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A mixed methods study of the social networks of female sex workers and their primary non-commercial male partners in Tijuana, Mexico

Karla D. Wagner, Ph.D.*; School of Community Health Sciences, University of Nevada, Reno

Jennifer L. Syvertsen, Ph.D.; Department of Anthropology, The Ohio State University

Silvia R. Verdugo, MD, MPH; Division of Global Public Health, Department of Medicine, University of California San Diego and Secretaria de Servicios de Salud Tijuana, Praderas de la Mesa, Baja California, Mexico.

Jose Luis Molina, Ph.D.; Department of Social and Cultural Anthropology, Universitat Autonoma de Barcelona

Steffanie A. Strathdee, Ph.D.; Division of Global Public Health, Department of Medicine, University of California San Diego

*corresponding author: Karla D. Wagner, Ph.D.; School of Community Health Sciences, University of Nevada, Reno; 1664 N. Virginia Drive; MC0274; Reno, NV 89557

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Abstract

Female sex workers (FSWs) are at risk for multiple health harms, including HIV. This article describes a mixed methods study of the social support networks of 19 FSWs and their primary male sex partners in Tijuana, Mexico. We collected quantitative and qualitative social network data, including quantitative network measures, qualitative narratives, and network visualizations. Methodologically, we illustrate how a convergent mixed methods approach to studying personal social support networks of female sex workers can yield a more holistic understanding of network composition and role. From a health-related perspective, we show how migration/deportation and stigma shape social networks and might be leveraged to support HIV prevention interventions. We believe others can benefit from a mixed methods approach to studying social networks.

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Introduction

Social Networks and HIV

Social network analysis is the systematic study of the social environment (Wasserman & Faust, 1994). Developed by Moreno in the 1930's as *sociometry* – the measurement of interpersonal relationships in small groups – the field has expanded to provide a theoretical and methodological foundation for the study of social relations in a host of disciplines, including social psychology, anthropology, business, communications, economics education, marketing, political science, and public health (Freeman, 2011; Valente, 2010; Wasserman & Faust, 1994).

Moreno's early sociograms used visual displays of connected individuals to represent networks in two-dimensional space – paving the way for the use of network visualizations by subsequent generations of network analysts (Hogan, Carrasco, & Wellman, 2007; McCarty, Molina, Aguilar, & Rota, 2007). Qualitative research by Moreno and others has made important contributions to the study of social networks dating back to the 1930s (Freeman, 2011; Hollstein, 2011). Innovation in mathematics and statistics has driven the use of graph theory, statistical and probability theory, and algebraic models to quantitatively specify and test models of social network structure and influences on behavior (Valente, 2010; Wasserman & Faust, 1994). Social network analysis encompasses a broad set of methodological approaches, the history and application of which are summarized elsewhere (e.g., Freeman, 2004; Kadushin, 2012; Robins, 2015; Scott & Carrington, 2011; Valente, 2010; Wasserman & Faust, 1994). The combination of qualitative and quantitative methods has been characterized as a

fruitful approach to describing networks and understanding their constitution and dynamics (Domínguez & Hollstein, 2014; Hollstein, 2011).

One of many areas in which social network analysis has been particularly useful is the field of HIV research, coming to national attention through its use in early investigations of HIV transmission dynamics (Rothenberg et al., 1998). This research has shown how risk behavior for HIV is constructed, in part, through dynamic and reciprocal interaction between individuals and their social environments (Latkin & Knowlton, 2005). Social networks also provide support, which can buffer stress, enhance coping, and promote wellbeing (Cohen & Wills, 1985). Employing social network analysis in the study of social support and HIV risk not only helps explain why and how HIV clusters within certain social groups, but also provides opportunities for more effective and sustainable intervention approaches (Latkin & Knowlton, 2005).

Social Networks and HIV risk among Female Sex Workers

Women engaging in sex work, commonly referred to as female sex workers (FSWs), are at risk for multiple harms, including HIV, sexually transmitted infections (STIs), poor mental health outcomes, and elevated rates of substance abuse and violence (Baral et al., 2012; el-Bassel et al., 1997; Mc Grath-Lone, Marsh, Hughes, & Ward, 2014; Shannon et al., 2009; Shannon et al., 2011). Typically, research focuses on commercial sex partners as an important source of risk for FSWs. However, global studies report that FSWs tend to use condoms less consistently with their non-commercial partners (e.g., their husbands or boyfriends) compared to their commercial partners (Philpot, Harcourt, & Edwards, 1991; Voeten, Egesah, Varkevisser, & Habbema, 2007). At the same time, both FSWs and their partners report risk behaviors

with partners outside the primary relationship (Robertson, Syvertsen, Palinkas, et al., 2013; Robertson, Syvertsen, Rangel, et al., 2013). This research highlights the complexity of how FSW's social and sexual network connections impact risk.

Importantly, women's non-commercial partners also provide emotional and social support, love, and caretaking; help to ensure physical safety; and contribute material support including money, housing, and childcare (C. Campbell, 2000; Jackson et al., 2009; Syvertsen et al., 2013). Supportive network members *in addition* to sexual partners may also influence women's health behaviors. Positive ties to social support network members can support efforts to negotiate safer behaviors (Wenzel et al., 2009), and interventions to strengthen those positive relationships could improve health outcomes (Latkin & Knowlton, 2005). These data point to the importance of considering multiple dimensions of FSWs' social networks (including social support and sexual connections) to inform our understanding of health behaviors.

While few studies have sought to characterize FSWs' social networks, existing efforts highlight the importance of using both qualitative and quantitative methods. Quantitative research has provided some data on the size and composition of FSW networks. In Eastern Europe, for example, FSW networks appear loosely connected and FSWs are relatively socially isolated (Simic et al., 2006). In contrast, research in Vietnam found more connections among FSWs who work in sex work venues (Johnston, Sabin, Hien, & Huong, 2006). Qualitative studies, on the other hand, have provided thick description of the meaning of particular network ties. For example, research in China revealed how "*laoxiang* [hometown] sisters" – FSWs who originate from the same villages – create solidarity and support for condom use and HIV testing (Tucker et al.,

2011). In a study with South African FSWs, women described considerable social isolation (particularly from kin and children), even among those who had regular non-commercial partners or boyfriends (C. Campbell, 2000). However, they also described availability of various types of social support through fellow FSWs, community members, and certain clients, who are important in supporting HIV prevention efforts.

In this paper we build on the existing literature in two ways. Methodologically, we illustrate our use of a mixed methods approach to describe the social support networks of FSWs and their primary non-commercial male sex partners, and highlight how the "whole" derived from the integrated analysis provides a more holistic understanding of participants' networks than would have been derived from either the quantitative or qualitative methods in isolation. From a health-related perspective, we highlight how our mixed methods approach uncovered processes that have shaped participants' social networks and factors that could be leveraged to support risk reduction interventions.

Methods

Setting

The study was conducted in Tijuana, Baja California, Mexico. Sex work is tolerated in Tijuana within a regulated "Zona Roja" (red light district), where FSWs are required to carry permits in order to work without prosecution (Strathdee, Philbin, et al., 2008). An informal industry also thrives, and sex work occurs in a variety of locations, including bars, brothels, strip clubs, shooting galleries, and public locations such as street corners (Pitpitan et al., 2013). The industry attracts clients from both sides of the US-Mexico border (Patterson et al., 2009). The prevalence of illicit drug use in this community is among the highest in Mexico (Rodriguez, Marques, & Touze, 2002), and

drug and alcohol use are common among both FSWs and their sexual and social contacts (Patterson et al., 2008; Pitpitan et al., 2013).

Research among sex workers and their social and sexual contacts in Mexico has demonstrated how factors above and beyond individual attributes shape the "risk environment" that influences HIV-related health outcomes. For example, research among male clients of FSWs in Tijuana highlighted how a search for intimacy led them to visit FSWs (Goldenberg et al., 2011). Though that study did not recruit men based on their immigration status, all 30 men recruited in Tijuana had been deported from the US and described lives in Tijuana characterized by frustration, loneliness, and separation from supportive network members. A study among FSWs in two Mexico-US border cities found that women who had higher rates of social support reported less psychological distress (Ulibarri et al., 2009). Finally, a study of people who inject drugs in Tijuana illustrated the role of geographic location and deportation in shaping HIV risk. Among women, 55% of whom reported ever trading sex in exchange for something of value, living in Tijuana for a longer duration was associated with a higher likelihood of being HIV-positive. Among men, 17% of whom also reported trading sex in exchange for something of value, the odds of being HIV-positive were four-fold higher among men who had been deported from the US compared to those who had not been deported (Strathdee, Lozada, et al., 2008).

Study Overview and Integration of Mixed Methods

The overarching aim of the current study was to describe the social support networks of FSWs and their primary non-commercial male sexual partners in Tijuana, Mexico, and to identify factors that influence HIV risk and protective behaviors. Our

convergent mixed methods approach encouraged a dialogue between quantitative and qualitative methods (Creswell, 2013). We combined quantitative personal or egocentric social network data, which can describe the size, composition, and structure of social connections (Marsden, 1990) with qualitative narrative accounts that speak to the meaning of and processes underlying those social connections (Bernardi, 2011) and network graphs or visualizations that reveal participants' 2-dimensional representations of their social environment .

Integration of mixed methods occurred at three points (Figure 1). During the data collection phase, we collected quantitative and qualitative data simultaneously in the same interview. Quantitative questions were informed by previous qualitative work in this population, and the qualitative interview questions were informed by data provided in the quantitative section of the interview. During the data analysis phase, we first analyzed the quantitative data while reflecting on the qualitative narratives, and looked to the qualitative narratives to inform our understanding of the quantitative findings. Then, we conducted a pile sorting analysis of the network graphs, informed by the results of the fist analysis phase. The final stage of interpretation reflected on the "whole" that was produced from and transcended the individual "parts" (Fetters & Freshwater, 2015).

<insert Figure 1 about here>

Sample

Our sample was drawn from a longitudinal cohort study of FSWs and their primary non-commercial male sexual partners, described elsewhere (Syvertsen et al., 2012). That study enrolled 214 FSWs and their partners in Tijuana and Ciudad Juarez,

Chihuahua, Mexico, and conducted semi-annual interviews for two years. Eligible women were at least 18 years old, reported any hard drug use in their lifetime, reported trading sex for money or goods in the past 30 days, and had a stable, non-commercial male sexual partner (i.e., one with whom they did not trade sex) with whom they had been involved for at least six months.

We sampled 19 couples from the Tijuana site of the larger study, using contact information and survey data reported during the longitudinal study visits. In accordance with the larger study protocol, which was designed to maximize the safety of the female respondents, couples were recruited through the female partner, who was asked whether she was comfortable referring her male partner to participate in the study. All couples completed a couple-verification screener to ensure they were not falsely enrolled, and were screened for serious, life-threatening domestic violence prior to enrolling in the larger cohort study. Those responding in the affirmative were referred to local resources. Because we anticipated that the male and female respondents would have different types of relationships and possibly have relationships that were unknown to their partner, we interviewed each member of the couple separately. A bi-national, bilingual female interviewer conducted all the interviews in Spanish at the study's field site office in downtown Tijuana. The Institutional Review Boards of the University of California, San Diego and El Colegio de la Frontera Norte in Tijuana approved study procedures. All names used in this report are psuedonyms.

Network Elicitation

Network data collection was conducted using established methods for personal network analysis (Valente, 2010) using the VennMaker software program (Gamper,

Schönhuth, & Kronenwett, 2011). First, the names of network members were elicited. The choice of an elicitation question can affect the type of network that is generated, including the size and types of relationships (K. E. Campbell & Lee, 1991). Because we were interested in the individuals who could be enlisted in future interventions to reduce high-risk behaviors, we asked participants to identify network members with whom they have positive or supportive ties. We anticipated that individuals would list individuals who provide social support but with whom they may also engage in drug or sexual risk behaviors, as has been demonstrated in other studies (Lakon, Ennett, & Norton, 2006). We used a series of seven questions that have been used in other drug-using populations (Latkin et al., 1995) and were adapted for this cultural context. We asked respondents to list the name, nickname, or initials of individuals who provide various types of social support, including: emotional, material, social participation, health advice, drug related, and relationship advice. Based on earlier ethnographic work with this population (Syvertsen et al., 2013) we also included a question specific to this cultural context, which asked respondents to list the names or initials of people "who you can count on '*tanto en las buenas como en las malas*' [in the good times and the bad times]". Respondents could name the same person more than once (i.e., someone who provides multiple types of social support – i.e., "multiplexity"), and the types of social support provided by each person were coded using a dichotomous indicator (1=provides this type of support, 0=does not provide this type of support).

Network Attributes

Next, respondents were asked to provide information about the individuals they named in their social support networks (i.e., their "alters"). We asked about

demographics (e.g., age, sex), relationship characteristics (e.g., relationship type, duration, and frequency of contact), and drug use and sexual behavior with each alter (i.e., injection and non-injection drug use, syringe sharing, sex, condom use). Finally, we asked respondents to report whether each pair of alters knows each other (i.e., "Does A know B?"). Alters were said to "know each other" if the respondent deemed it likely that the two alters would meet up with each other even if the respondent were not around.

Network Graphs

To create the network graphs we employed the Hierarchical Mapping technique, which has been used in other qualitative and mixed methods social network studies (Antonucci, 1986; Bernardi, 2011). Respondents placed their network contacts into a series of concentric circles displayed on a laptop monitor using VennMaker. In the center was a star labeled "ego", representing the respondent. Three circles surrounded ego. The innermost circle represented "people very close to you, so close that you can't imagine life without them". The middle circle represented "people who are close to you, but not as close as the first circle" and the outermost circle represented "people who are a bit farther away, but who are still important." The distance between the circles represents increasing emotional distance moving out from the center (Figures 3-5). Lines were drawn between alters in the network graph to represent their relationships with each other.

Qualitative Data Collection

Once the alters were placed into the network graph, the interviewer elicited qualitative narratives from the respondents about the graph. A series of loosely

structured questions guided the qualitative component, which elicited the respondents' impressions of the network, their thoughts about anyone who was missing from the graph, and, for women, the role of other FSWs in their social networks (Figure 2). The loosely structured questions were developed through consultation with the study investigators and interviewers who had intimate knowledge of the population. The questions evolved iteratively as the qualitative interviews proceeded, and integrated our understanding of the quantitative network data and the qualitative narratives. For example, as more respondents talked about children and family members missing from their networks, we focused more closely on discussions of missing people. Interviews lasted approximately 1.5 hours, were digitally recorded and transcribed.

<Insert Figure 2 about here>

Our design produced three linked data sets: (1) a quantitative data set containing information about the egos, the number of network members, the attributes of network members, and their relationships with each other; (2) a qualitative transcript that documented participants' descriptions of and stories about their network members; and (3) the network graphs, or visualizations of the networks.

Analysis

Our iterative analysis strategy integrated the qualitative and quantitative data and built upon what was learned during the data collection phase. The quantitative analysis described the structure and composition of participants' networks. We calculated summary statistics including size (i.e., number of contacts listed), composition (e.g., proportion of network contacts who are female, drug users, family members, etc.), and

structure (i.e., density, or the proportion of network contacts who know each other divided by all possible connections) of networks (Wasserman & Faust, 1994).

Qualitative analysis employed an inductive thematic analysis of the narrative data. We identified patterns that represented salient themes across participants (Patton, 2002). We developed a preliminary set of “open codes” (Strauss & Corbin, 1998) to highlight themes, which integrated the information we learned from the quantitative data and qualitative interviews. Some themes emerged naturally from the structure of the interview (e.g., missing people, number of family members) and others emerged through comparison across transcripts (e.g., stigma). The interviewer hand-coded the transcripts and quotes were selected that best illustrated the themes. We conducted the qualitative analysis in Spanish and translated quotes into English.

Finally, we grouped the graphs into dyads (i.e., male and female member of the couple) and conducted a pile sorting exercise to identify themes in the visual data (Bernard, 1995; Ryan & Bernard, 2003). Three team members (the interviewer, the Principal Investigator, and an ethnographer who conducted interviews and participant observation with the larger cohort study) examined the network graphs, sorting them into piles based on similarities in structure (e.g., size, location of key individuals, density). We then compared the different piles to each other, identifying differences across them and ensuring consensus (Ryan & Bernard, 2003). While quantitative analyses can be conducted with the resulting clusters (e.g., Trotter & Potter, 1993), in the current analysis we integrated emergent themes from the qualitative data with the quantitative comparisons and visual analysis to help explain and interpret the patterns observed in the network graphs.

Results

Quantitative Personal Network Data

Nineteen couples (38 individuals) provided data for this analysis. Couples had known each other for approximately 9 years (SD 7.4; Table 1). Men had a median age of 42 years (range: 26-54), while women were slightly younger at 37 years (range: 24-51). Forty-two percent of women said they had lived in Tijuana their whole life, while only 32% of men had lived in Tijuana their whole life. Two-thirds of men had been deported from the US at least once, while only 16% of women had ever been deported. Drug use was prevalent, with 84% of women and 79% of men reporting that they had injected drugs in the past six months. Heroin was the predominant drug of choice, followed by heroin combined with methamphetamine, methamphetamine alone, and marijuana.

<insert Table 1 about here>

Network sizes ranged from 2 to 23 alters; the median size for both men and women was 5 (Table 1). The average network density, or the number of network members who know each other divided by all possible connections, was 0.60 (interquartile range [IQR] 0.33, 0.71) for women and 0.67 (IQR 0.43, 0.80) for men, indicating that, on average, a majority of alters in participants' networks know each other. Both men and women reported an average of two female alters. Women reported an average of one family member in their network while men reported two. Both men and women, on average, named one friend in their network. Women reported from zero to three paying sexual partners (i.e., clients) in their social support networks.

In terms of risk behavior with network members, both women and men reported an average of one injection drug using contact. Women reported an average of zero contacts with whom they shared syringes, while men reported an average of one. Both women and men reported an average of one sexual contact in their network and zero contacts with whom they used condoms in the past six months.

Qualitative themes: Missing people, drug use, and relationships with other FSWs

Missing people. While quantitative social network data collection methods are able to capture information about the people in participants' social networks, by the nature of the method they are unable to provide information about individuals who are missing from those networks. Through the qualitative data collection, we uncovered two groups of people who were missing from participants' networks, and identified the important role that these missing people played in participants' lives.

The first group was children. While few participants listed children as members of their social support networks, female participants in particular lamented the absence of their children and described the role of other family members in caring for their children. Most women had children, fathered by either their current partner or a former partner, though few had custody of their children at the time of their participation in the study. Family members were usually caring for children, and women emphasized that they wanted to have their children in their lives but could not until they stopped using drugs. For many women who still had custody of their children, earning money to provide for their children was a primary motivation for continuing to engage in transactional sex.

The second group of missing individuals was family members. Quantitatively, men listed an average of two family members, while women listed one, even if they

described having larger families in the qualitative narratives. Quantitative data also showed that most participants were not originally from Tijuana and, especially among men, deportation from the US had played a significant role in their migration history (Table 1). Qualitative narratives revealed that families were often large, but separated by hundreds or even thousands of miles, since most participants were originally from elsewhere in Mexico and had migrated to Tijuana. The international border separated other families, with some members living in the US and others living in Mexico. This distance served to limit the availability of family members in participants' social support networks and create geographic as well as social distance from kin – explaining the low number of family members identified through quantitative analysis.

Stigma. In their qualitative narratives participants described strong internalized and anticipated stigma (Earnshaw & Chaudoir, 2009) associated with their substance use that, along with their histories of migration and deportation, helped to further explain the absence of family members and children from their support networks. In the following quote, Hernando illustrates how the two qualitative themes (missing people and stigma) interact, as he describes why he does not visit his family:

"They do not know that I am using heroin…That's why I do not want to go over there. They do not know. I would feel awful about what my siblings will say to me. "Look how far you have fallen". That's why, right now, I am trying to find a [treatment] center so I can be there for three months and then come out and go home so that I can talk to them. It is something awful, when people tell you how horrible you look. It feels awful. And I do not like it that my siblings say: "you look like a junkie"."

Hernando was also concerned about exposing his mother to his drug use, which led him to isolate himself from her:

"Not because I don't love her. I love her so much. She is my mom. I love her so much, that is why I don't want to worry her."

Among women, the effects were amplified by the fact that family members were often caring for their children. The discussion frequently turned to focus on a desire to stop using drugs, which would allow participants to reunite with their children and families. Rosa was separated from her two children due to her deportation from the US and her drug use. In the following quote, she explains that if she were to stop using drugs and discontinue working as a sex worker, she would be able to reunite with her children and their fathers:

"It would simply mean that I would return to my obligations…I know that I could see my daughter and try to earn the trust of her father. Not only to return to be with my daughter, but also begin being responsible for my son."

Relationships with other FSWs. Because participants were recruited in the Zona Roja, the area of Tijuana where sex work is common and highly visible, we anticipated that women would name other FSWs as members of their social support networks. However, women described few enduring or close relationships with other FSWs. To the contrary, some women described relationships characterized by animosity, which was fueled by distrust, professional competition, and economic need. For example, one participant said that other FSWs pressured her to charge her clients more, and the fact that she had more clients due to her lower prices created jealousy and resentment among her peers.

"We make a deal about the amount of payment that they will give me. It is a lot of money, I accept it. I don't want more….And that is why they get annoyed with me. Because they tell me, "They give you 100 pesos [approximately 10 USD]." It doesn't matter, I tell them. I need money. "Yes, because you are a drug addict." 100 pesos seems pretty good to me, I tell them."

Other women said that they do not trust other FSWs, because other women steal clients and perpetuate rumors that are bad for their business.

Visual Analysis of Network Graphs

Results from the quantitative network data suggested that there were few differences between the composition and structure of men and women's personal networks, while qualitative narratives highlighted some differences in terms of the impact of migration, deportation, and the role of family members. The visual analysis of the network graphs (Figures 3-5) revealed variation in the patterns of network structure that were obscured by the summary quantitative data. We present three case studies to illustrate patterns of couple's support networks: (1) female partner with a larger support network than her partner; (2) a more balanced case of the male partner having a slightly larger support network; and (3) a case where the partners were not identified as close ties in the support network. We draw from the qualitative data to interpret and explain the network configurations observed in these couples. The network alters are identified using a random number assigned by VennMaker. The key at the bottom of the figures provides information about the alteri, including the types of support they provide (depicted as colored pie pieces surrounding the individual), the sex of the individual (white = female, black = male), and the type of relationship that the respondent has with each alter.

Case Study 1: Ana and Pedro. On the left side of Figure 3, Ana's network contains 15 individuals. She placed her partner Pedro in the innermost circle (#57), where he is connected to the remainder of the network members. Pedro provides multiple kinds of support for Ana, including emotional, material, social, and drug-use

related support. The other individuals in the inner circle are family members, who also provide a variety of support. While five members of Ana's family are depicted as providing at least three different types of emotional support, three others – who live in the United States – only provide two types of support: emotional and "good times and bad times" support. Ana's inclusion of her geographically-distant family members highlights how physical distance can influence access to social support resources. The middle circle contains the father of Ana's children, who provides only emotional support and is connected to other male members of her family. Ana's network provides an example of a large, multi-component network, where some alters are densely connected to each other, while others are not. The second component of Ana's network contains three clients, who are all in the outside circle, representing the least emotional closeness. Two of these partners know each other, but these men are not connected to other individuals in her inner network. They provide minimal (mostly material) support.

In contrast to Ana, Pedro's network is small (n=3 alteri), and his partner Ana (#57) occupies an intermediary role by connecting the other two network members. Similar to Ana, Pedro reported that his partner provides multiple types of social support including material, drug-related, social, and emotional. The other two individuals in Pedro's network, a male friend (#59) and a female family member (#58), do not know each other. While his network appears small, Pedro described strong and meaningful relationships with the three people in his network.

<Insert Figure 3 about here>

Case Study 2: Carmen and Luis. Figure 4 shows a second pattern – larger male networks and smaller female networks. Carmen's network contains five alters: a client

(#58), the study outreach worker (#60), her partner Luis (#61), her best friend (#57), and one family member (#59). In contrast to Ana, Carmen's network provides considerably less social support and nearly all of her network alteri occupy the circles further from the center. Carmen was one of the few study participants who did not spontaneously name her partner as a member of her network. When asked why, she replied "*porque a veces que cuando tenemos la crisis, pues, es la crisis de los dos*" [because when we have a crisis, well, it is a crisis for both of us]". That is, if she were to need help, her partner Luís would also need the same help, therefore would not be able to provide assistance to her, and vice versa. Rather than understanding the quantitative social support data as signaling a lack of support from her partner, Carmen revealed that, in fact, she and her partner are quite close and mutually dependent. In contrast to Ana, whose clients occupied the outermost ring separate from her more intimate network members, Carmen's client (#58) provides more types of support, is located closer to the center, and is connected to her partner Luís. This reflects findings from other research, in which some commercial partners become more integrated into the social spheres of FSWs (Robertson, Syvertsen, Amaro, et al., 2013). The figure also shows that Luís occupies an intermediary or brokerage role in Carmen's personal network, since he connects the four other individuals.

Luís' network clearly depicts two components – one comprised entirely of family (left) and one comprised of friends (#63 and 62), an acquaintance (#61), and his partner Carmen (#57). He receives emotional, material, and social support from his family members, while he receives more material and social support from his friends and acquaintances. Luís reported that Carmen provides multiple types of support, including

drug-related, material, emotional, social, and “good and bad times” support. Carmen also occupies a brokerage position in Luis’ network, since she connects the other three individuals in the “friend/acquaintance” component.

<Insert Figure 4 about here>

Case Study 3: Maria and Jose. Not all couples identified their primary partner as an important member of their network. In Figure 5, Maria and Jose placed each other in the outermost circle of their graphs (#59 on the left and #61 on the right). Like Carmen, Jose also did not spontaneously name Maria as someone who provided support for him. However, in this case the qualitative narratives revealed that Maria and Jose’s relationship was characterized by more conflict and emotional distance. Both obtain social support from the other members of their networks, but less from each other. Anecdotal knowledge of the couple from the larger study suggested that the couple seems to stay together mostly based on their shared use of drugs. Jose mostly named male friends in his innermost circles. Maria’s family had been heavily impacted by deportation and, with the exception of the study outreach worker (#57), she named only a densely connected set of family members in her innermost circles.

<Insert Figure 5 about here>

Discussion

In the current study we illustrated our use of a convergent mixed methods design to investigate the social networks of FSWs and their primary male sex partners. We have identified two primary implications of our approach – the first health-related and the second methodological.

Health-related implications

The health-related implication of our work is in the identification of two processes – migration/deportation and drug related stigma – that appear to play a role in shaping the observed composition and structure of the support networks, and which could be leveraged to support participants in reducing health harms. First, deportation created geographical separation between study participants and their children and other family members, with families straddling the international border and living in central Mexico and the border region. This process appeared particularly influential in shaping men's networks, by creating and perpetuating isolation from family members and social dependence on female partners in Tijuana. This finding is consistent with earlier work among male clients of FSWs, who described their experience of living in Tijuana to be characterized by loneliness, isolation and a quest for intimacy (Goldenberg et al., 2011). Migration and deportation have also been highlighted as factors that influence access to prevention resources and heighten risk for infectious disease (Soskolne, 2007). While deportation and migration appeared to impact the networks of both women and their partners in the current study by separating them from supportive ties, epidemiological research has highlighted how these processes may have particularly harmful effects among men who inject drugs in Tijuana by elevating their risk for HIV infection (Strathdee, Lozada, et al., 2008).

Second, stigma has created both emotional and physical separation between women and their families. Stigma is a social process in which prejudices, stereotypes, discrimination, and other attitudes are perpetuated within a social context (i.e., within networks; Earnshaw & Chaudoir, 2009). In this case, participant's internalized drug use-related stigma influenced supportive ties with their family members, which was

illustrated in our quantitative network data as a small number of kinship ties. But for other couples, the shared experience of drug use appeared to contribute to the maintenance of relationships that otherwise might have dissolved. The role of internalized stigma appeared particularly influential in shaping women's networks, as it was related to their separation from children and family members who were caring for those children. While men were also separated from their families, the loss of children was not as salient in their narratives. The experience of stigma and related discrimination has been shown to influence HIV risk behavior, willingness to seek HIV testing, and mental health outcomes (Earnshaw, Smith, Chaudoir, Lee, & Copenhaver, 2012; Latkin, Davey-Rothwell, Yang, & Crawford, 2013).

Our findings also reflect those from the larger cohort study, which highlighted the role of children in shaping the intimate relationships of couples in both positive and negative ways. Rolon and colleagues (2013) found that concerns about children's well-being motivated parents' behavior change including HIV risk reduction and lifestyle changes. Our findings build upon that earlier work by demonstrating how a desire to reunite with children and family could motivate some participants, particularly mothers, to successfully engage with drug treatment. The fear of losing children (or being unable to reunite with them) can create barriers to engaging in substance abuse treatment (Powis, Gossop, Bury, Payne, & Griffiths, 2000).

We also found that women listed few commercial sex partners in their networks. This may be because we elicited the networks using a social support name generator, which generated networks of supportive individuals. However, FSWs have a variety of relationships with their commercial partners ranging from purely transactional to deeply

caring and loving (Robertson, Syvertsen, Amaro, et al., 2013). A strength of the current study is that our method elicited some networks that contained commercial partners who also provided social support.

Our findings suggest the need for interventions that build upon existing supportive relationships and enhance ties to other pro-social community members while working to reduce stigma. Importantly, our quantitative data did not reveal an absence of social support. However, our qualitative data revealed that the type, quality, and availability of social support may not be sufficient to buffer against the stressors of participants' lives and the impact of drug-related stigma. Others have recommended that stigma-reducing interventions for conditions such as HIV/AIDS, mental illness, and other "social conditions" (e.g., homelessness) could help vulnerable individuals maintain supportive relationships (Brown, Kennedy, Tucker, Golinelli, & Wenzel, 2013). A systematic review of stigma reducing interventions for individuals with substance use disorders found a range of possible approaches, including those that target self-stigma (i.e., substance user's internalized experience of stigma), social stigma (i.e., the general public's attitudes towards substance use disorders), and structural stigma (e.g., targeted interventions for medical students, police officers, and substance use counselors (Livingston, Milne, Fang, & Amari, 2012). More than half of the reviewed interventions achieved positive results. Our findings suggest that reductions in self and social stigma might help women reunite with family members and other sources of social support. In addition, substance abuse treatment programs that include "wraparound" social services, in addition to drug treatment services, may help improve parenting outcomes and assist with reunification (Grella, Needell, Shi, & Hser, 2009).

Community mobilization interventions (CMIs) that help to organize or create solidarity among FSWs have been successful in other parts of the world (Kerrigan, Telles, Torres, Overs, & Castle, 2008; Swendeman, Basu, Das, Jana, & Rotheram-Borus, 2009). CMIs seek to change the social environment by organizing women for collective action and challenging power inequalities (Blankenship, Burroway, & Reed, 2010), thereby creating or enhancing social ties. Our findings suggest that formative research should be done to assess feasibility of such an intervention, which must be tailored for the cultural and social context.

Methodological Implications

From a methodological perspective, the three integration points of quantitative network data, qualitative narratives, and visual network graphs provided additional insight in two related ways: (1) by revealing underlying processes (Kelle, 2001) that may have shaped the current structure and composition of those networks, and (2) by identifying social network contacts that were not captured in the quantitative instrument.

While our quantitative data were cross-sectional, thereby limiting our ability to observe network dynamics over time, the addition of the qualitative data helped to overcome this limitation by revealing underlying processes that shape network formation. This was observed in the examination of network composition: on average women and men both appeared to include small numbers of family members in their networks quantitatively, while the addition of the qualitative narratives described the processes (i.e., deportation, stigma) underlying their separation from and desire to reunite with those family members, as described above.

Contrary to qualitative findings in other regions (e.g., C. Campbell, 2000; Tucker et al., 2011), women in our study did not appear to have many supportive or enduring relationships with other FSWs and few listed other FSWs in their social support networks. This may be due to other characteristics of our sample - namely, the high levels of drug use and street-based (vs. venue-based) nature of these women's work. However, qualitative narratives highlighted how women's dependence on sex work as a source of income appeared to foster greater economic competition amongst FSWs, which reduced trust and increased social distance, thereby providing an explanation for the absence of other FSWs in their networks.

Mixed methods designs are directly responsive to calls for an integrated approach to social network analysis (Crossley, 2010) and are consistent with the interdisciplinary origins of the field (Edwards, 2010). Mixed methods designs provide the opportunity to understand both the "structure" of social relationships and the "processes" that generate those structures (Edwards, 2010). From another perspective, quantitative tools provide the "abstract, formal and structural mapping" of social life, while qualitative tools reveal "shared meanings, conventions/norms and identities" within those structures (Crossley, 2010) p. 2). A mixed methods design capitalizes on the strengths and buffers the weaknesses of the constituent parts.

Our design was similar to other mixed methods social network studies (e.g., Bernardi, Keim, & von der Lippe, 2007) in that we had a sample of egos and alters and we collected quantitative personal network data and qualitative narratives from each. Like Bernardi (2007), we also considered the context in which the social networks were constructed by examining quantitative network indicators (e.g., size, composition)

alongside qualitative data that provided a greater understanding of the quantitative data, and enabled us to examine the underlying processes that may have contributed to the observed structures. A primary methodological contribution of the current work is its demonstration of the generalizability of this approach in multiple cultural settings. In fact, our findings bear some similarity to those in Bernardi's (2011; 2007) research with transnational German families, particularly in terms of the role of migration and children.

Limitations

Our findings should be considered in light of several limitations. Due to the funding limitations of our study, we were only able to recruit a small sub-sample of participants from a larger cohort study. Therefore, we were limited by the initial enrollment criteria and our findings should not be generalized to other populations. All couples were screened for current domestic violence and those found to be at risk were deemed ineligible and referred to social services. While this exclusion criterion was enforced to protect the safety of our respondents, it also yielded a sample that is likely characterized by more positive primary relationships and our findings will not generalize to couples that are experiencing severe intimate partner violence. All data were obtained via self-report and, as is the nature of self-reported data, may be subject to social desirability. As with all personal network studies, data about network contacts were not corroborated by those individuals. Finally, while personal network methods are particularly useful among populations where the entire network cannot be identified (Valente, 2010), they limit our ability to identify connections across the networks described by each participant.

Despite these limitations, our study has several strengths specifically in terms of efforts to increase its quality of inference, or validity. While qualitative and quantitative methods embrace slightly different standards in this regard, mixed methods research seeks to combine the methods to build upon complementary strengths while minimizing overlapping weaknesses (Onwuegbuzie & Johnson, 2006). Our data collection instrument was participatory and interactive, with interviewer and participant working side-by-side to enter the data and create and describe the network graphs. This participant-aided approach provides a holistic view of participants' networks (Hogan et al., 2007) that represents the participants' own cognitive understanding of their personal networks (McCarty et al., 2007). Collaborative creation and discussion of network graphs with interview participants is commonly used in qualitative social network studies (e.g., Bernardi et al., 2007; Schiffer, 2007). Laypeople can naturally identify characteristics and patterns in personal network graphs (Kennedy, Green, McCarty, & Tucker, 2011) and interviewees can accurately report about observable characteristics of their network members (Green, Hoover, Wagner, Ryan, & Ssegujja, 2013) providing some evidence for the validity of this approach. Our bi-national and bi-lingual interviewer developed a trusting rapport with participants, many of whom described their satisfaction with the collaborative nature of the network interview, which we believe also increased authenticity of reports. Throughout the data collection, analysis, and interpretation phases we relied on multiple perspectives including those of the investigator, the interviewer, an ethnographer, and the participants. Finally, in the interpretation phase we identified areas where our findings were consistent or inconsistent with the existing knowledge base.

Conclusion

In this mixed methods study of the social support networks of FSWs and their primary male partners, we illustrated how a design that integrated quantitative social network data, qualitative narratives, and visual network graphs provided a more holistic understanding of social support networks. Through the social network mapping, participants were able to describe their networks quantitatively, and qualitative describe the underlying processes that appear to have led to the current structure and composition of those networks. Topically, the legal process of deportation, the social process of drug-related stigma, and, for women, the nature of street-based sex work led to participants being isolated from their social support networks in ways that operated differently for men and women. Methodologically, we showed how information that would have been lost in a purely quantitative social network study (i.e., important missing people in participants' networks) was revealed through the comparison of quantitative and qualitative data. Future research should investigate whether interventions to enhance supportive networks could facilitate substance abuse recovery, enhance prevention interventions, and serve as protective buffers in this high-risk environment.

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Table 1. Descriptive characteristics of personal support networks, by sex (N=38)

	Women (N=19)		Men (N=19)	
	n	%	n	%
Ego characteristics				
Median age (IQR)	37	29, 44 Range: 24-51	42	32, 46 Range: 26-54
Marital status: civil union	19	100%	19	100%
Lived in Tijuana your whole life	8	42%	6	32%
Ever deported from US	3	16%	12	63%
Drug of choice				
Marijuana	2	10.5	1	5.3
Heroin	10	52.6	9	47.4
Heroin + cocaine	0	0	1	5.3
Heroin + meth	6	31.6	5	26.3
Methamphetamine	1	5.3	3	15.8
Injected any drug in past 6 months	16	84.2	15	79.0
Network characteristics	Median	IQR Range	Median	IQR Range
Network size	5.0	3, 7 3-15	5.0	3, 7 2-23
Network density*	0.60	0.33, 0.71 0.29-1.0	0.67	0.43, 0.80 0-1.0
Years with primary partner	8.0	4.0, 15.0 2-26	6.0	4.0, 10.0 2-30
Alter characteristics **Number of:**	**Median**	**IQR** **Range**	**Median**	**IQR** **Range**
Female alters	2	1,4 0-9	2	2,3 1-11
Family members	1	0, 4 0-9	2	1,4 0-10
Spouses/boyfriends/girlfriends	1	Range: 1-1	1	Range: 1-1
Acquaintances	0	0,1 0-2	0	0,1 0-3
Friends	1	1,2 0-4	1	0,2 0-10
Paying sex partners (clients)	0	0-1 0-3	0	0
IDUs	1	1,2 0-3	1	1, 2 0-6
IDUs with whom ego shares syringes	0	0,1 0-2	1	0,1 0-4
Alters who use non-IDU drugs	1	1, 3 1-4	1	1, 3 1-11

Non-IDU alters with whom ego shares drug paraphernalia	1	0, 2 0-4	1	0, 1 0-9
Alters with whom ego has had sex in past 6 months	1	1, 2 1-5	1	1, 1 1-2
Sex contacts with whom ego has used condoms in past 6 months	0	0,1 0-3	0	0,1 0-1

*influenced by network size

Figure 1. Study Design.

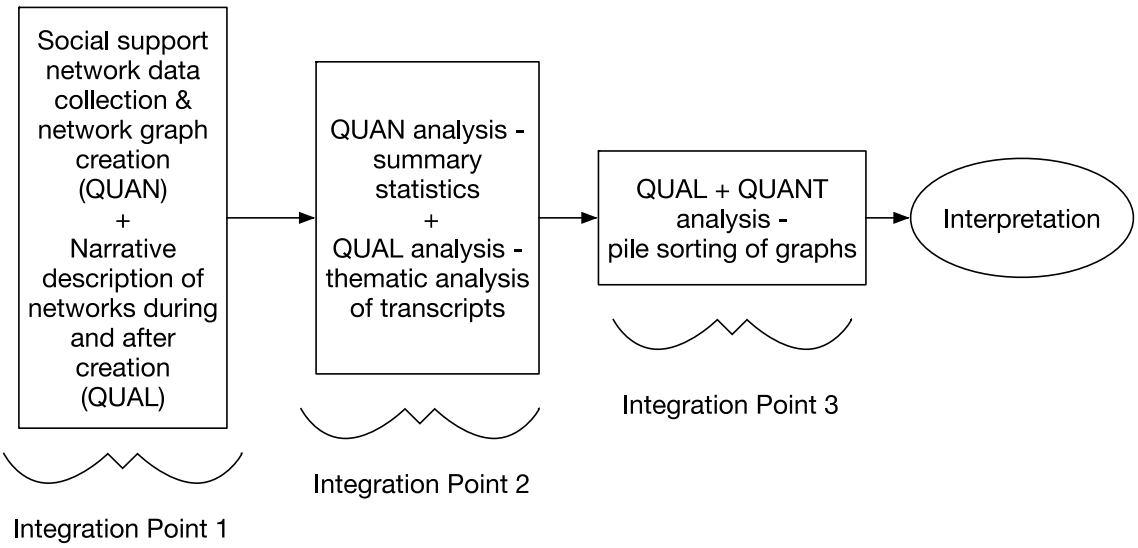

Figure 2. Examples of open-ended questions used in qualitative interviews.

1. Now that we have drawn this map about your social network, I'm curious to know what you think. What do you think about the map?
2. Why do you think it looks how it does?
3. Is there someone else that you would like to add to this drawing? Is there anyone missing that you would like for me to add? Tell me about them.
4. Do you feel connected to other women who work with clients like you do (i.e., other sex workers?) Why or why not?
5. Tell me about the people you put in the "closest" circle. What do they mean to you? Tell me about your relationship with them. How are they different than the people you put on the outside?

Figure 3. Pattern 1: large dense female network, small sparse male network.

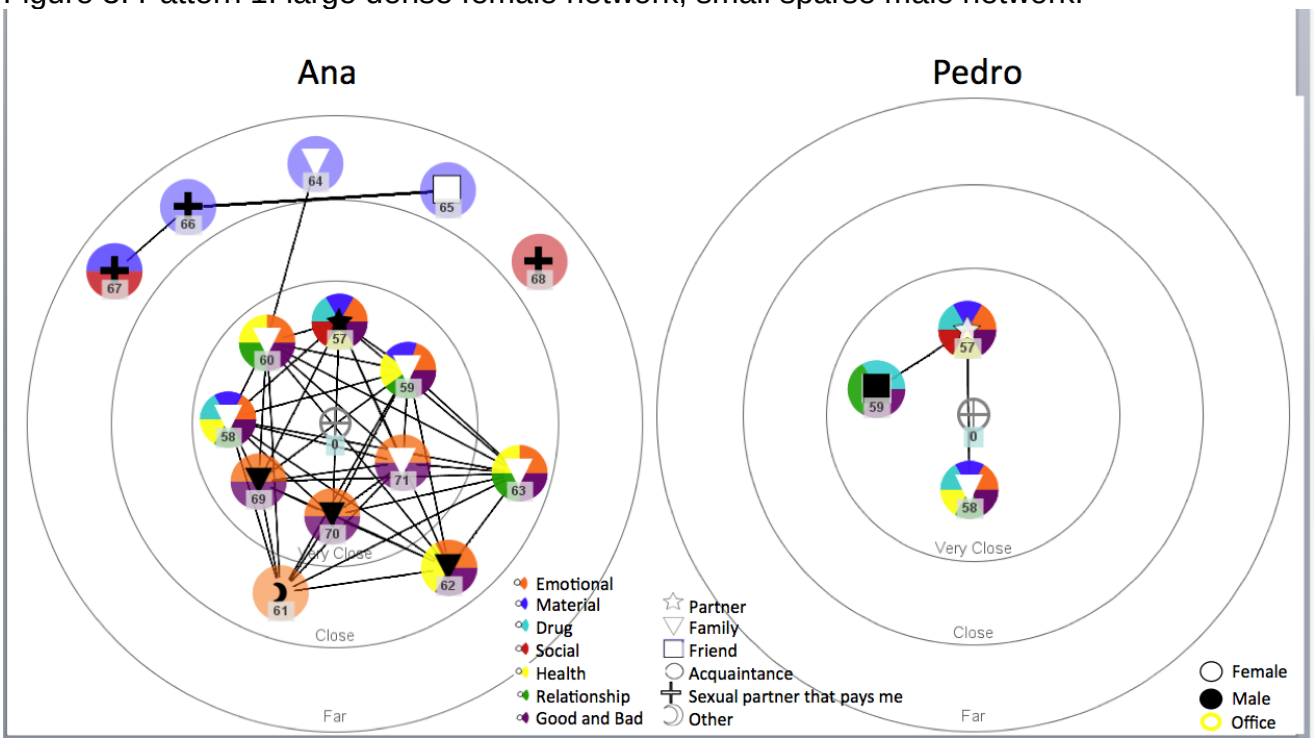

Figure 4. Pattern 2: larger male network, smaller female network.

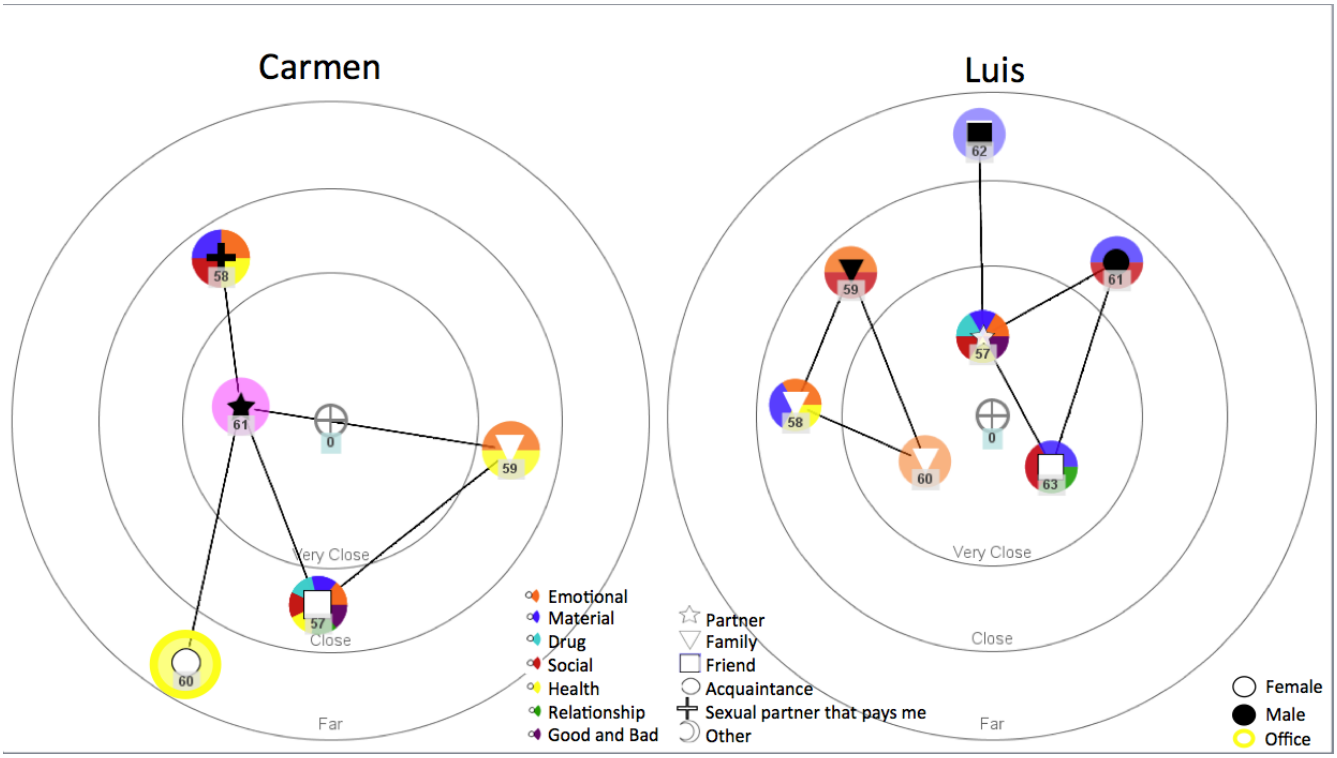

Figure 5. Pattern 3: partners not identified as close ties.

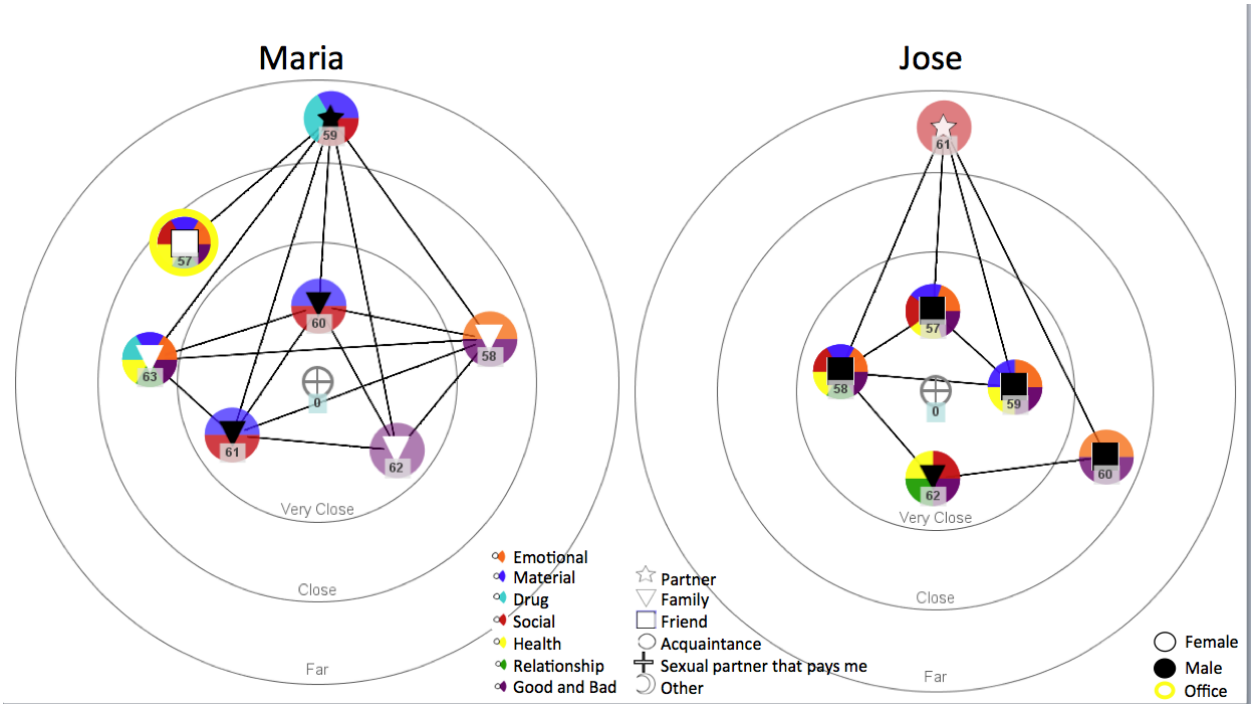

Table 1. Descriptive characteristics of personal support networks, by sex (N=38)

	Women (N=19)		Men (N=19)	
	n	%	n	%
Ego characteristics				
Median age (IQR)	37	29, 44 Range: 24-51	42	32, 46 Range: 26-54
Marital status: civil union	19	100%	19	100%
Lived in Tijuana your whole life	8	42%	6	32%
Ever deported from US	3	16%	12	63%
Drug of choice				
Marijuana	2	10.5	1	5.3
Heroin	10	52.6	9	47.4
Heroin + cocaine	0	0	1	5.3
Heroin + meth	6	31.6	5	26.3
Methamphetamine	1	5.3	3	15.8
Injected any drug in past 6 months	16	84.2	15	79.0
Network characteristics	Median	IQR Range	Median	IQR Range
Network size	5.0	3, 7 3-15	5.0	3, 7 2-23
Network density*	0.60	0.33, 0.71 0.29-1.0	0.67	0.43, 0.80 0-1.0
Years with primary partner	8.0	4.0, 15.0 2-26	6.0	4.0, 10.0 2-30
Alter characteristics **Number of:**	**Median**	**IQR** **Range**	**Median**	**IQR** **Range**
Female alters	2	1,4 0-9	2	2,3 1-11
Family members	1	0, 4 0-9	2	1,4 0-10
Spouses/boyfriends/girlfriends	1	Range: 1-1	1	Range: 1-1
Acquaintances	0	0,1 0-2	0	0,1 0-3
Friends	1	1,2 0-4	1	0,2 0-10
Paying sex partners (clients)	0	0-1 0-3	0	0
IDUs	1	1,2 0-3	1	1, 2 0-6
IDUs with whom ego shares syringes	0	0,1 0-2	1	0,1 0-4
Alters who use non-IDU drugs	1	1, 3 1-4	1	1, 3 1-11
Non-IDU alters with whom	1	0, 2	1	0, 1

ego shares drug paraphernalia		0-4		0-9
Alters with whom ego has had sex in past 6 months	1	1, 2 1-5	1	1, 1 1-2
Sex contacts with whom ego has used condoms in past 6 months	0	0,1 0-3	0	0,1 0-1

*influenced by network size