participants described a variety of methods employed by methamphetamine distributors, but most transactions they described were either delivery transactions or took place in the dealer's home or at another private place controlled by the dealer.

The social organization of distribution observed in the study was consistent with a niche market. Almost all the distributors described by study participants appear to be freelancers, with a few MSM participants describing socially-bonded dyads of two men in a sexual relationship who sell together. The MSM dealer interviewed provides an example of this configuration. No

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participants reported buying from the sort of large corporate-style distributors with many “runners” that are common in the retail cannabis trade in New York (Curtis et al. 2002).

The most striking characteristic of the methamphetamine market in New York City is the extent of the secondary market. While participants were reticent in discussing instances when they themselves supplied others with crystal, others were apparently more willing to do so. This may be because participants feared that the interview might not really be confidential and that disclosing supplying others would therefore be risky for legal reasons, or it may reflect participants’ self image as “not drug dealers” coloring their responses. Because participants were much more willing to discuss being supplied by others than supplying others themselves, the discussion of secondary markets is based primarily on participants’ accounts of being supplied by others as more accurately reflecting the reality of the market.

The MSM market for “tina” was much more characterized by secondary distribution than the non-MSM market for “crystal meth”/”crank.” This may be, in part, an artifact of the reality that this market is organized along sexual network lines—each new market participant must be the sex partner of an existing market participant—and that the social organization of consumption is around consumption during prolonged bouts of sexual activity, generally among dyads or small groups of men. Norms of reciprocity among sex partners may demand that partners take turns supplying drugs (unless the relationship is one where the parties have accepted their respective ”sugar daddy” and “hustler” roles, with

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accordingly different expectations of limited symmetry of supply). Intermittent availability of product among dealers may also lead different members of a dyad or group supplying "party favors" because they have access at a given time and others do not.

High levels of secondary distribution typically arise when dealers are reluctant to take on new customers despite demand among consumers; secondary distribution represents a market configuration working around the resultant network "bottlenecks" which would otherwise limit consumption, as those who are able to buy from the closed network of existing dealers supply their friends or associates who lack such contacts. In social network analysis terms, such a "bottlenecked" network is described as one offering high opportunities for *brokerage*, as network actors with access to desired flows (in this case, of methamphetamine) within the network take advantage of structural characteristics of the network. However, existing dealers' reluctance to take on new customers would not create network bottlenecks if new dealers could easily enter the market to supply consumer demand. Thus, another inference that can be drawn from a market with high levels of secondary distribution is that there are high barriers to market entry.

In illegal markets, the typical barriers to entry are lack of supply, fear of violence from market competitors and fear of intervention by law enforcement agencies. In this case, it seems most reasonable to conclude that the major barrier to entry is lack of access to supplies of methamphetamine, rather than fear of violence from competitors, or sanctions by law enforcement. Data

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collection in this study and a review of the pertinent literature reveal little evidence of any substantial amount of violence among distributors in the New York City methamphetamine market; this is consistent with both the social status of most market participants and the observed structure of distribution. Delivery markets and private indoor location markets typically make violence more costly than beneficial for distributors, particularly freelancers or dyads: their invisibility is their strength, protecting them from competitors and law enforcement alike; any competitive gains achievable by violence against competitors are far outweighed by this sacrifice. Of course, in a closed indoor/delivery market, distributors are likely to have limited contact with, or direct awareness of, their competitors. Similarly, there is little evidence that fear of law enforcement is a major barrier to market entry by potential new methamphetamine distributors. Retail methamphetamine markets in New York City receive only sporadic attention from Federal law enforcement, and next to none from the New York City Police Department.

Most of those interviewed did not know where the crystal they used came from. Of those who claimed some knowledge of the product's origins, the most commonly mentioned sources were New Jersey, San Francisco, and upstate New York; a few also believed that they knew of manufacturing in New York City. Of the two persons interviewed who were willing to answer questions about drug-selling, one said he had no idea where the methamphetamine he sold came from, while the other described going on runs to pick up crystal from the MSM "cook" in northern New Jersey. The fact that the study gathered some data about

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methamphetamine production in areas near New York City does not necessarily indicate that most or even very much of the methamphetamine used in NYC is produced nearby—the only production sources that participants are likely to be familiar with are those that are nearby.

Many participants discussed their sources running out of product from time to time and having different batches of methamphetamine over time (characterized by different appearance, texture/crystal configuration and quality). No participants in either sub-market said that their source always had the same product over time. This is consistent with a market with multiple sources of supply of limited capacity, and seems to indicate that supplies of methamphetamine available in New York are produced in many small labs, rather than the “superlabs “described in some law enforcement sources. Of course, these data are equally compatible with multiple intermediary sources supplying products from a few production sources; the variations described could also be the result of dilution by intermediate distributors.

One characteristic distinguishing the two sub-markets is the differing views of participants as to whether or not cocaine or crack were equivalents of, or substitutable for, methamphetamine. MSM participants agree that “tina” is very different from cocaine or crack because of the intense sexual effects of “tina”, while MSM/W and Other participants were much more likely to see “crystal meth” as a cheaper or more cost-effective form of cocaine. Both groups agree that methamphetamine was better than cocaine or crack in that the longer lasting effects led to much less “geeking” or “fiending” for the next dose. Participants

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also almost universally agreed that methamphetamine provided a longer-lasting initial “rush” on ingestion.

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Estimating the size of the New York City methamphetamine market

Estimating the size of a hidden population is a notoriously difficult business. The team present two estimation procedures, one based on a capture/recapture analysis, and the other based on a review of secondary data sources about levels of methamphetamine use. The capture/recapture method gives an estimate for the total population of the sampled network as 12,229 persons, with an upper bound of 61,512, and a lower bound of 7,441 network members (at 68% confidence). The estimate based on secondary data is that there are likely no more than 39,000 monthly users of methamphetamine and no more than 63,000 past-year users of methamphetamine, in New York City. These estimates are broadly compatible in that the market network may not be identical to the universe of users.

Estimating the size of the network from study data

The population of the total number of methamphetamine market participants in New York City can be estimated using a capture/recapture technique. The RDS sample of respondents (*n*=132) represents captured subjects. Each of the 132 subjects was asked to provide data on up to 5 methamphetamine-related network contacts, selected at random from the subject's celiphone. Each of these (s=466) reported contacts represents a recapture assay. Of the data collected on each report, 7 categorical variables will be considered here: telefunken code (derived from phone number, as described in Appendix 3), gender, race, height, weight, hair color, and eye color. Two individuals who agree on all 7 of these variables are said to *telefunken-match*. Of the 466 reports, 11 telefunken-matched one of the original 132

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subjects, providing the recapture number (t=11). Extrapolation from this capture/recapture paradigm using the Lincoln-Peterson method yields a population estimate P=132(466/11)=5,592.

Given the coarseness of telefunken-matching, it is possible that some number of telefunken-matches will occur *by random chance* between the 466 reports and the 132 subjects, and as such, t= 11 is an over-count of recapture number. Over-counting occurs whenever the researchers identify a subject in the N=132 sample that appears to match one of the s=466 reports, but despite the apparent agreement (on all 7 categorical variables), the report actually refers to someone outside the N=132 sample. Because such *false matches* are possible, t=11 is an over-count of the recapture number, and hence the P=5,592 estimate is a conservative lower estimate of the population. However, the expected number of false matches can be estimated. Appendix 4 gives the details of a sequence of successively more sophisticated probabilistic analyses, estimating the expected number of false matches to be 0.25, 3.56, and 5.97. Subtracting off false matches from the discovered matches (t=11) yields a sequence better estimates of the true recapture number: t=10,74, t=7.42, t=5.03, from which one may derive successively better Lincoln-Peterson population estimates: P=5,725; P=8,290; P=12,229.

Thus, based on study data, the total number of methamphetamine market participants is estimated to be 12,229 persons. Given the sensitivity of false match frequencies, the 12,229 estimate must be taken as a central value with a fairly wide range. The analysis provides an upper bound of 61,512 on population

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size (at 68% confidence), and a lower bound of 7,441 (at 68% confidence). Further details of the analysis may be found in Appendix 4.

Secondary-data-based population estimate

Another method for estimating the total size of the market would be by extrapolation from data as to levels of methamphetamine use among different user sub-populations as reported in secondary data. The federal Centers for Disease Control's National HIV Behavioral Surveillance study provides one basis for estimating the number of MSM market participants (see Table 37). An upper bound estimate of the number of past month methamphetamine users, assuming for the sake of the calculation that the much higher 2005 NHBS figures are a more accurate measure of use, might be calculated by taking the sum of 10% of the estimated combined MSM and MSM/W population of NYC (32,400 of 324,000; NYC DOHMH), and an estimate of numbers of users among non-MSM.

Table 37 Amphetamine Use from the National HIV Behavioral Surveillance (NHBS) Study of MSM in New York City: 2004 versus 2008 (note NHBS MSM definition includes MSM/W)

	2004 %	2008%	% change
Past Year Methamphetamine Use	13.5	5.8	-57.0%
Use ≥1x/month	10.6	0.6	-94.3%
Use ≥1x/week	3.1	0.0	-99.4%
By age			
18-29	11.1	4.0	-64.0%
30-39	17.7	9.3	-47.5%
40+	12.9	5.2	-59.7%
By race			
Black	12.5	4.1	-67.2%
White	16.5	7.6	-53.9%
Hispanic	12.7	5.7	-55.1%
Other	9.2	5.3	-42.4%
By Interview Venue			
Bars	17.8	6.9	-61.2%
Other	9.3	4.2	-54.8%
By Sexual Orientation			
Gay	15.5	5.7	-63.2%
Bi	6.5	5.7	-12.3%

(MSM1 figures from Koblin et al. 2007)

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Estimating the number of users who are not MSM or MSM/W is more difficult. In the NSDUH (2009), in New York State, .12% report past year methamphetamine use. While past month use is not given in the state-by-state breakdowns of usage rates, nationally, past month use was about one third of past year use, so, assuming this also holds true in New York State (and City), it would mean that .04% of New Yorkers report having used methamphetamine in the past month. Doubling this figure to account for under-reporting of hard drug use on a household survey gives rates of .24% for past year use and .08% for past month use, or about 6,400 non-MSM past month users. These very rough calculations suggest that there are likely no more than 39,000 monthly users of methamphetamine in New York City.

Similarly, based on the same rates, it can be estimated that the number of casual (past year but not past month) users of methamphetamine is no more than 11,340 MSM and MSM/W combined, and 12,800 other New Yorkers, or a total of no more than about 24,000 who used methamphetamine in the past year but not the past month. Thus, it can be said that the overall number of methamphetamine users is likely to be fewer than 63,000.

According to the National HIV Behavioral Surveillance study[25], which recruited MSM and MSM/W in MSM-oriented public venues in New York City, methamphetamine use declined considerably among MSM and MSM/W between the NHBS MSM I study in 2004 and the follow-up MSM II study in 2008, with past

[25] Travis Wendel is the NYC Principal Investigator for this study.

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year use declining from 13% in 2004 to 5.8% in 2008 (see Table 37). Past month and past week methamphetamine use declined dramatically, with past month use down 94% and past week use dropping to 0%. Among MSM/W, use declined only 12% from a much lower base, with use rates equal among MSM and MSM/W in 2008, where MSM use had been more than twice MSM/W use in 2004. The decline in reported use may be attributable to a decline in real use rates, sampling differences in the two studies, or a decline in reporting following the major public health campaigns around methamphetamine, sex and HIV risk that took place starting in 2005, which may have lead to NHBS participants under-reporting use out of social shame at disclosing to HIV researchers behavior that was outside the professed norms of MSM communities. Also, recall the participant in the present study who said that the "drug gays are totally different than the bar gays": it may be that methamphetamine users are less likely to be found in bars and other public MSM-oriented establishments than in the past, either because of use of websites rather than bars for partner-seeking or because the campaigns against "tina" in the MSM community since 2005 have led methamphetamine users to avoid MSM-identified venues because their drug use has become stigmatized within elements of the MSM community that frequent such establishments.

Total expenditures on methamphetamine by market participants

If it is assumed that the participants in this study are typical of monthly users, and further assumed that all past year-but-not-past month users use twice annually at the same average rates of expenditure per episode as this study's

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participants, then 39,000[26] monthly users spending an average of $17,000 each per year would be a $633,000,000 per year market, and 24,000 casual users spending $300 would add only about another $7,000,000 annually (of course this is an artifact of assuming very low rates of use) for a total methamphetamine market size of about $640,000,000 annually for NYC (see Table 38).

[26] Based on the secondary data population estimate given above.

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Table 38 Estimated total expenditures on methamphetamine in the last year by all participants

	Include outlier*	Exclude outlier
All Study Participants		
Total spent on last purchase by all 132 participants* (*n*=97 who paid for last methamphetamine they got- 35 did not, almost all of these being supplied by sex partners)	$14,735	$13,115
Average amount of last purchase	$152	$137
Acquisition events in the last year	8031	7979
Total purchases in the last year by study participants**	**$2,238,353**	**$1,791,700**
MSM ONLY		
Total spent on last purchase by all 65 MSM (+1MSM/W) participants (includes outlier purchase of $1,620 by MSM/W for MSM sex party). 47 paid, 18 did not.	$8,920	$7,300
Average amount of last purchase	$190	$159
Acquisition events in the last year	4076	4024
Total purchases in the last year by MSM study participants**	**$1,692,902**	**$1,158,478**
Percentage of study participant market represented by MSM	**76%**	**65%**

* Includes outlier purchase of $1,620 by sex party promoter.
**Calculated by multiplying average amount of last purchase by number of participant acquisitions.

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Methamphetamine Markets and Violence

Participants reported almost no experience of violence connected with buying, selling or using methamphetamine. This is striking because the drug has often been connected in both the scholarly and popular literature with a propensity for violence, although of course the data was collected in a city that has led national trends in decreasing violence for many years.

The lack of violence in the experiences of the participants in the study may simply reflect the fact that violence has become very rare in New York City during the last decade, roughly the same time period over which methamphetamine became more available in the city. Further, methamphetamine distribution became established during a period when indoor sales and delivery sales replaced outdoor sales and other public and semi-public location sales as the predominant market formations in the technical organization of distribution in illicit drug markets in New York City (Curtis and Wendel 2000).

Emerging methamphetamine distributors in the MSM community may have thus emulated the distribution techniques they saw employed by distributors of other drugs used by their middle-class customers such as high-end cannabis, which was often sold by delivery services (Curtis et al. 2001; see also Sifaneck et al. 2006). These distribution techniques offer few rewards for violence, since in each case, indoor and delivery distributors depend on invisibility as a strategy to avoid the attention of would-be competitors, rather than force or a reputation for force (Curtis and Wendel 2007).

While this section is necessarily brief because participants had little to tell us about violence since they had experienced little of it, this absence of accounts

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of violence in markets for a drug that has been so associated with violence is noteworthy.

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Methamphetamine Markets and Criminal Justice

Another topic on which study participants had little to say was encounters with law enforcement, arrest and other criminal justice involvements. Study participants had comparatively few encounters with law enforcement, especially given their high levels of illicit drug use, since most were users of other illegal substances as well. The participants in the MSM "tina" subculture were of course protected from arrest by the closed nature of that market as a sexual network, and by the fact that almost all transactions took place in private locations; compare Sales and Murphy (2007), discussing middle-class sellers of ecstasy within social networks: "[t]he social class of drug sellers—in this case mostly white, male, middle class, educated, in school or employed, and housed—protected them from… exposure to criminal justice…" (944).

What few encounters with law enforcement study participants had experienced were almost entirely as a result of drug enforcement, and, in the case of sex workers, anti-prostitution activity by police.

However, the drug arrests study participants had experienced were seldom as a result of their use of methamphetamine.

Even aside from the fact that participants had few arrests resulting from their methamphetamine market participation, they also reported that it was very rare that law enforcement had any impact on their ability to get methamphetamine when they wanted it. When asked about difficulties or problems they had encountered the last three times they acquired methamphetamine, study participants were far more likely to give answers like "the dealer was too high to answer the phone" than to mention difficulties caused

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by police or drug enforcement generally.

When asked explicitly about whether they had been prevented from buying or selling methamphetamine by law enforcement activity, 18% of participants answered that this had occurred. Almost as many (14%) answered that other things in the community besides law enforcement (e.g., the dealer's "nosy neighbors", or bouncers in a club) had prevented them from buying or selling methamphetamine. In every case, the preventive effect was temporary. None reported ever having been unable to find methamphetamine in the last year because it was unavailable due to drug enforcement activity.

Again, as in the discussion of violence above, this is a necessarily brief section because study participants had little to say about this topic, although participants certainly had more to say about the police and getting arrested than they had to say about violence. Once again, the fact that study participants, despite committing felonies on a regular basis, have little experience of arrest, or even of law enforcement making it harder for them to engage in drug transactions is noteworthy.

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LIMITATIONS

- This sample is almost certainly not representative of all participants in NYC methamphetamine markets with regard to *race* or *socioeconomic status*; the sample recruited almost certainly over-represents poorer black participants in the market, and under-represents more affluent white market participants, based on both the available literature and the accounts of study participants themselves.

  This sample most likely is representative as to the *methamphetamine market participation*, and *methamphetamine consumption behaviors* participants described, with the caveat that it is logical to assume that study participants' comparatively impecunious status may lead them to purchase methamphetamine less often than more-affluent market participants are likely to do.

  The over-representation of poorer market participants is typical of many drug-market studies, and is generally considered to be an artifact of the comparatively lesser attraction of financial incentives offered for study participation to more affluent drug users (Hamid et al. 1997; see also Semaan et al. 2008).

- Study participants were much more forthcoming about describing their market roles as receivers/buyers of methamphetamine than they were about describing their roles as providers of methamphetamine to others. It is almost certain that participants provide methamphetamine for others much more often than they were willing to disclose; this interpretation is in accord with the SNA findings described above, which posit a large population of "semi-dealers".

- The methamphetamine market network as analyzed in the SNA section (in Results above) is likely to contain "false negatives"—it is less dense, and contains fewer MSM connections than actually exist in the New York market network —in addition to "false positives" or "false

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matches"—network connections that are artifacts of the analytic methods employed and do not exist in the real-world methamphetamine market network.

Therefore, these SNA results must be interpreted with caution, although they do accord with both other study data and other literature on the study populations.

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IMPLICATIONS OF FINDINGS AND SUGGESTIONS FOR FUTURE RESEARCH

- Public health service providers and treatment providers should be mindful that methamphetamine use is most often very connected with sexual behavior, especially among MSM. As persons seeking to discontinue methamphetamine use present for treatment, providers should enquire carefully into connections between use and sexual behavior, and implement treatment protocols that help recovering users work through the often difficult task of simultaneously changing their sexual behavior and ending their drug use, given that many participants in this study described the two as so entangled that it was impossible to distinguish their sexuality from their drug use.
- Policymakers and law enforcement strategists should consider the cost-effectiveness of interventions into MSM-based methamphetamine markets, given the closed sexual-network basis of these markets, and the fact that they apparently are associated with essentially no violence, and appear to have very limited effects on non-participants in the markets (see Curtis and Wendel 2007). Public-health-based interventions may be more effective than law enforcement in addressing the harms caused by these markets.
- Policymakers should consider whether it makes sense to re-examine current policing, sentencing, and other criminal justice policies that make a sharp distinction between “users” (subject to lesser sanctions and penalties) on the one hand, and “dealers” (subject to more severe (and often *much* more severe) penalties) on the other, based on the findings of this and other studies (see, e.g., Curtis et al. 2002, Duffy et al. 2008, Sales and Murphy 2007) that reveal that participants in the markets for many if not most illicit drugs typically perform both roles at different times. The greatly increased sanctions attached to the supplier/”dealer” role, when

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which role is played in a given transaction may be largely a matter of happenstance, may serve simply to dramatically increase sanctions for what may be an essentially randomly-selected subset of users, with few of the deterrent or preventive effects on markets that are the reason for market interventions by law enforcement.

- Future research on methamphetamine markets should be mindful of the role of social networks in methamphetamine distribution, the fluidity with which market participants adopt and trade supplier and consumer roles, and the importance of sexual behavior in methamphetamine use. Conversely, future studies of MSM and MSM/W sexual behavior should be mindful of the importance of methamphetamine use in the sexuality of many MSM and MSM/W.

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APPENDICES TO "DYNAMICS OF RETAIL METHAMPHETAMINE MARKETS IN NEW YORK CITY":

APPENDIX 1 STUDY INSTRUMENT

APPENDIX 2 SHANNON-JENSON DIVERGENCE AS A MEASURE OF INTER-GROUP DIFFERENCE

APPENDIX 3 EXPANDING THE NETWORK SAMPLE: COMPUTING THE STRENGTH OF MATCHES

APPENDIX 4 ESTIMATING THE POPULATION SIZE

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APPENDIX 1 STUDY INSTRUMENT

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RDS coupon manager questions

Coupon #

> *[The following 7 questions are used to generate a unique ID for recruitment reimbursement purposes & to prevent sample duplication ("twins")]*

First two letters of last name

First letter first name

First letter mother's first name

Birth month

Birth year

Gender:
- Male
- Female
- Trans

Ethnicity:
- White
- Black
- Hispanic
- Asian
- Other

Description, for recruitment reimbursement purposes & to prevent sample duplication ("twins"):

Height:
- [specify]

Weight:
- [specify]

Hair
- Blond(e)
- Brown
- Black
- Salt & pepper

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Grey
Bleached
Color not found in nature
Shaves head

Eye color:
Blue
Light Brown
Brown
Green
Other

Other notable physical characteristics
[specify]

Last digit of cellphone number:
Even
Odd
0-4
5-9

Next to last digit:
Even
Odd
0-4
5-9

Digit before that:
Even
Odd
0-4
5-9

Eligibility screener:

In the last 30 days, did you obtain methamphetamine from someone else (whether you paid or not) or provide methamphetamine to anyone else (whether you got paid or not) or both?
Neither *(not eligible)*
Obtain?
Provide?
Both?

[Open-ended follow-up questions, based on data obtained in formative research, to screen for imposters seeking recruitment incentives: prices, packaging, mode of use, etc.]

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If eligible:

Birth location
[5 boroughs; 50 states; Other: (specify)]

Level of education:
Some HS
HS grad
Some college
BA
Some grad
Grad degree

Employed
Yes
No

Job(s)
[question prompt for audio for qualitative analysis]- includes extralegal work]

Income
[brackets by year/week]

How many hours weekly do you work?
1-10
11-20
21-30
31-40
41-50
51 or more

Lives
Battery-Canal
Canal-14
14-23
23-59
59-86
86-110
Above 110th
Bronx
Brooklyn
Queens
SI
LI

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NJ
Other

Hangs out Brooklyn/Bronx/Manhattan/Queens/SI/LI/NJ/Other? What neighborhoods?
[question prompt for audio for qualitative analysis]- includes extralegal work]

Drinks?
No
Occasionally
Almost every day
Every day

Smokes cigarettes?
Yes
No

Smokes cannabis?
No
Occasionally
Almost every day
Every day

Cocaine use?
Yes
No

If yes to cocaine use, which do you use more often?
cocaine
methamphetamine

Other drug use [checkboxes & number fill-ins for “How often/year” for each]
Ecstasy
GHB
Ketamine
Ritalin/Adderall
LSD, other psychedelics
Heroin
Prescription opiates
Valium or other benzos
Xanax
Other [specify]

Do you have sex with
Men

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Women
Both

In the last year, did you get services from Callen-Lorde Health Center?
Yes
No

If yes, what services?
[question prompt for audio for qualitative analysis]

In the last year, did you get services from Gay Men's Health Crisis?
Yes
No

If yes, what services?
[question prompt for audio for qualitative analysis]

In the last year, were you diagnosed as having gonorrhea?
Yes
No

RDS questions:

Seed
Yes
No

How do you know your recruiter?
Friend
Acquaintance
Family member
Co-worker
Someone I buy drugs from
Someone I sell drugs to
Sex partner
Stranger
Other [specify]

How many people whose cell number you know use methamphetamine?

How many people whose cell number you know provide methamphetamine for others, whether they are dealers or not?

[For each of above questions:]

Of those, number male?

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Of those, number female?

Number gay/MSM?

Number not gay/MSM?

Number White?

Number Black?

Number Hispanic?

Number Asian?

Number Other? (Specify)

Number who use only?

Number who use & provide for others?

Number who provide for others only, no use?

Number of those who provide for others who are dealers?

Methamphetamine obtaining questions

Number of episodes **obtaining last** 30 days?
Number

Number of episodes **obtaining** last year?
Number

Last episode:

When was the last time you got some methamphetamine?
Last 24 hours
More than a day, less than a week
More than a week, less than two weeks
A month ago
More than a month ago

Is this source a dealer?
Yes
No

Quantity **obtained**?
[specify]

Payment
Cash
Free

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Trade for goods
Sex
Other

Weight or dollar denomination?
Weight
Dollar denomination

Obtained for use or distribution?
Use
Distribution
Both (used some, distributed some)

Location?
Delivery
Supplier's home
Other supplier location
Street
Bar/club
Other (specify)

How often have you **obtained** methamphetamine from him/her?
[question prompt for audio for qualitative analysis]

For how long?
[question prompt for audio for qualitative analysis]

Relationship with source:
Drug supply/receive only
Friend
Someone i get high with
Someone i get work with
Business (not drugs)
Sex partner
Exchange partner
Other (specify)

How do you contact the provider?
Cellphone (his/hers)
Beeper
Home/office landline phone
Meet in place where he/she hangs out (public locale)
Meet in place where he/she hangs out (private locale)

Describe provider's method:
[question prompt for audio for qualitative analysis]

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Was this a “get it & go” situation or did you hang out & socialize?
- “Get it & go”
- Socialized but no use
- Got high together
- Got high & had sex
- Had sex

How was the quality of this last product?
- Excellent
- Good
- Fair
- Poor
- I can’t tell the difference

Packaging if any?
- Plastic Ziploc
- Folded paper
- Glass bottle
- No packaging
- Other [specify]

If you know, did the provider prepare the product him/herself or get it from someone else?
- Prepared it
- Go from someone else
- Don’t know; suspect A
- Don’t know; suspect B

Have you ever provided methamphetamine to this provider?
- Yes
- No

Any problems?
- Yes [specify]
- No

Was this episode typical
- Yes
- No

Previous episode:
Same source as previous purchase?
- Yes
- No

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What if anything was different?
[question prompt for audio for qualitative analysis]]

Episode before that:

Same source as previous purchase?
Yes
No

What if anything was different?
[question prompt for audio for qualitative analysis]

When was the last time before that you got something from a different source?
[question prompt for audio for qualitative analysis]

Tell me about that
[question prompt for audio for qualitative analysis]

Consumer questions

Do you normally sniff, smoke or inject methamphetamine?
Sniff
Smoke
Inject
Other [specify]

Mode of ingestion, last 3 episodes of use?
[3 pulldowns of above]

Is the money that you spend on methamphetamine earned from a regular job?
Yes
No

Do you work when you use methamphetamine?
Yes
No

Do you have sex?
Yes
No

Do you get violent?
Yes
No

How long is a typical period of use for you?

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Less than 6 hours
6-12 hours
12-18 hours
18-24 hours
1-2 days
More than 2 days
Daily/almost daily user

Why do you use methamphetamine?
[question prompt for audio for qualitative analysis]

Is it your “drug of choice”?
[question prompt for audio for qualitative analysis]

When you use methamphetamine, do you use other drugs at the same time?
Never
Very rarely
Alcohol
GHB
Other {specify]

If you are a current or past cocaine user, how would you compare the two?
[question prompt for audio for qualitative analysis]

If you are a current or past Ecstasy user, how would you compare the two?
[question prompt for audio for qualitative analysis]

How do you manage your use? Do you set rules or ration yourself, for example?
[question prompt for audio for qualitative analysis]

When are you most likely/unlikely to use methamphetamine?
[question prompt for audio for qualitative analysis]

What do you do to counteract the effect of crashing?
[question prompt for audio for qualitative analysis]

How long does it take you to recover?
[question prompt for audio for qualitative analysis]

How has methamphetamine affected your relationship with your family and friends?
[question prompt for audio for qualitative analysis]

How has methamphetamine affected your routine of work?
[question prompt for audio for qualitative analysis]

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How has methamphetamine affected taking care of your needs?
[question prompt for audio for qualitative analysis]

Would you say you are dependent on methamphetamine use?
Yes
No

Have you been in the past?
Yes
No

Has methamphetamine use let you to engage in other illegal behaviors to make money, get drugs or avoid the police?
Yes
No
How many people are in your use circle or network?
Number

How many if any are MSM/non-MSM?
Number

On average how long have you known them?
[question prompt for audio for qualitative analysis]

How did you meet these people?
[question prompt for audio for qualitative analysis]

Do you have regular using partners?
Yes
No

How many people do you typically use the drug with?
Number

How would you describe most of the people in your use network? (close friend, friend, fuck-buddy, acquaintance)
[question prompt for audio for qualitative analysis]

What level of trust do you have with these people?
[question prompt for audio for qualitative analysis]

Have other users stolen from or otherwise taken advantage of you?
Yes
No

How do you/did you find your dealer?

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[question prompt for audio for qualitative analysis]

How long have you known your dealer?
[question prompt for audio for qualitative analysis]

Is this provider reliable? (i.e., always/sometimes holding, prompt/late, answers phone/doesn't answer phone, etc.)
Yes
No [specify; question prompt for audio for qualitative analysis]

Does the person you get methamphetamine from sell any other things?
Yes
No
What? *[checkboxes]*
Cannabis
Cocaine
Ecstasy
Pharmaceuticals
Other [specify]

How many dealers do you currently have access to?
Number

Tell me about the last dealer you knew before your current source
[question prompt for audio for qualitative analysis]

Providing for others questions

In the last 30 days, have you provided methamphetamine for anyone else, whether you made money or not (for example, splitting a bag with someone or hooking up a friend)?
Yes
No

How often?
Number

Number of episodes in the last year?
Number

Last episode:

When was the last time you provided or got some methamphetamine for someone else?
Last 24 hours
More than a day, less than a week

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More than a week, less than two weeks
A month ago
More than a month ago

Quantity?
[question prompt for audio for qualitative analysis]

Payment
Cash
Free
Trade for goods
Sex
Other

Weight or dollar denomination?
Weight
Dollar denomination

Location?
Delivery
Supplier's home
Other supplier location
Street
Bar/club
Other (specify)

Relationship with receiver
Drug supply/receive only
Friend
Someone i get high with
Someone i get work with
Business (not drugs)
Sex partner
Exchange partner
Other (specify)

How did receiver contact you?
Cellphone (mine)
Beeper
Home/office landline phone
Meet in place where I hang out (public locale)
Meet in place where I hang out (private locale)

Describe method:
[question prompt for audio for qualitative analysis]

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Was this a “get it & go” situation or did you hang out & socialize?
- “Get it & go”
- Socialized but no use
- Got high together
- Got high & had sex
- Had sex

How was the quality of this last product?
- Excellent
- Good
- Fair
- Poor
- I can’t tell the difference

Packaging if any?
- Plastic Ziploc
- Folded paper
- Glass bottle
- No packaging
- Other [specify]

Have you ever obtained methamphetamine from the receiver?
- Yes
- No

Any problems?
- Yes [specify]
- No

Was this episode typical?
- Yes [specify]
- No

Previous episode

Same as above, plus:
Same receiver as previous distribution?
- Yes [specify]
- No

Episode before that:

Same as above

[If all three previous episodes were sales for cash, follow up with seller module here]

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Seller module [all answers here for audio/qualitative analysis & subsequent coding]

Do you consider yourself a dealer?

Do you think others think of you that way?

How often do you provide methamphetamine for cash?

How long have you been doing this? How did you start?

Did you ever do this anywhere else besides NYC? Where?

Do you currently cook methamphetamine? Have you ever?

Do you have a regular supplier?

Do you shop around for the best deal?

What quantities do you typically get? Cost? How often? How much do you pay?

Do you pay when get the supply or after you have sold it?

Do you test purity when purchasing? How?

Do you cut/dilute before selling? How?

How do you store your product?

Do you sell by weight or dollar denomination?

Do you prepackage your product or weigh each sale individually?

If you know, where does the product you sell originate?

Is your source a dealer? Ethnicity/cultural identity? MSM/non-MSM?

Do you sell any other drugs?

Do you charge everyone the same amount? How much, or range and reasons?

Do you give credit?

How many customers do you have? Who are they? Ethnicity? Class? MSM/non-

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MSM?

How do you meet new customers, if at all?

Do you work with others? If yes, how do you know them? Relationship?

Usual selling method? Has this changed? If so, why?

Are you concerned about security from robbery? If so, what do you do about that?

Are you concerned about getting arrested when you're selling? If so, what do you do about that?

What do you spend your money on?

Market change questions [all answers here for audio/qualitative analysis & subsequent coding]

Are there any new groups of buyers or sellers that you have noticed in the recent past?

Are there any new ways of buying or using the drug that you have encountered in the recent past?

Criminal justice/crime questions [all yes/no, except "where" & "describe"]

Have you been arrested for methamphetamine possession:

Ever?

Last year?

Last 30 days?

Where?

Have you been arrested for methamphetamine distribution:

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Ever?

Last year?

Last 30 days?

Where?

Have you been arrested for other drug offenses:

Ever?

Last year?

Last 30 days?

Where?

Have you been arrested for other reasons:

Ever?

Last year?

Last 30 days?

Where?

Have the police prevented you from buying or selling?

Ever?

Last year?

Last 30 days?

Where?

Have the police confiscated your drugs?

Ever?

Last year?

Last 30 days?

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Where?

Have neighbors or other community residents prevented you from buying or selling methamphetamine? Ever?

Last year?

Last 30 days?

Where?

Weapons: Do you:

Own?
- No
- Yes (specify)

Carry?
- No
- Yes (specify)

Carry when selling?
- No
- Yes (specify)

Using?
- No
- Yes (specify)

Have you been robbed while selling?

Ever?

Last year?

Last 30 days?

(Describe; question prompt for audio for qualitative analysis)

Have you been robbed while buying?

Ever?

Last year?

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Last 30 days?

Where?

(Describe; question prompt for audio for qualitative analysis)

Have you been involved in any violence when selling?

Ever?

Last year?

Last 30 days?

(Describe; question prompt for audio for qualitative analysis)

Have you been involved in any violence when buying?

Ever?

Last year?

Last 30 days?

(Describe; question prompt for audio for qualitative analysis)

Sex network questions

How many sex partners have you had in the last year?

Last 30 days?

How many did you use methamphetamine with: Last year?

Last 30 days?

Is your meth use primarily around having sex?
- Yes
- No

How often do you have sex without using meth?
- Never
- Seldom
- About half the time
- More often than not
- Seldom/never have sex during meth use

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How does meth use change sex?
[question prompt for audio for qualitative analysis]

Do you seek methamphetamine-using sex partners on the internet?
Yes
No

Through other means?
Yes
No

If yes to either:
We meet for sex, each supplies drugs (non-exchange)
I supply drugs for my partners
my partners supply drugs for me
Other (specify)

Random sampling from ego network

Earlier, you told me you know X people who use methamphetamine or provide it for others (whether or not money or other payment changes hands) whose cell number you know.
[If number is 5 or fewer, attempt to get matching/follow-up data n all; if number is greater, Participant is given list of first names in rough inverse order of frequency in the US population, with names beginning with the same first letter & which occur with approximately the same frequency clustered so as to obscure from the interviewer what name is actually being chosen]

I'd like you to look at this list of names, until you find the name of one of those people. Then I'd like you to answer a series of questions about that person.
[Matching question module]

OK, I'd like you to find another person in the list
[Reiterate until five network members are elicited]

Nature of relationship:

Relationship to market
Obtains only
Obtains & provides for others
Provides for others only

Relationship:
Drug supply/receive only

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Friend
Someone i get high with
Someone i get work with
Business (not drugs)
Sex partner
Exchange partner
Other (specify)

If drug supply/receive only:
I get from him/her
He/she gets from me
Both

If sex partner:
Married/live together
Other long-term relationship
Dating
Casual partner
Internet partner

If exchange partner:
Commercial exchange partner- I pay
Commercial exchange partner- he/she pays
Drug exchange partner- I supply
Drug exchange partner- he/she supplies
Other

Other network data (2 questions, each with matching follow-ups)

Now I want to ask you about the person you personally get it from, whether that's a dealer or not. I'd like you to answer a series of questions about that person.
[Matching question module]
Is this person a dealer or someone who just hooks other people up?
Dealer
Someone who hooks up others

Now I'd like to ask you to think about the person you'd call to find a new source if your regular sources all had nothing available. I'd like you to answer a series of questions about that person.
[Matching question module]

Matching Question module:

Last digit of cellphone number:
Even

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Odd
0-4
5-9

Next to last digit:
Even
Odd
0-4
5-9

Digit before that:
Even
Odd
0-4
5-9

Is the person:
Male
Female
Trans

Does the person have sex with
Men
Women
Both
Don’t know

Race:
White
Black
Hispanic
Asian
Other

Age:
Under 20
20s
30s
40s
50s
60 or older

Use/sell:
Uses only
Uses & hooks up others
Uses & sells

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Sells only
Other

Height:
5'4" or less
5'4"-5'8"
5'7"-5'11"
5'10-6'2"
6'1'-6'4"
6'4" & taller

Weight:
125 or less
125-145
135-155
145-165
155-175
165-185
175-195
185-205
195-225
205-225
225 or more

Lives:
Battery-Canal
Canal-14
14-23
23-59
59-86
86-110
Above 110th
Bronx
Brooklyn
Queens
SI
LI
NJ
Other
Don't know

Hair color:
Blond(e)
Brown
Black
Salt & pepper

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Grey
Bleached
Color not found in nature
Shaves head

Eye color:
Blue
Light Brown
Brown
Green
Other

Other notable physical characteristics
[specify]

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Follow-Up interview

How many did P recruit?
- One
- Two
- Three

[Import refusal data from RDSCM]

Do any of the people you recruited know your recruiter?
- No
- One does
- Two do
- All three do

[As appropriate:]
Which one/which two?
- Number
- Number

Do any of the people you recruited know each other?
- No
- All know each other
- Other [specify]

When we did the last interview, I asked you some questions about people you know.
Were any of the people you recruited among those people you told me about then?
- No
- One: Number
- Two: Numbers
- Three: Numbers
- Four: Numbers
- Five: Numbers
- Six: Numbers
- Seven: Numbers

Do you have any new sources of methamphetamine since our initial interview?
- Yes
- No
- Yes, but I haven't gotten anything from new source yet

[If Yes: followup as needed, up to 3 new sources]

Is this source a dealer?

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Yes
No

Quantity **obtained**?
[specify]

Payment
Cash
Free
Trade for goods
Sex
Other

Weight or dollar denomination?
Weight
Dollar denomination

Obtained for use or distribution?
Use
Distribution
Both (used some, distributed some)

Location?
Delivery
Supplier's home
Other supplier location
Street
Bar/club
Other (specify)

How often have you **obtained** methamphetamine from him/her?
[question prompt for audio for qualitative analysis]

For how long?
[question prompt for audio for qualitative analysis]

Relationship with source:
Drug supply/receive only
Friend
Someone i get high with
Someone i get work with
Business (not drugs)
Sex partner
Exchange partner
Other (specify)

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How do you contact the provider?
- Cellphone (his/hers)
- Beeper
- Home/office landline phone
- Meet in place where he/she hangs out (public locale)
- Meet in place where he/she hangs out (private locale)

Describe provider's method:
- [question prompt for audio for qualitative analysis]

Was this a "get it & go" situation or did you hang out & socialize?
- "Get it & go"
- Socialized but no use
- Got high together
- Got high & had sex
- Had sex

How was the quality of this last product?
- Excellent
- Good
- Fair
- Poor
- I can't tell the difference

Packaging if any?
- Plastic Ziploc
- Folded paper
- Glass bottle
- No packaging
- Other [specify]

If you know, did the provider prepare the product him/herself or get it from someone else?
- Prepared it
- Go from someone else
- Don't know; suspect A
- Don't know; suspect B

Have you ever provided methamphetamine to this provider?
- Yes
- No

Any problems?
- Yes [specify]
- No

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Has your use of methamphetamine changed since out first interview?
[question prompt for audio for qualitative analysis]

What else has changed since we last talked?
[question prompt for audio for qualitative analysis]

Constructed Variables, by Dataset (italicized)

MethRoster

AgeCat = Categorical Age (Categorical, String)
18-29
30-39
40 plus

Obtaining

SexualID = Sexual Identity (Categorical, Numeric)
0 = MSM
1 = MSMW
2 = MSW
3 = WSM
4 = WSMW
5 = TSM

SexID3 = 3-Category Sexual Identity (Categorical, String)
MSM
MSMW
Everyone Else

MSM = Subject Identifies as MSM (Binary, Numeric)
1 = MSM
0 = Non-MSM (Note: includes MSMW, and all subjects not identifying as strictly MSM)

MSMW = Subject Identifies as MSMW (Binary, Numeric)
1 = MSMW
0 = Non-MSMW (Note: includes MSM, and all subjects not identifying as strictly MSMW)

MSMandMSMW = Subject Identifies as MSM or MSMW (Binary, Numeric)
1 = MSM or MSMW
0 = Not MSM or MSMW

Everyone Else = Subject Identifies as MSW, WSM, WSMW, or TSM (Binary, Numeric)

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1 = "Everyone Else," i.e., MSW, WSM, WSMW, TSM
0 = MSM or MSMW

MSM1 = Same variable as MSM, but missing data.

MSM2 = Same variable as Everyone Else, but missing data.

EveryoneElseOld = Same variable as Everyone Else, but missing data.

MSM3 = Subjects Identifying as MSM, MSWM, or TSM (Binary, Numeric)
(Note: This variable contains missing data.)
1 = MSM, MSMW, or TSM
0 = Not MSM, MSMW, or TSM

Race = Subject's Reported Race (Categorical, Numeric)
1 = White
2 = African-American
3 = Hispanic or Latino/a
4 = Other Race

WhereGotRecode = Condensed "Where Subject Got Meth at Last Transaction" (Categorical, String)
Bar/Club
Delivery
Other
Street
Supplier Home

RelationshipToSourceRecode = Condensed "Relationship to Source at Last Transaction" (Categorical, String)
Drug Transaction Only
Exchange Partner
Friend
I Get High With
Other
Sex Partner

DrugTransOnly = Last Transaction Revolved Around Drug Only (Binary, Numeric)
1 = Yes
0 = No

HowContactedRecode = Condensed "How Contacted Source at Last Transaction" (Categorical, String)
(s)he hangs out in priv.
(s)he hangs out in public

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Cellphone
Other

QualityClean = Cleaned Version of "Quality of Meth at Last Transaction" (Categorical, String)
Poor
Fair
Good
Excellent

Quality Scale = Scale Version of "Quality of Meth at Last Transaction" (Scale)
1 = Poor
2 = Fair
3 = Good
4 = Excellent

PackingRecode = Condensed Version of "Packaging of Meth at Last Transaction" (Categorical, String)
Foil
Glassine
No Packaging
Other
Plastic Ziplock

ObtainedDaily = Subject Obtained Meth Daily (Binary, Numeric)
1 = Yes
0 = No

ObtainedWeekly = Subject Obtained Meth Weekly (Binary, Numeric)
1 = Yes
0 = No

Obtained30 Cat = Number of Days Subject Obtained Meth in Past Month (Categorical, Numeric)
1 = 1-4 Days
2 = 5-9 Days
3 = 10-19 Days
4 = 20-29 Days
5 = 30 Plus Days

SpentLastTransaction = Amount in Dollars Subject Spent on Meth at Last Transaction (Continuous, Numeric)

SpentLastCat = Amount in Dollars Subject Spent on Meth at Last Transaction (Categorical, Numeric)
1 = 0-59

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2 = 60-119
3 = 120-239
4 = 240-359
5 = 360 plus

SpentLastTransaction2 = Recoded " Amount in Dollars Subject Spent on Meth at Last Transaction" (Categorical, Numeric)
1 = 119 and Under
2 = 120-239
3 = 240-359
4 = 360 and Over

Consumer

(Note: Variables **SexualID, SexID3, MSM, MSMW, MSMandMSMW, EveryoneElse, MSM1, MSM2, EveryoneElseOld, MSM3**, and **Race** detailed above.)

UsuallyTakeHowClean = Cleaned Version of "UsuallyTakeHowClean" (Categorical, String)
Inject
Other
Smoke
Sniff

WorkWhileUsingClean = Cleaned Version of "WorkWhileUsing" (Binary, String)
Yes
No

PeriodOfUseClean = Cleaned Version of "Typical Period of Use" (Categorical, String)
Over 2 Days
1-2 Days
12-18 Hours
18-24 Hours
6-12 Hours
Less than 6 Hours

Gender = Subject's Reported Gender (Categorical, Numeric)
0 = Male
1 = Female
2 = Transgender

White = Subject Reported "White" Race (Binary, Numeric)
1 = Yes
0 = No

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Black = Subject Reported "Black" Race (Binary, Numeric)
1 = Yes
0 = No

Hispanic = Subject Reported "Hispanic" Race (Binary, Numeric)
1 = Yes
0 = No

Other = Subject Reported "Other" Race (Binary, Numeric)
1 = Yes
0 = No

Smoke = Subject Reported Smoking as Usual Route of Meth Administration (Binary, Numeric)
1 = Yes
0 = No

Sniff = Subject Reported Sniffing as Usual Route of Meth Administration (Binary, Numeric)
1 = Yes
0 = No

Inject = Subject Reported Injecting as Usual Route of Meth Administration (Binary, Numeric)
1 = Yes
0 = No

OtherAdmin = Subject Reported Other as Usual Route of Meth Administration (Binary, Numeric)
1 = Yes
0 = No

UseMoneyRecode = Numeric Version of "UseMoneyFromJob" (Binary, Numeric)
1 = Yes
0 = No

WorkWhileUsingRecode = Numeric Version of "WorkWhileUsing" (Binary, Numeric)
1 = Yes
0 = No

HaveSexRecode = Numeric Version of "HaveSex" (Binary, Numeric)
1 = Yes
0 = No

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GetViolentRecode = Numeric Version of "GetViolent" (Binary, Numeric)
1 = Yes
0 = No

DependentRecode = Numeric Version of "Dependent" (Binary, Numeric)
1 = Yes
0 = No

RegularPartnersRecode = Numeric Version of "RegularPartners" (Binary, Numeric)
1 = Yes
0 = No

IllegalBehavRecode = Numeric Version of "IllegalBehaviors" (Binary, Numeric)
1 = Yes
0 = No

StolenAdvantageRecode = Numeric Version of "StolenAdvantage" (Binary, Numeric)
1 = Yes
0 = No

PeriodofUseCat = Numeric Version of "PeriodOfUseClean" (Categorical, Numeric)
1 = Less Than 6 Hours
2 = 6-12 Hours
3 = 12-18 Hours
4 = 18-24 Hours
5 = 1-2 Days
6 = Over 2 Days

HowManyUseWithCat = Categorical Version of "HowManyUseWith" (Categorical, Numeric)
1 = 0
2 = 1
3 = 2-4
4 = 5-9
5 = 10 Plus

PeriodOfUseCat = Recode of PeriodOfUseCat (Categorical, String)
12-24 Hours
24-48 Hours
48 Hours and Over
Less Than 12 Hours

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Criminal Justice

(Note: Variables **SexualID, SexID3, MSM, MSMW, MSMandMSMW, Gender, EveryoneElse, MSM1, MSM2, EveryoneElseOld, MSM3**, and **Race** detailed above.)

ArrestedPossessionRC = Numeric Recode of Arrested Possession (Binary, Numeric)
1 = Yes
0 = No

Network

(Note: Variables **SexualID, SexID3, MSM, MSMW, MSMandMSMW, Gender, EveryoneElse, MSM1, MSM2, EveryoneElseOld, MSM3**, and **Race** detailed above.)

PropUseProvide = Proportion of Users (in Subject's Network) Who Also Provide (Continuous, Numeric)

PropProvDealers = Proportion of Providers (in Subject's Network) Who Are Dealers (Continuous, Numeric)

SeldomSexWoMeth = Subject Reports (S)he Seldom or Rarely Has Sex Without Meth (Binary, String)
Yes
No

Providing

(Note: Variables **SexualID, SexID3, MSM, MSMW, MSMandMSMW, Gender, EveryoneElse, MSM1, MSM2, EveryoneElseOld, MSM3**, and **Race** detailed above.)

WhereProvidedRecode = Condensed Version of "WhereProvided" (Categorical, String)
Bar/Club
Delivery
Other
Street
Supplier Home

RelationshipProvidedRecode = Condensed Version of "RelationshipProvided" (Categorical, String)
Drug Transaction Only

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Exchange Partner
Friend
I Get High With
Other
Sex Partner

HowContactedProvidedRecode = Condensed Version of "HowContactedProvided" (Categorical, String)
(s)he hangs out in priv.
(s)he hangs out in public
Cellphone
Online
Other

ProvidedDaily = Subject Provided Meth Daily (Binary, Numeric)
1 = Yes
0 = No

ProvidedWeekly = Subject Provided Meth Weekly (Binary, Numeric)
1 = Yes
0 = No

Egonet

RoleClean = Cleaned Version of "Role" (Categorical, String)
Obtain and Provide
Obtain Only
Provide Only

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APPENDIX 2 SHANNON-JENSON DIVERGENCE AS A MEASURE OF INTER-GROUP DIFFERENCE

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The Shannon-Jensen Divergence of two distributions is the difference between the entropy of the average distribution, and the average of the entropies of the individual distributions.

EXAMPLE.

For example, suppose we have the probability distribution P of a fair coin: P(heads)=0.5, P(tails)=0.5. Suppose Q is the distribution for a coin which is biased 5% towards heads: Q(heads)=0.525, Q(tails)=0.475. What is the Shannon-Jensen divergence of between P and Q?

The (base 2) entropy of P is $H(P) = [-0.5 * \log_2(0.5)] + [-0.5 * \log_2(0.5)] = 1$

Likewise, $H(Q) = [-0.525 * \log_2(0.525)] + [-0.475 * \log_2(0.475)] = 0.998196$

The average of these two entropies $(H(P) + H(Q))/2$ is 0.999549

The average distribution $A = (P+Q)/2$ is given by A(heads)= 0.5125, A(tails)= 0.4875.

Now $H(A) = [-0.5125 * \log_2(0.5125)] + [-0.4875 * \log_2(0.4875)] = 0.999549$

The difference between H(A) and $(H(P) + H(Q))/2$ is by definition, the Jensen-Shannon divergence, of P and Q. This evaluates to: 0.000451

NOTE: All the calculations above were done using log base 2. If they had been done using base 10, he computed numbers would be lower by a multiplicative factor of $\log_2(10)$, which is 3.321928. Thus, in base 10 computations, the difference between H(A) and $(H(P) + H(Q))/2$ is by definition, the Jensen-Shannon divergence, which evaluates to: 0.000451/3.321928 which is **0.000136.**

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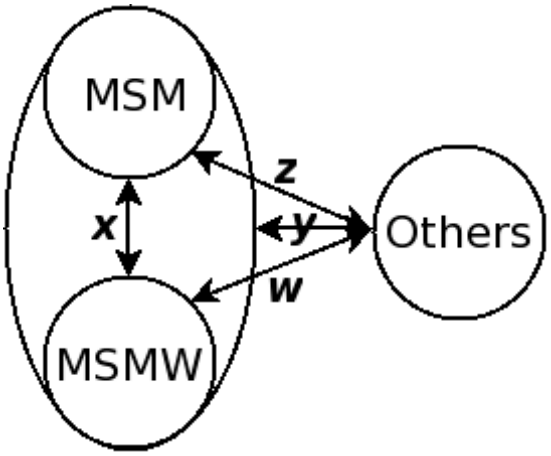
In our analyses, all Shannon-Jensen distances are computed using base 10.

Two distributions are said to be significantly different, if their Shannon-Jensen distance exceeds **0.000136** (see the above example).

In our analyses, for each variable, we shall consider three subpopulations:

(i) MSM: men who have sex with (only) men
(ii) MSMW: men who have sex with men and women
(iii) Others, i.e. everyone else – including men who have sex only with women, women regardless of their sexual identity, and transgender persons.
(iv) The union of sets (i) and (ii).

Between these four sets, we compute the four Shannen-Jensen distances depicted in the following diagram.



X represents the distance of the variable distributions manifested by the MSM and MSMW populations.
Z represents the distance of the variable distributions manifested by the MSM and Others populations.
W represents the distance of the variable distribution manifested by the MSMW and Others populations.
Y represents the distance of the variable distribution manifested by the MSM+MSMW and Others populations.

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When any of these quantities approach 0, the corresponding pair of distributions become identical.

To help evaluate the significance of these numbers, we construct a ratio table, in which the (row I, column J) entry has the quotient of the variable associated with row I and the variable associated with column J:

	Bigger	X	Y	Z	W
Smaller		X	Y	Z	W
X	X	*X/X*	*Y/X*	*Z/X*	*W/X*
Y	Y	*X/Y*	*Y/Y*	*Z/Y*	*W/Y*
Z	Z	*X/Z*	*Y/Z*	*Z/Z*	*W/Z*
W	W	*X/W*	*Y/W*	*Z/W*	*W/W*

Note that the diagonal entries of the table all must necessarily be 1, and that the value of entry I,J is the reciprocal of the value in entry J,I. In light of these structural facts, we will minimize the visual congestion by showing only those entries in the table that are >1.

Below is an example of a real table of such distances for the variable **PrescriptionYN**.

Smaller		0.0002535	0.0008485	0.0005661	0.0015757
X	0.0002535		*3.3464542*	*2.2326931*	*6.214621*
Y	0.0008485				*1.8570764*
Z	0.0005661		*1.498842*		*2.7834641*
W	0.0015757				

Geometrically, one of three possible cases may arise in regarding the relationships of the quantities X,Z, and W. These are:

- **Case 1: MSM and MSMW are most similar, the Others population is different.**
  X < Z and X < W, or equivalently Z/X > 1 and W/X>1
- **Case 2: Others and MSMW are most similar, the MSM population is different.**

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W < X and W < Z, or equivalently X/W > 1 and Z/W>1

- **Case 3: Others and MSM are most similar, the MSMW population is different.**

  Z < X and Z < W, or equivalently X/Z > 1 and W/Z>1

Let us now see how we can identify these cases from patterns of values in the corresponding ratio tables. Since the cases are defined in terms of quantities X, Z, and W, they do not concern Y, and we have emphasized this by shading the row and column of Y in red.

- **Identifying Case 1: MSM and MSMW are most similar, the Others population is different.**

  X < Z and X < W, or equivalently Z/X > 1 and W/X>1

Two different ratio tables can give rise to this (since the relationship of Z to W is unspecified).

	Bigger	X	Y	Z	W
Smaller		X val	Y val	Z val	W val
X	X val			####	####
Y	Y val				
Z	Z val				
W	W val			****	

CASE 1A

	Bigger	X	Y	Z	W
Smaller		X val	Y val	Z val	W val
X	X val			####	####
Y	Y val				
Z	Z val				****
W	W val				

CASE 1B

Identifying Case 2: Others and MSMW are most similar, the MSM population is different.

W < X and W < Z, or equivalently X/W > 1 and Z/W>1

Two different ratio tables can give rise to this (since the relationship of Z to X is unspecified).

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	Bigger	X	Y	Z	W
Smaller		####	####	####	####
X	X val			****	
Y	Y val				
Z	Z val				
W	W val	####		####	

CASE 2A

	Bigger	X	Y	Z	W
Smaller		X val	Y val	Z val	W val
X	X val				
Y	Y val				
Z	Z val	****			
W	W val	####		####	

CASE 2B

Identifying Case 3: Others and MSM are most similar, the MSMW population is different.

Z < X and Z < W, or equivalently X/Z > 1 and W/Z>1

Two different ratio tables can give rise to this (since the relationship of X to W is unspecified)

	Bigger	X	Y	Z	W
Smaller		X val	Y val	Z val	W val
X	X val				
Y	Y val				
Z	Z val	####			####
W	W val	****			

CASE 3A

	Bigger	X	Y	Z	W
Smaller		X val	Y val	Z val	W val
X	X val				****
Y	Y val				
Z	Z val	####			####
W	W val				

CASE 3B

The earlier concrete example of **PrescriptionYN** ratio table, is now seen to fall clearly into Case 1B.

Smaller		0.0002535	0.0008485	0.0005661	0.0015757
X	0.0002535		*3.3464542*	*2.2326931*	*6.214621*
Y	0.0008485				*1.8570764*
Z	0.0005661		*1.498842*		*2.7834641*
W	0.0015757				

From this we conclude that in the study of **PrescriptionYN**, the MSM and MSMW are most similar, while the Others population is different.

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APPENDIX 3 EXPANDING THE NETWORK SAMPLE AND COMPUTING THE STRENGTH OF MATCHES

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Expanding the Network Sample: The Matching Relation

To construct the expanded network, each of the 132 subjects interviewed in the course of the study was asked to report their ego network size. The subject was then asked for details about a randomly selected subset of members from their ego network, up to 5 total.[27] For each of member of their network identified (hereafter referred to as "reports"), the subject was asked to provide the report's telefunken code, together with 6 pieces of categorical data: gender, ethnicity, weight, height, hair color, and eye color.

The matching procedure used these data to identify connections between research subjects that were not discovered by the RDS referral chains. To obtain these connections, it is assumed that two individuals (be they reports or subjects) are a "*match*" if their telefunken codes coincide, and that at least 3 of the 6 categorical data elements concerning them agree (see the section "Computing the strength of matches" below). Degrees of similarity less than 3 are shown below, but did not result in a connection being added to the RDS trees in the construction of the expanded network.

Inferring Internal Links

A total of 75 matches were found between reports and subjects with 3 or more degrees of similarity. These form the basis of inferred internal links. To

[27] In the event that their ego network was smaller than 5, the subject was asked for characteristics of their entire network. The limit of 5 partners was intended to allow the interview process to remain reasonable from the perspective of the participant. It does, however, limit the outdegree of some participants, and in those cases where outdegree is systematically higher for some research sub-populations than for others, this will necessarily result in a systematic bias in the results. These limits are discussed later in this section.

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begin, 48 potential matches in the subject reports were found to unambiguously match a unique research subject (see Table A3-1). This provided us information about 48 potential edges, internal to the study population—that is, where one research subject identified a link with only one other research subject that was not accounted for in the list of connections discovered in the RDS sample.

In addition, 11 of the reports were found to match 2 subjects, and 2 reports were found to match 3 subjects (see table A3-2). This accounts for the remaining 28 matches discovered. However, the fact that these reports matched more than one subject makes our knowledge of the location of these 13 internal edges uncertain. As a result, these connections were not entered into the expanded network.

In conclusion, it is possible to postulate the unambiguous existence of 48 internal edges, and the existence of 13 potential additional internal edges whose uncertain location required that they be left out of the expanded network.

Addressing the Non-Transitivity of the Matching Relation

In addition, there were 135 matches discovered between pairs of reports, yet where no match to any research subject was discovered (see Table A3-3). Here, for example, a report from Subject A of a close network contact produced a telefunken code and description that matched a report from Subject B, yet not anyone interviewed in the course of our research. These sorts of matches form the basis of inferred external links. In considering these 135 matches between descriptions of reported individuals (sharing the same telefunken code) there is a subtle problem: The matching relation, while being reflexive and symmetric, is in general *not transitively closed.* It is easy to see how this can occur, since A and

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B may be deemed a match, and B and C may be deemed a match, but A and C may not be deemed a match. This non-transitivity of the matching relation makes the definition of equivalence classes of reports difficult to establish.

A first approach to this problem would be to simply add *all* missing A,C links required to (artificially) make the matching relation transitive. This is not the approach the team took, but consider what such an approach would entail. First, there are 34 instances of nodes A, B, C where A and B are a matching, B and C are a matching, but A and C are not a matching. Adding these 34 implied A-C links induces yet more new violations of transitivity, and addressing these requires adding an additional 11 matchings. Finally, having added a total of 34+11=45 matchings, the matching relation becomes transitively closed.

The problem with the above naive approach is that some of the links added to make matching relation transitive are not very plausible. As a hypothetical example, one can imagine reports A and B who agree on gender, ethnicity, height, and hair color, and reports B and C who agree on gender, ethnicity, height, and weight. Yet, reports A and C may differ greatly on hair color—for example A may be described as blond while C may have been describes to have black hair. Adding a matching link between A and C in such a scenario would be unwarranted. When one makes a more careful systematic examination of the 34 transitivity violations, we find that many are implausible as matches in this or other ways: 28 differ significantly on height, 33 differ significantly on weight, 27 differ significantly on hair color, and 26 differ significantly on eye color. Indeed, many transitivity violations are implausible

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because of *more than one* discrepancy in physical description. A careful examination shows us that only 9 of the 34 transitivity violations can be addressed by addition of artificial matchings that are plausible. After adding these 9 matchings, 11 new transitivity violations arise, of which only 3 are plausible as matchings. Taking this more nuanced approach, adds 9+3=12 plausible matchings. Although the matching relation is still not transitive, it is more dense, allowing us to take the next step.

Inferring External Nodes

In order to determine whether reports from different research subjects refer to the same (not-interviewed) contact, a similar process of matching reports was used. Yet because the actual telefunken code and demographics of the not-interviewed connection are unknown, additional steps must be taken. To begin, all clusters of report nodes that are connected under the matching relation are partitioned into cliques. These cliques represent classes of equivalent reports, permitting us to infer the existence of external nodes. Within each clique, the constituent nodes may be viewed as being reports who both have the same telefunken code *and* mutually share many physical characteristics. Each clique is coalesced by aggregating its constituent nodes to a point. This new aggregate node then represents a postulated individual, external to the study, whose existence and structural relationship to the study population has been inferred.

If analysis is restricted to individuals who have been reported by at least 2 different study subjects (i.e. cliques of size at least 2), there are 63 such new external individuals.

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These individuals, together with their physical characteristics form the bases of inferred external members of the network. A final list of these additional nodes is given below (see table A3-4), along with the characteristics gleaned from the overlaps in reported characteristics. For example, the new node 182 is white, male, between 6ft 1" and 6ft 4", weighing approximately 175-195 pounds, with brown hair and brown eyes. From the table above, one can see that our new node182 is the consolidation of report 10295 by subject 9, report 10296 by subject 20, report 10297 by subject 41 and report 10298 by subject 52. All 4 subjects (9,20,41, and 52) reported knowing methamphetamine-related contact with a white male, between 6ft 1" and 6ft 4", weighing approximately 175-195 pounds, with brown hair and brown eyes *and having the same telefunken code.* In cases where there were minor variations in physical description of reported individuals, the description given is that of the earliest report. As a result of this matching procedure, 63 additional vertices were added to the network.

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Table A3-1 Connections Among Research Subjects via Telefunken/Demographics

Match Number	Research Subject	Report	Match to Subject	Degrees of Similarity
1	1	10001	28	4
2	18	10093	125	4
3	31	10306	11	4
4	48	10056	25	4
5	60	10094	125	4
6	97	10026	90	4
7	10	10317	40	3
8	16	10184	69	3
9	30	10034	8	3
10	31	10247	21	3
11	33	10122	36	3
12	34	10229	10	3
13	36	10329	40	3
14	39	10320	40	3
15	45	10041	8	3
16	49	10322	78	3
17	50	10348	85	3
18	51	10226	10	3
19	53	10129	36	3
20	54	10011	28	3
21	54	10325	33	3
22	55	10130	52	3
23	55	10382	60	3
24	62	10138	67	3
25	73	10028	90	3
26	73	10305	126	3
27	74	10159	20	3
28	76	10039	8	3
29	85	10373	75	3
30	90	10095	110	3
31	97	10300	32	3
32	100	10054	25	3
33	101	10216	14	3
34	107	10355	54	3
35	111	10151	119	3
36	112	10328	79	3
37	113	10213	14	3

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Match Number	Research Subject	Report	Match to Subject	Degrees of Similarity
38	116	10010	28	3
39	116	10127	36	3
40	119	10379	60	3
41	123	10126	52	3
42	124	10228	10	3
43	125	10048	53	3
44	126	10391	120	3
45	127	10309	70	3
46	128	10057	25	3
47	128	10336	95	3
48	132	10070	99	3

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Table A3-2 Matches without a Uniquely Identified Subject

Match Number	Subject	Report	Number of Subjects Identified
49, 50	3	10002	2
51, 52	15	10393	2
53, 54	30	10003	2
55, 56	48	10224	2
57, 58	54	10086	2
59, 60	57	10387	2
60, 61	76	10388	2
62, 63	95	10071	2
64, 65	102	10083	2
66, 67	121	10090	2
68, 69	123	10085	2
70, 71, 72	90	10051	3
73, 73, 75	127	10389	3

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Table A3-3 Matches of Clique Size 2 or Greater, with No Corresponding Match to a Research Subject

newID	CliqueSize	Subject_Report	Matchings
133	2	3_10002	30_10003;
134	3	39_10004	116_10010; 119_10009
135	2	127_10008	71_10013;
136	2	52_10017	89_10018;
137	3	49_10021	45_10023; 96_10027;
138	2	97_10026	73_10028;
139	3	8_10032	45_10041; 76_10039;
140	2	122_10037	126_10040;
141	3	27_10046	125_10047; 24_10038;
142	3	100_10054	48_10056; 79_10060;
143	2	18_10069	94_10072;
144	3	44_10081	44_10080; 65_10088;
145	3	102_10083	123_10085; 54_10086;
146	3	121_10090	18_10093; 60_10094;
147	2	75_10091	90_10095;
148	3	5_10098	31_10110; 70_10105;
149	3	51_10100	114_10103; 129_10102;
150	2	57_10101	70_10106;
151	2	36_10107	27_10111;
152	3	123_10112	36_10114; 60_10113;
153	2	32_10121	97_10128;
154	2	33_10122	116_10127;
155	2	40_10123	53_10129;
156	2	123_10126	55_10130;
157	2	24_10133	24_10134;
158	2	33_10141	37_10142;
159	3	16_10146	111_10151; 84_10152;
160	2	126_10149	54_10153;
161	2	7_10167	103_10173;
162	3	52_10185	110_10187; 121_10186;
163	2	5_10190	52_10192;
164	2	47_10194	125_10195;
165	3	19_10196	29_10200; 37_10197;
166	2	85_10199	73_10201;
167	2	42_10203	44_10204;
168	2	90_10208	79_10209;
169	3	113_10213	101_10216; 77_10215;

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newID	CliqueSize	Subject_Report	Matchings
170	2	88_10217	104_10218;
171	2	127_10219	60_10220;
172	2	51_10226	34_10229;
173	2	3_10232	128_10234;
174	2	13_10236	45_10239;
175	2	34_10240	65_10243;
176	2	6_10244	44_10246;
177	2	6_10248	75_10252;
178	2	122_10259	72_10262;
179	2	57_10275	114_10276;
180	2	41_10282	46_10283;
181	3	16_10291	110_10293; 120_10292;
182	4	9_10295	20_10296; 41_10297; 52_10298;
183	2	8_10308	34_10310;
184	2	22_10318	70_10327;
185	3	49_10321	127_10323; 130_10326;
186	2	42_10330	77_10332;
187	2	129_10342	45_10343;
188	3	67_10352	107_10355; 129_10350;
189	2	4_10356	49_10359;
190	2	37_10371	128_10372;
191	2	33_10374	119_10380;
192	2	76_10378	112_10381;
193	4	57_10387	127_10389; 15_10393; 76_10388;
194	3	8_10394	25_10395; 34_10400;
195	2	82_10402	29_10405;

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Table A3-4 63 New Network Nodes with Final Characteristics Drawn from Earliest Subject Report

newID	CliqueSize	Gender	Ethnicity	Height	Weight	HairColor	EyeColor	Subject_Report
133	2	Male	White	5ft 10in - 6ft 2in	175-195	Brown	Blue	3_10002
134	3	Male	Hispanic	5ft 4in - 5ft 8in	125-145	Brown	Brown	39_10004
135	2	Male	Black	5ft 4in - 5ft 8in	135-155	Shaved	Brown	127_10008
136	2	Male	Black	5ft 7in - 5ft 11in	145-165	Black	Brown	52_10017
137	3	Male	Hispanic	5ft 7in - 5ft 11in	> 225	Black	Brown	49_10021
138	2	Male	Black	5ft 4in - 5ft 8in	135-155	Black	Brown	97_10026
139	3	Male	White	5ft 10in - 6ft 2in	175-195	Brown	Blue	8_10032
140	2	Male	Black	5ft 4in - 5ft 8in	175-195	Black	Brown	122_10037
141	3	Male	Hispanic	Below 5ft 4in	135-155	Black	Brown	27_10046
142	3	Male	White	5ft 7in - 5ft 11in	185-205	Brown	Blue	100_10054
143	2	Male	Hispanic	5ft 4in - 5ft 8in	155-175	Brown	Brown	18_10069
144	3	Male	White	5ft 4in - 5ft 8in	145-165	Brown	Brown	44_10081
145	3	Male	Black	5ft 7in - 5ft 11in	155-175	Black	Brown	102_10083
146	3	Male	Black	5ft 7in - 5ft 11in	155-175	Black	Brown	121_10090
147	2	Male	Hispanic	5ft 4in - 5ft 8in	185-205	Black	Brown	75_10091
148	3	Male	White	5ft 10in - 6ft 2in	175-195	Brown	Brown	5_10098
149	3	Male	Black	5ft 7in - 5ft 11in	175-195	Black	Brown	51_10100
150	2	Male	White	6ft 1in - 6ft 4in	175-195	Blond(e)	Blue	57_10101
151	2	Male	Hispanic	5ft 10in - 6ft 2in	155-175	Brown	Brown	36_10107
152	3	Male	White	5ft 10in - 6ft 2in	155-175	Black	Blue	123_10112
153	2	Male	Hispanic	5ft 4in - 5ft 8in	145-165	Brown	Light Brown	32_10121
154	2	Male	White	5ft 10in - 6ft 2in	185-205	Brown	Brown	33_10122
155	2	Male	White	5ft 4in - 5ft 8in	>225	Brown	Brown	40_10123
156	2	Male	Black	5ft 7in - 5ft 11in	195-215	Black	Brown	123_10126
157	2	Male	Hispanic	5ft 10in - 6ft 2in	205-225	Black	Brown	24_10133
158	2	Male	Hispanic	5ft 4in - 5ft 8in	165-185	Black	Brown	33_10141
159	3	Male	Black	5ft 4in - 5ft 8in	145-165	Black	Brown	16_10146
160	2	Male	Black	5ft 7in - 5ft 11in	175-195	Dreds	Brown	126_10149
161	2	Male	White	5ft 10in - 6ft 2in	205-225	Black	Green	7_10167
162	3	Male	Black	6ft 1in - 6ft 4in	205-225	Black	Brown	52_10185
163	2	Male	White	5ft 7in - 5ft 11in	155-175	Grey	Brown hazel	5_10190
164	2	Male	Hispanic	6ft 1in - 6ft 4in	>225	Black	Brown	47_10194