Understanding the Conflict Between Withdrawal and Disease Avoidance in the Risk Networks of People Who Inject Drugs in Rural Puerto Rico

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Vermont Center for Behavioral Health

March 2022

Why study rural drug use in Puerto Rico

Injection drug use in rural Puerto Rico has increased dramatically since the 1980s:

- Close link to New York and Boston heroin markets
- Evolution of the “trampoline” drug economy
- Gentrification and urban renewal that displace low-income high unemployment communities to rural areas
- Natural and fiscal disasters that hurt law enforcement efforts and exaggerated treatment deficits

2014-present “Vida Accion Salud (VAS)”

Support

- “Injection Risk Networks in Rural Puerto Rico” National Institute of Drug Abuse R01 DA037117.
  - NIDA Minority Supplement R01 DA037117-S1 -S2.
  - “Competing Supplement: Injection Risk Networks in Rural Puerto Rico”. National Institute on Drug Abuse R01 DA037117-S3.
- “REU Site: Undergraduate Research Opportunities to Broaden Participation in Minority Health Research” National Science Foundation SMA 1461132.
- “Modeling Social Behavior via Dynamic Network Interaction” National Institutes of Health, General Medical Sciences R01 GM118427.
- “REU Site: Social Network Analysis for Solving Minority Health Disparities”. National Science Foundation SMA 1757739
- “Assessing the effects of hurricane Maria on Opioid Agonist Treatment access among PWID in rural Puerto Rico.” R21 DA047304 National Institutes of Health, National Institute on Drug Abuse.
- “Biomarkers for Dysbiosis-Related HIV-Associated Cognitive Disorders among Persons Who Inject Drugs in Puerto Rico” National Institutes of Health, National Institute on Drug Abuse R01 DA047823

Local Partners:

- **El punto en la Montaña SEP**
- **University of Puerto Rico Medical Sciences** (Juan Carlos Reyes, Professor and Chair of Epidemiology and Biostatistics)
- **Universidad Central del Caribe School of Medicine** (Department of Microbiology and Immunology)
- **CDC National HIV Surveillance Team San Juan** (Sandra Miranda, Puerto Rico Department of Health)

Conflicts of Interest Declaration

This presentation declares no conflicts of interest or sources of support other than the federal funding support and university/organization partnerships listed in the previous slide.

Contents lists available at ScienceDirect

Journal of Substance Abuse Treatment

Association between alcohol consumption and injection and sexual risk behaviors among people who inject drugs in rural Puerto Rico

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Contents lists available at ScienceDirect

Addictive Behaviors Reports

journal homepage: www.elsevier.com/locate/abrep

Social determinants of HIV/HCV co-infection: A case study from people who inject drugs in rural Puerto Rico

Roberto Abadie *, Melissa Welch-Lazoritz, Bilal Khan, Kirk Dombrowski

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Full length article

Rural and urban comparisons of polysubstance use profiles and associated injection behaviors among people who inject drugs in Puerto Rico

Dane Hautala*, Roberto Abadie, Bilal Khan, Kirk Dombrowski

Substance Use & Misuse

ISSN: 1082-6084 (Print) 1532-2491 (Online) Journal homepage: http://www.tandfonline.com/loi/isum20

Injection Partners, HCV, and HIV Status among Rural Persons Who Inject Drugs in Puerto Rico

Patrick Habecker, Roberto Abadie, Melissa Welch-Lazoritz, Juan Carlos Reyes, Bilal Khan & Kirk Dombrowski

THE JOURNAL OF RURAL HEALTH

ORIGINAL ARTICLE

Latent Risk Subtypes Based on Injection and Sexual Behavior Among People Who Inject Drugs in Rural Puerto Rico

Dane Hautala, PhD;[1] Roberto
Kirk Dombrowski, PhD[1]

Duncan et al. Harm Reduction Journal (2017) 14:69
DOI 10.1186/s12954-017-0195-5

Harm Reduction Journal

RESEARCH Open Access

Needle acquisition patterns, network risk and social capital among rural PWID in Puerto Rico

Ian Duncan[1*], Patrick Habecker[1], Roberto Abadie[1], Ric Curtis[2], Bilal Khan[1] and Kirk Dombrowski[1]

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: http://ees.elsevier.com/pmedr

Hepatitis C serosorting among people who inject drugs in rural Puerto Rico

Contents lists available at ScienceDirect

International Journal of Drug Policy

journal homepage: www.elsevier.com/locate/drugpo

Research paper

Differential access to syringe exchange and other prevention activities among people who inject drugs in rural and urban areas of Puerto Rico

Melissa Welch-Lazoritz[a,*], Patrick Habecker[b], Kirk Dombrowski[a], Angelica Rivera Villegas[c], Carmen Ana Davila[c], Yadira Rolón Colón[d], Sandra Miranda De León[d]

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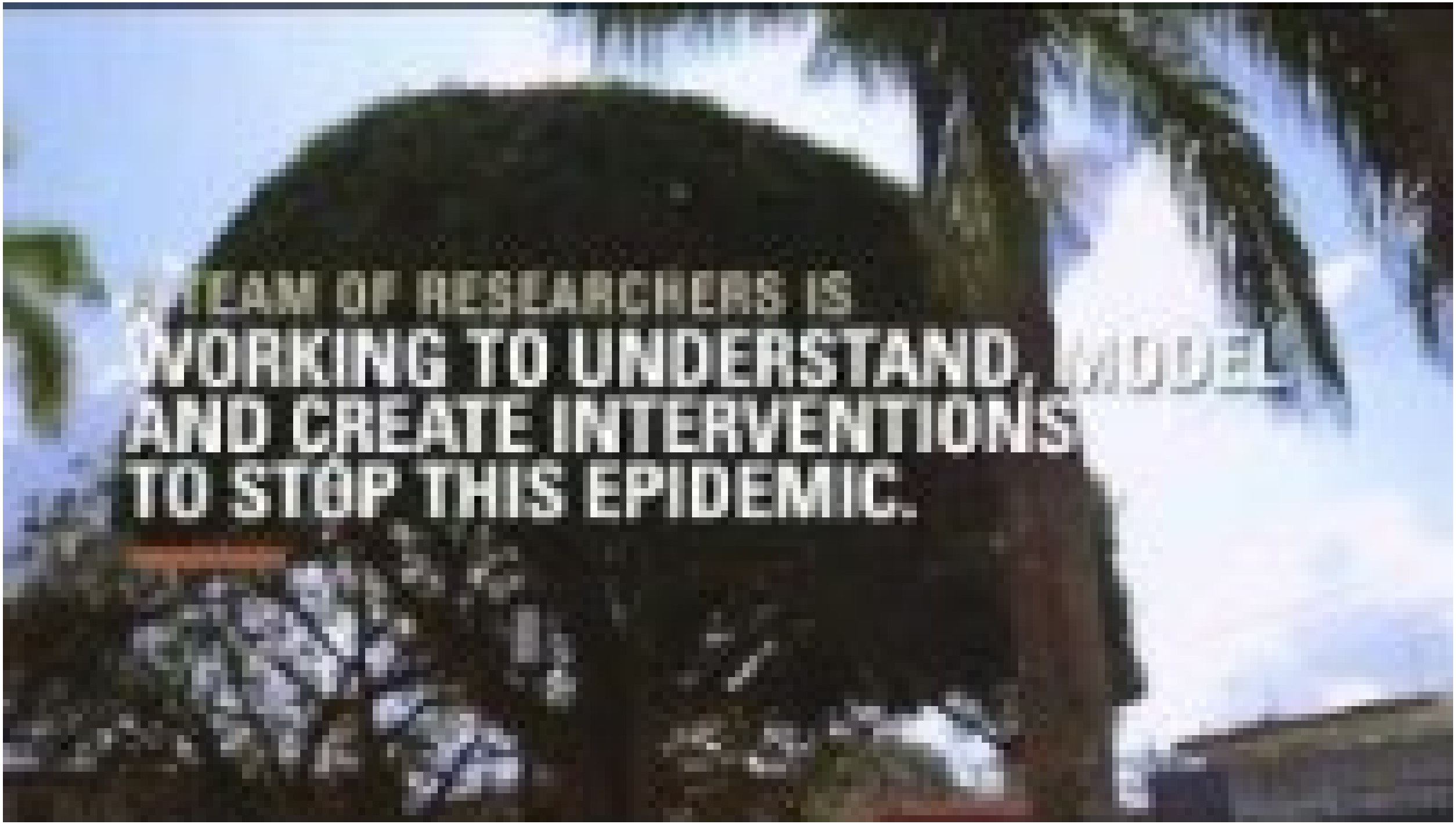

A TEAM OF RESEARCHERS IS
WORKING TO UNDERSTAND,
AND CREATE INTERVENTIONS
TO STOP THIS EPIDEMIC.


787.739.3993
CONSULTORIA ORTIZ
SERVICIOS DE CONSULTORIA


Benzos
1. Pali / Xanax
2. Ativan
3. Klonopin
4. Valium
5. Clonazepam
Riesgos Altos
1. Mezcla de Drogas
2. Usar de mas
3. Calidad / Potencia / Pure
4. haber
5. Usar solos
6. condicion fisico
Síntomas sobredosis
1. ronquido
2. no consciencia
3. viste perdida / ida
4. morado en labios, punta dedos
5. pálido

Table 1. Descriptive Statistics.

	Urban sample (512)	Rural sample (315)	Urban NHBS national aggregate
Demographics and health			
Age	41.1	41.8	
Gender (% female)	19%*	10%*	
Mean per capita income	$4,918*	$4,451*	
HIV + Status	13.4%*	6.0%*	11.00%
Been tested for HCV and HCV + Status	48.0%	49.0%	
Have health insurance coverage	52.0%*	82.0%*	61.20%
Have a usual source of health care	71.0%*	90.0%*	
Past year visited a health care provider	55.0%*	68.0%*	78.60%
Unable to access health care due to cost	26.0%*	12.0*%	
No visit to health care in past 5 years	12.0%*	8.0%*	
Ever tested for HIV	87.00%	90.00%	91.30%
Ever tested for HCV	65.0%*	77.0%*	78.00%
Injection drug use behaviors			
Age at first injection	20.6*	21.9*	
# of years spent injecting	20.1	19.9	
# of people used needles after	2.7*	1.2*	
# of people used works after	6.3	4.5	
# of people divided drugs with	4.3*	1.4*	
Past year average frequency of injection	5.8*	5.5*	
Frequency used a sterile needle	3.0*	2.7*	
Frequency used a dirty needle after someone	0.7*	0.4*	
Receptive sharing of syringes	36.90%	32.40%	33.00%
Receptive sharing of injection equipment	45.90%	59.00%	57.00%
Frequency shared a cooker with someone	1.0	1.1	
Frequency shared cotton with someone	0.9	0.7	
Frequency shared water with someone	0.8*	0.7*	

*$p < .05$

The San Juan NHBS sample and the VAS sample are similar in many ways, except:

- **Gender**
- **HIV Status**
- **Health Insurance/Care**
- **Drug and equipment sharing**

Where national NHBS statistics were available, the rural PR cohort seemed more like the national population than the urban San Juan network.

The baseline data

Risk for HCV

- Reported network size is positively associated with HCV+ status
- Smaller injection networks among those who self-report HCV− status suggests that those who believe their status to be negative may take protective action by reducing their injection network compared to those have a self-reported HCV+ or an unknown status.
- Urban PWID in PR with a known HCV+ status were more likely to know their last co-injector partner's HCV status than were their peers with a negative or unknown HCV status.
- Almost three-quarters (71.43%) used a cooker, cotton, or water that somebody had previously used, while one in three (32.14%) divided drugs with a syringe that had been previously used by somebody else.

Risk for HIV

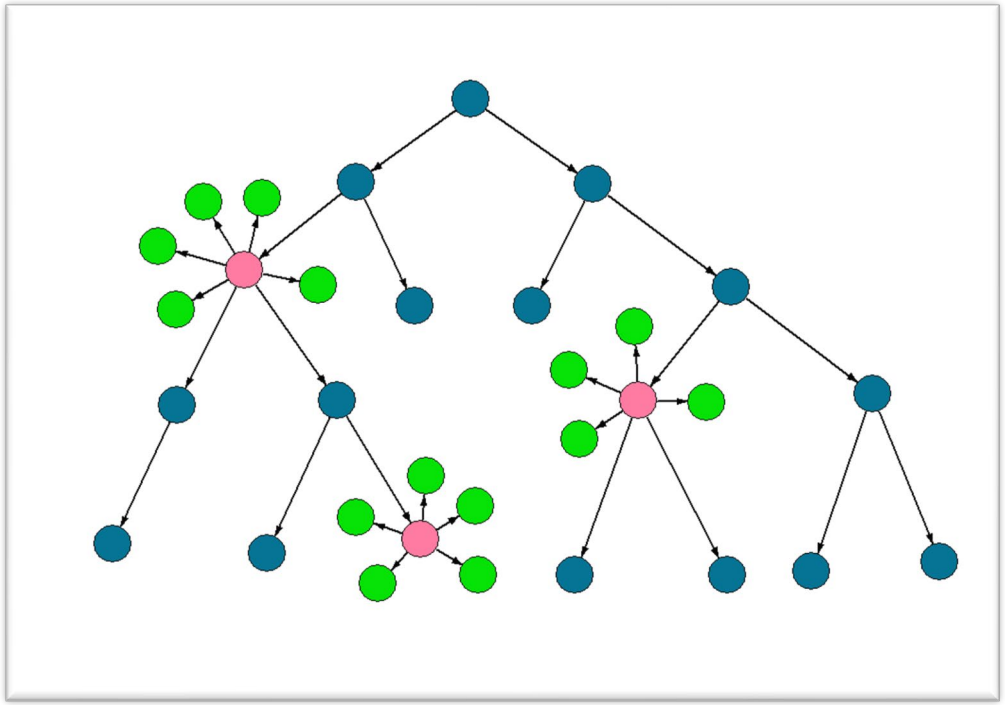
- Self-reported HIV statuses are not associated with different numbers of injection partners.
- Latent class analysis indicated four distinct risk groups: low risk (36%), high injection/low sexual risk (22%), low injection/high sexual risk (20%), and high risk (22%). Younger age and past year homelessness predicted high risk latent class membership, relative to the other classes.
- Daily speedball use predicted membership in the high injection/low sexual risk class, relative to the low risk and low injection/high sexual risk classes.

Vida Accion Salud

2015 Wave 1 – Respondent Driven Sampling, with a recruitment criteria of injection drug use in the last 30 days
2017 Wave 2 – Random resampling of the Wave 1 network for peer recruitment and micro ethnographic assays
2017 Post-Maria OAT study
2018 Wave 3 – Post-Maria resampling
2019 Photovoice Project
2019 Dysbiosis Related HIV Cognition Study

RDS sampling: we overlaid “micro-ethnographic assays” on RDS sampling to emphasize ethnographic consideration of network material

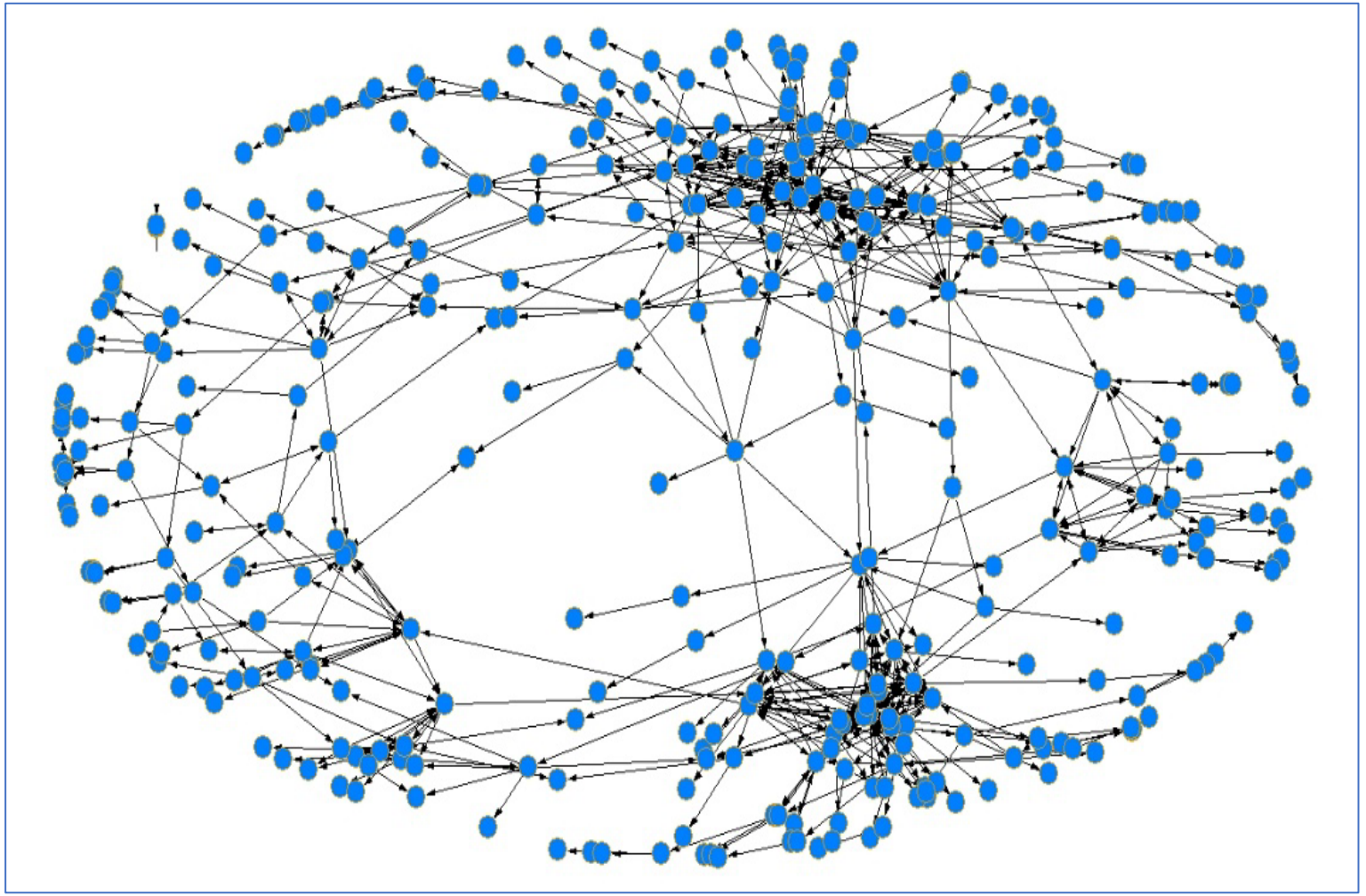
Micro-ethnographic assay: an extended version of “focal follows” that involved consistent interaction, informal questions, focal follows, and “visual reconstruction”



Co-use network

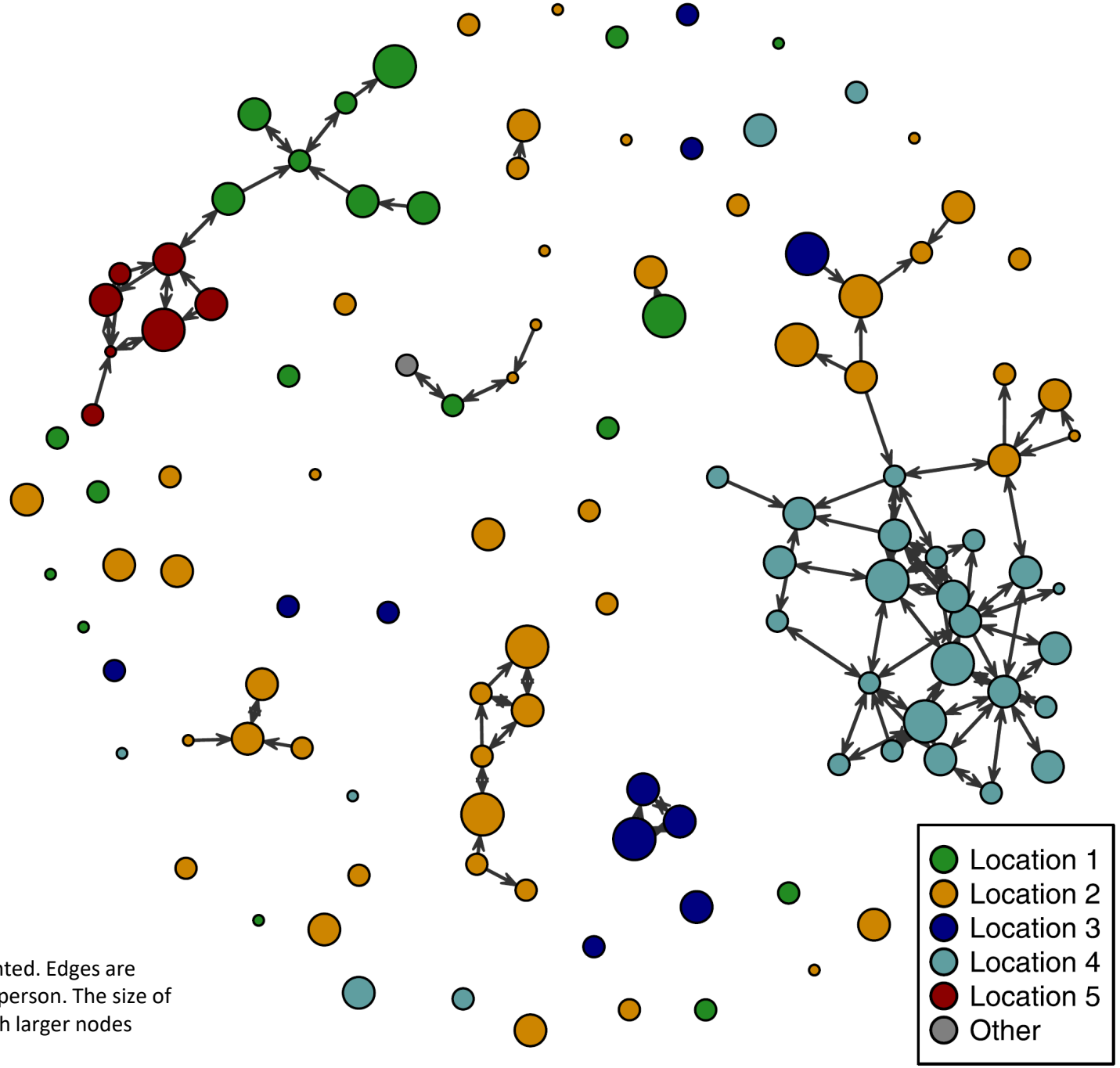
Last 30 co-users of injection drugs

- Clustering shows “core” individuals in 4-5 different communities
- Co-use can include syringe sharing, but could also include shared equipment use (cookers, filters) in an arrangement called “caballo”



The big question:

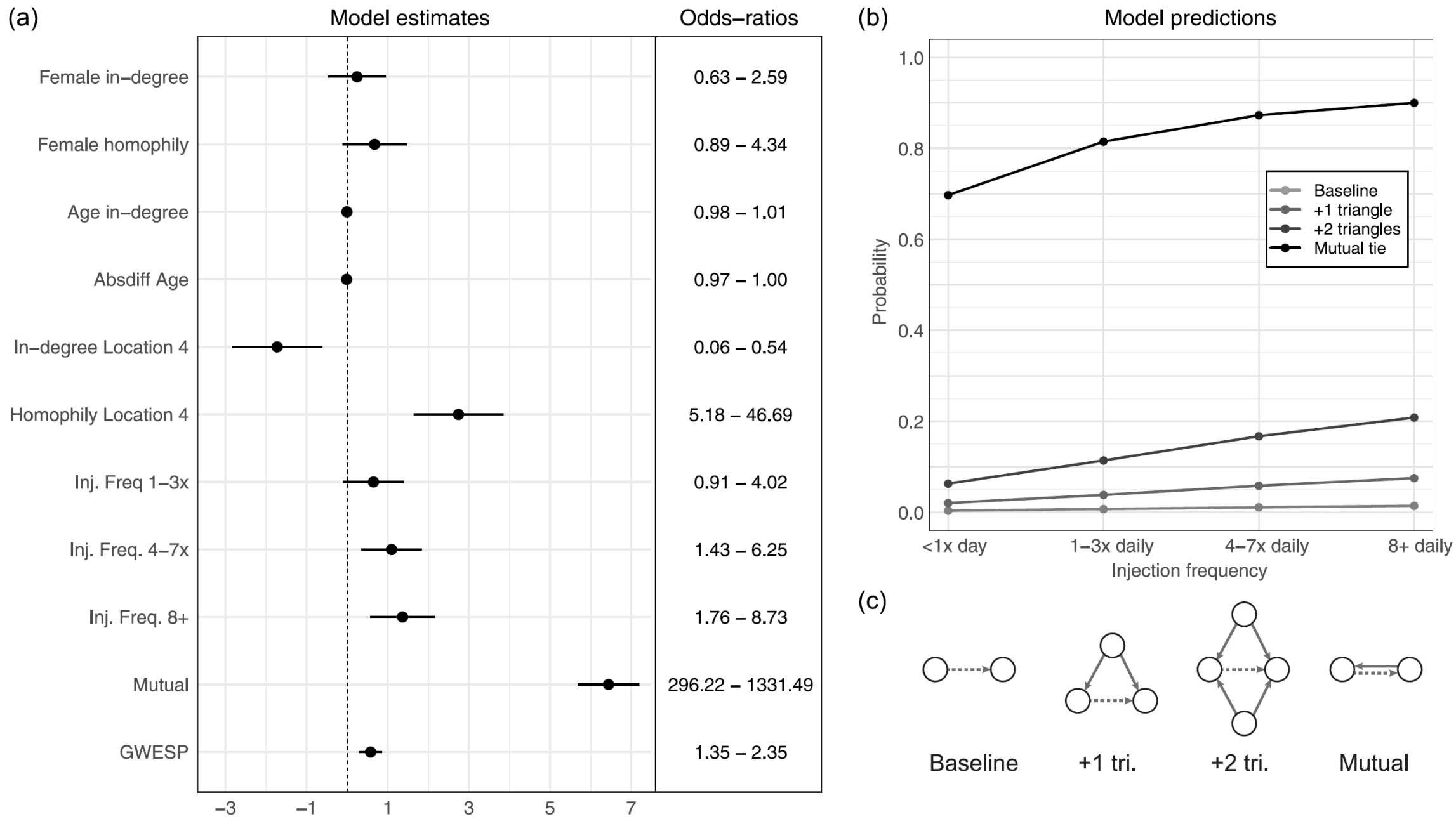
Do members engage in partner restriction to lower their risk of contracting HIV or hepatitis C (HCV), or in informed altruism to prevent others from contracting these infections?

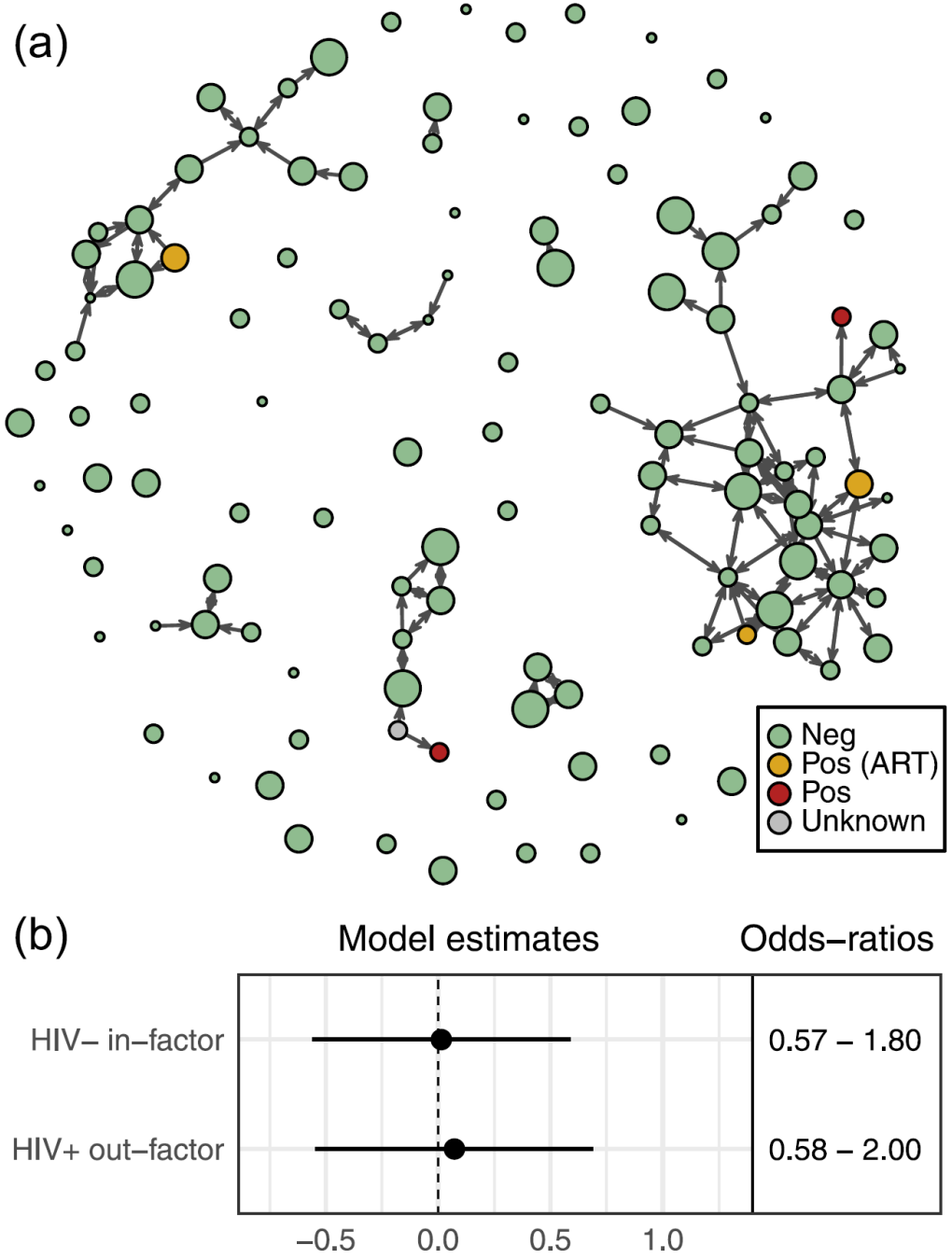


Nodes (individuals) are colored by the residence location of the individual represented. Edges are directed, with arrows pointing to the individual who used a needle after the other person. The size of nodes reflects the frequency with which individuals were using injection drugs, with larger nodes representing network members with a higher injection frequency.

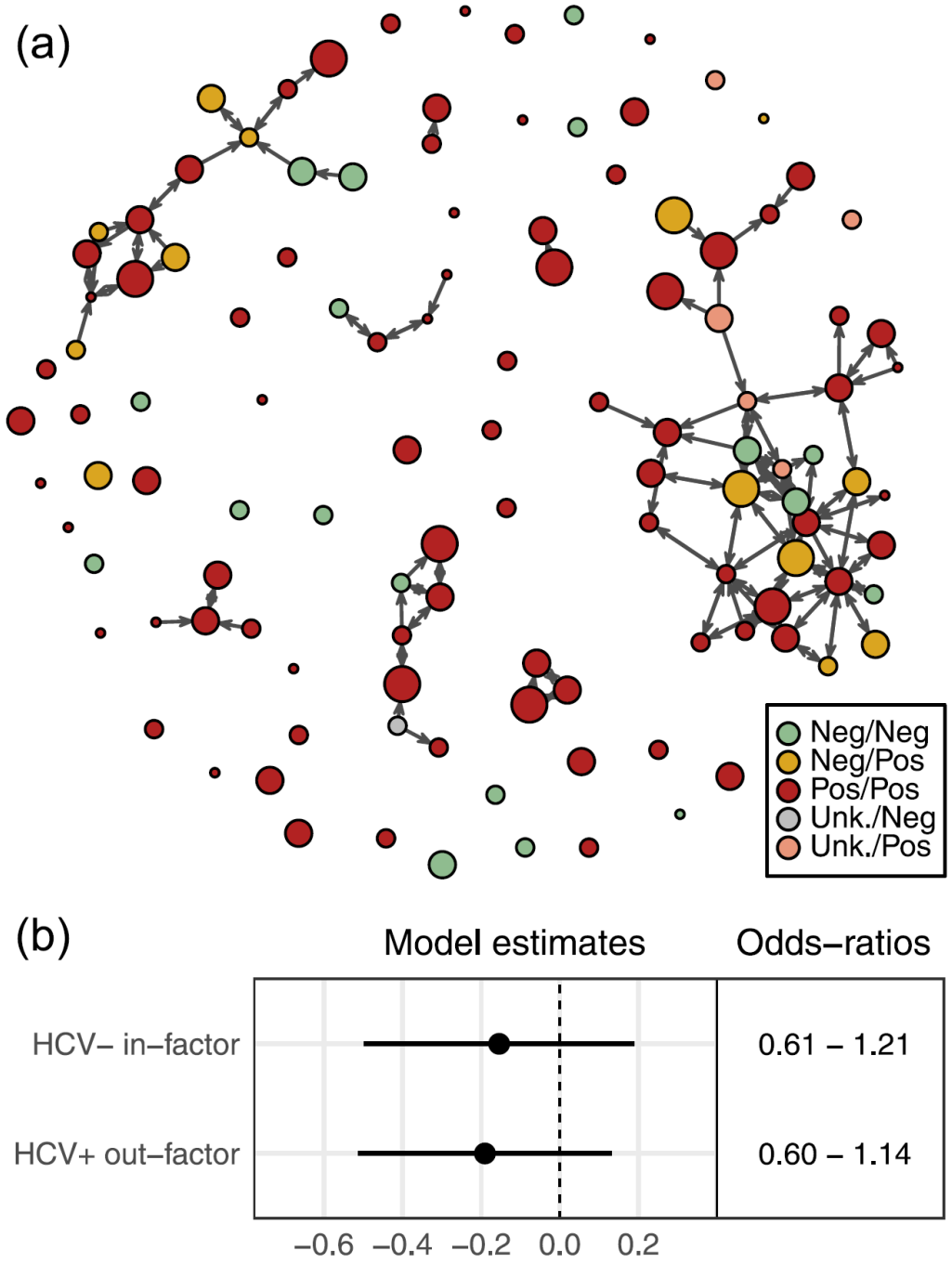
Method: Using ERGM to model tie likelihood

	Model 1 (Base model)			Model 2 (+ Mutual)			Model 3 (+ Transitivity)		
	Coef.	S.E.	*p*-value	Coef.	S.E.	*p*-value	Coef.	S.E.	*p*-value
Edges	−5.47	0.62	<0.01	−6.54	0.60	<0.01	−6.44	0.55	<0.01
Node in-factor Female	0.20	0.36	0.58	0.24	0.37	0.51	0.24	0.36	0.50
Node match Female	1.89	0.53	<0.01	0.79	0.45	0.08	0.68	0.40	0.09
Node in-factor Age	−0.01	0.01	0.29	−0.01	0.01	0.34	−0.01	0.01	0.43
Absdiff Age	−0.03	0.01	0.03	−0.02	0.01	0.07	−0.01	0.01	0.08
Node in-factor Location 4	−1.69	0.60	<0.01	−1.83	0.55	<0.01	−1.73	0.57	<0.01
Nodematch Location 4	4.54	0.59	<0.01	3.34	0.53	<0.01	2.74	0.56	<0.01
Node in-factor Injection 1–3×	0.75	0.41	0.07	0.75	0.40	0.06	0.65	0.38	0.09
Node in-factor Injection 4–7×	1.34	0.40	<0.01	1.37	0.39	<0.01	1.09	0.38	<0.01
Node in-factor Injection 8+ ×	1.67	0.44	<0.01	1.71	0.43	<0.01	1.37	0.41	<0.01
Mutual				6.61	0.37	<0.01	6.44	0.38	<0.01
GWESP							0.58	0.14	<0.01
GWESP decay (α)							0.04	0.26	0.89
AIC	1347.08			968.22			950.78		
BIC	1422.24			1050.90			1048.48		
Log Likelihood	−663.54			−473.11			−462.39		


(a)
Model estimates
Odds–ratios
Female in–degree
Female homophily
Age in–degree
Absdiff Age
In–degree Location 4
Homophily Location 4
Inj. Freq 1–3x
Inj. Freq. 4–7x
Inj. Freq. 8+
Mutual
GWESP
0.63 – 2.59
0.89 – 4.34
0.98 – 1.01
0.97 – 1.00
0.06 – 0.54
5.18 – 46.69
0.91 – 4.02
1.43 – 6.25
1.76 – 8.73
296.22 – 1331.49
1.35 – 2.35
−3
−1
1
3
5
7
(b)
Model predictions
Probability
1.0
0.8
0.6
0.4
0.2
0.0
Baseline
+1 triangle
+2 triangles
Mutual tie
<1x day
1–3x daily
4–7x daily
8+ daily
Injection frequency
(c)
Baseline
+1 tri.
+2 tri.
Mutual



HIV infection and needle-sharing. (a) Needle-sharing network colored by self-reported HIV status. “Pos (ART)” denotes individuals on antiretroviral treatment. The person represented by the grey node did not know their HIV status. (b) Estimates and odds-ratios of model coefficients (with 95% confidence intervals) for the partner restriction and informed altruism terms from the ERGMs considering HIV status.

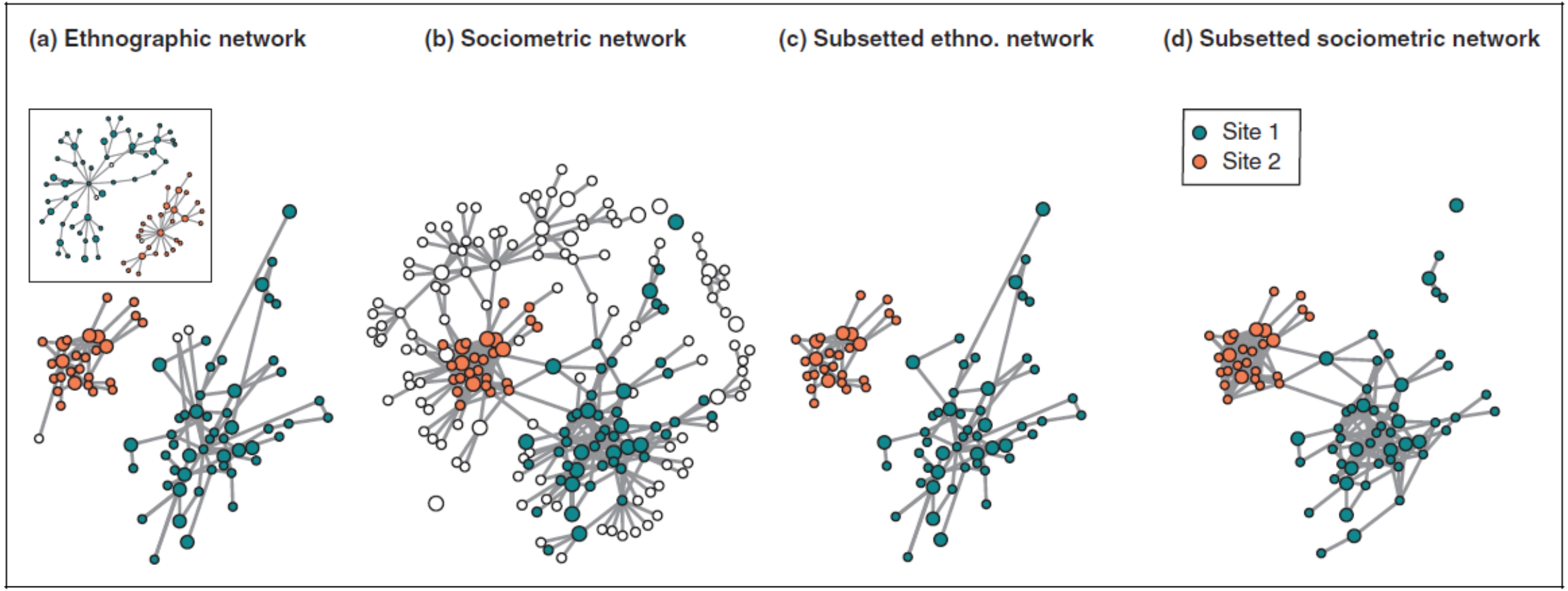


HCV infection and needle-sharing. (a) Needle-sharing network colored by HCV status, shown as the combination of self-report (first term) and antibody test results (second term). (b) Estimates and odds-ratios of model coefficients (with 95% confidence intervals) for the partner restriction and informed altruism terms from the ERGMs considering self-reported HCV status.


LimoStudio
ROLANDO
No use Droga
una es demasiado
y 1000 no es suficiente

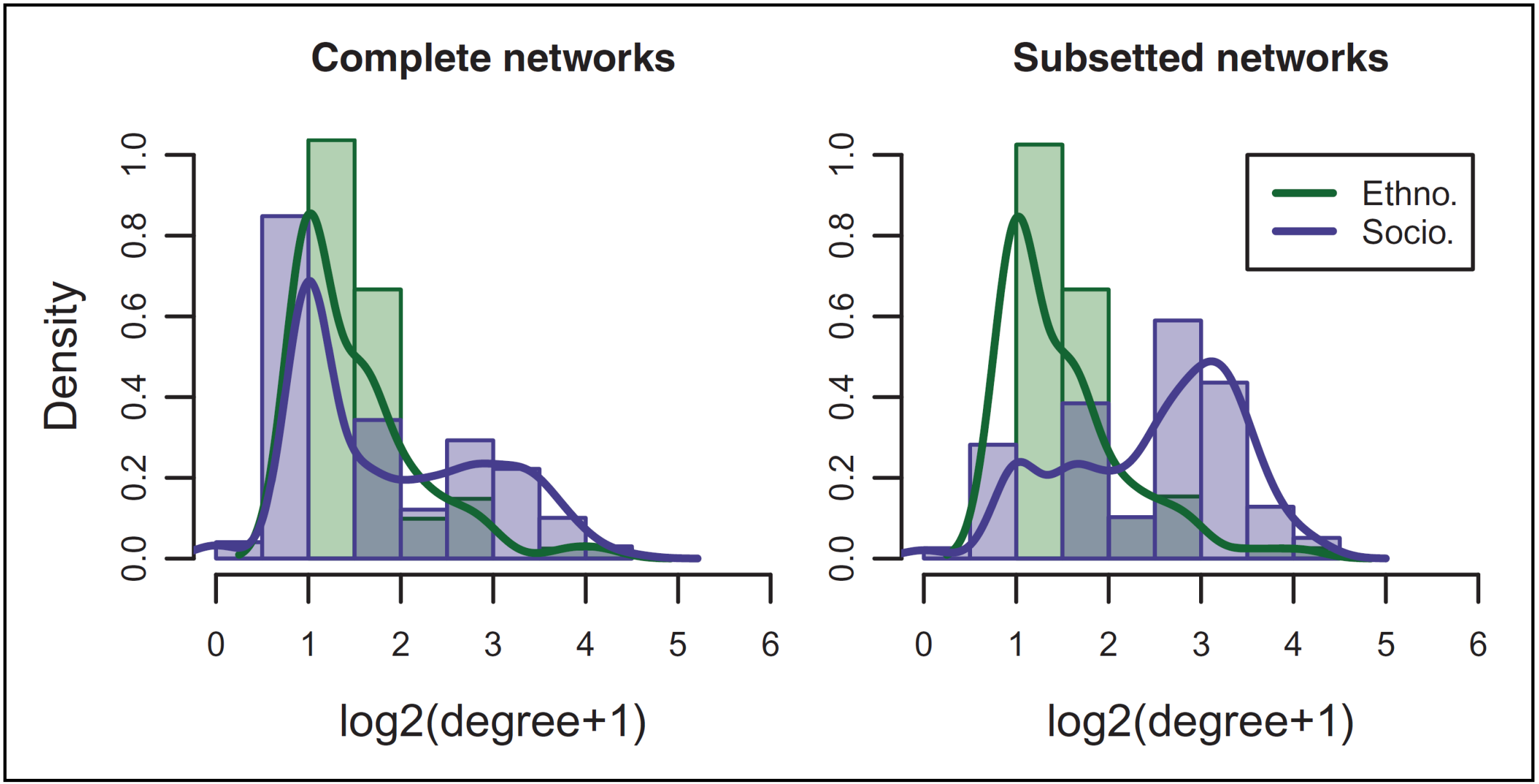

Esto no es
Facil no deja
nada pero te
Quita yo Me Perdi
Estremidades

Validating the network interviews



Ethnographic versus Sociometric Samples

- Only three individuals appeared in the ethnographic network but not in the sociometric network
- Key respondent network across the samples are highly correlated (product–moment correlation of .49, estimated p value of 0 based on a quadratic assignment procedure test with 10,000 permutations)
- There are 73 overlapping edges in the two networks (79% of the ties in the ethnographic network are present in the sociometric network; 19% of ties in the sociometric network are present in the ethnographic network).
- The ethnographers reported 15 edges between survey respondents that were not self-reported by the respondents.


Complete networks
Subsetted networks
Density
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
log2(degree+1)
Ethno.
Socio.

Overall Alignment

In terms of both nodes and edges, the ethnographic network is largely a subset of the sociometric network. While the ethnographers drew a network with substantially fewer people and ties than the sociometric network, most of the edges they recorded were also reported as active, recent ties by study participants in formal interviews. Individuals who appear in the ethnographic network tend to have higher degree and belong to denser parts of the sociometric network than individuals who participated in the project but who were not included in the ethnographic network. This was not a result of a bias toward key respondents in the sociometric data because in the sociometric data, key respondents differed relatively little from other survey participants. Thus, the ethnographers seemed to be able to home in quite readily toward individuals who formed part of the core of the local PWID network. Further, the ethnographers' qualitative argument that centrality in the network was partly driven by injection frequency is upheld by the sociometric data.

Caballo

In rural Puerto Rico, two or more PWID often pool funds necessary to acquire and later share drugs. Most participants in our study have as a drug of choice a combination of heroin “droga” and cocaine “perico”, referred to as “speedball”. Speedballs have more heroin than cocaine, and a usual way in which participants talk about their drug mix is by identifying the ratio of heroin to cocaine. For example, they would say “1–2” meaning one bag of cocaine and two of heroin. Other users might prefer three bags of heroin and one of cocaine “1–3”. In turn, this preference is also reflected in drug sharing arrangements. The drugs are mixed together in a cooker dissolved in water, and the resulting drug solution is shared usually through backloading, removing the plunger in a syringe and squirting the content using the tip of the needle of a loaded syringe, before placing it back. This practice is locally known as “*caballo*” (literally, horse). Participants do not recall the origin of the name, *“caballo”* but suggest that the same expression is used on the island in situations where people pool resources to acquire and later consume goods together, usually food but also transportation.

Social factors affecting risk

The need to acquire drugs while having limited money to pay for them draws PWID into social interactions with others in a way that considerably increases their risk of using shared equipment.

Most PWID in the study would prefer to avoid *caballo* if they could, particularly, for high frequency users, the economic demands make it extremely hard to go during the day without partnering with another user to acquire and use drugs.

Caballo can also be structured along defined social roles, with important epidemiological repercussions. A primary partner directs the preparation and distribution of the drug solution, usually keeping the cooker and cotton used to share drugs and using their own syringe to divide the solution. The soaked filter and the drug residue left in the cooker can be later re-used adding a little bit of water for another shot. Usually, this role is occupied by the user that contributed the most to the caballo.

Josephine:

“Look, let’s suppose that I want to use two and one [two bags of heroin and one bag of cocaine] and that you have $5 and I have $10. So, I ask you, Julio, ‘Do you have $5?’ ‘Yes,’ [you respond].[I say,] ‘Great! Let’s do two and one, you put in those $5 for the *perico* [cocaine] and I put [in for] the heroin.’ We put everything together in the cooker, and then we divide it in the syringe, half and half, and we get cured. That’s it.”

Sick:

The effects of heroin withdrawal, or what our participants call “being sick,” is characterized by bodily pain and discomfort, nausea, coldness, shivers, and diarrhea that leave them “unable to function.” Only “la cura”, the cure, another dose of heroin, will stop or prevent these symptoms form occurring.

Faced with limited resources to “get cured” the user must make a choice between partnering with somebody in a *caballo* or going it alone and hustling until they can afford the whole dose they need.

Entering into a caballo arrangement, enables them to feel normal again, while they can keep hustling to get their next dose. While the rewards of going alone might be higher because participants get a larger dose, so are the associated costs because users have to battle their withdrawal symptoms longer to come up with the money.

Fixers and Maximizers

- “Fixers” do *caballo* with a limited number of trusted injection partners in their network, usually kin, or others with whom they have close relationships, from school age friends, to neighbors or those with whom they have shared drugs extensively in the past.
- By minimizing the number of partners and routinizing sharing expectations, Fixers ensure access to resources while limiting the potential problems associated with doing *caballo* with strangers.
- “Maximizers,” enter into *caballo* with as many partners as possible, increasing their opportunities to access drugs by multiplying potential partners. Sometimes maximizers only know their caballo partners because they have seen them around, in Puntos, or shooting galleries, or because they have done a caballo in the past.
- The downside of the maximizer strategy is that this choice also increases the potential problems associated with the transaction—robbery, cheating, hoarding.
- Not always a fixed strategy: persons in our study might have been a maximizer but, over time, begun doing *caballo* with a limited number of partners, and the opposite also happens. Jail, drug treatment, quitting drug use, and migration can all affect a person’s social networks and their ability to engage in *caballo* by *increasing* their social networks and number of known / willing patners.

Syndemic Prevalence:

- PWID in rural Puerto Rico tend to avoid direct sharing of syringes; only 7.14% reported having used a needle after somebody else had employed it, and 84.62% used a sterile needle the last time they used drugs with somebody.
- In contrast, participants often engaged in indirect sharing: 71.43% divided drugs with a cooker or cotton that had been used by somebody else, and 32.14% divided drugs with a syringe that had been used by somebody else.
- These factors can help explain why HIV prevalence is low (8-10% in our study area—it is spread mainly through shared needles) and HCV is high (~80% in our study area—it can be spread more easily through backloading and shared cooker/cotton).
- Tim Rhodes, Merril Singer and others have use the term “syndemic” to describe this nexus of addiction, withdrawal and social factors related to drug use—which combine to create high prevalence levels and frustrate traditional intervention strategies like education.

Additional Sources:

- "Caballo": risk environments, drug sharing and the emergence of a hepatitis C virus epidemic among people who inject drugs in Puerto Rico
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- Prevalence and risk factors associated with homelessness among drug users in Puerto Rico
  JC Reyes, M Welch-Lazoritz, L Zayas-Martinez, B Khan, K Dombrowski Puerto Rico health sciences journal 38 (1), 54-59 (2018)
- Competing forces of withdrawal and disease avoidance in the risk networks of people who inject drugs
  E Ready, P Habecker, R Abadie, B Khan, K DombrowskiPloS one 15 (6), e0235124 (2021)
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  R Abadie, P Habecker, CGelpi-Acosta, K Dombrowski BMC Public Health 19 (1), 1-9 (2021)
- Injection partners, HCV, and HIV status among rural persons who inject drugs in Puerto Rico
  P Habecker, R Abadie, M Welch-Lazoritz, JC Reyes, B Khan, K Dombrowski Substance use & misuse 53 (7), 1128-1138 (2019)

Special thanks to the many co-authors, students, and collaborators whose work was discussed here today.

Especially: Elspeth Ready, Patrick Habecker, Roberto Abadie, Bilal Khan, Carmen Anna Davila, Angelica Rivera, Mayra Coronado-García, Courtney R. Thrash, Melissa Welch-Lazoritz, Robin Gauthier, Juan Carlos Reyes, Sandra Miranda De Leon, Yadira Rolon Colon, Kimberly Gocci-Carrasco, and Dane Hautala.

- Modeling work was performed in the REACH Lab at the University of Nebraska-Lincoln under the direction of Bilal Khan and Kirk Dombrowski
- Support for this project from the National Institutes on Drug Abuse and the National Science Foundation is gratefully acknowledged. The conclusions and discussion raised here at the responsibility of the investigators and do not necessarily reflect the opinions, thoughts or conclusions of these funding agencies.


VAS