Social Science & Medicine 317 (2023) 115612

Contents lists available at ScienceDirect

Social Science & Medicine

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

Intergroup relationships with people who use drugs: A personal network approach

Ashley F. Railey [a,b,1,*], Adam R. Roth [a,b,c,1], Anne C. Krendl [d], Brea L. Perry [a,c]

[a] Department of Sociology, Indiana University Bloomington, IN, USA
[b] Department of Sociology, Oklahoma State University, Stillwater, OK, USA
[c] Network Science Institute, Indiana University Bloomington, IN, USA
[d] Department of Psychological and Brain Sciences, Indiana University Bloomington, IN, USA

ARTICLE INFO

Keywords:
Intergroup contact
People who use drugs
Social networks

ABSTRACT

Positive and meaningful intergroup contact between people who use drugs and those with the potential to provide positive social interactions has been identified as an important pathway to address the burden of drug use by reducing stigmatizing views and behaviors. Traditional approaches to intergroup contact typically rely on laboratory experiments or survey vignettes to examine the consequences of variation in contact conditions and relationships. Although seldom measured, contact occurs naturally through individuals' personal social networks. Here, we apply this latter approach to examine how the characteristics of drug use and social roles are associated with positive and meaningful intergroup contact in daily life. We leverage unique data from a state representative sample of Indiana residents aged 18 or older (n = 926) that completed a personal network interview and separately reported people they know who have a drug use problem. We first identified the respondents who nominated a person who uses drugs as a member of their core personal network and then evaluated the relationship, disease, and individual characteristics that were associated with that person's inclusion in the personal network. We find that primary relationships (e.g., having a spouse or child who uses drugs) are associated with meaningful contact with people who use drugs but that intense manifestations of disease characteristics (severe or problematic, danger to self) can limit the likelihood of contact. These findings demonstrate how the nature of intergroup contact can shape the types of relationships that have been shown to help reduce stigmatizing attitudes and the behavioral barriers to recovery, such as social isolation. Thus, core networks present a valuable approach to defining the factors that likely contribute to effective intergroup contact.

1. Introduction

Drug overdose mortality has significantly increased in the United States in recent years. More than 100,000 deaths were reported between April 2020 to April 2021 (Ahmad et al., 2021). Stigma and social isolation represent significant barriers to addressing the drug crisis by preventing people with substance use disorders from seeking treatment and recovery services (Ahern et al., 2007; Corrigan et al., 2017; Crapanzano et al., 2018; Hammarlund et al., 2018; Young et al., 2005). Promoting positive social (intergroup) contact with people who use drugs (PWUD) can help prevent the social isolation that promotes drug-taking (Zoorob and Salemi, 2017), motivate recovery (Timpson et al., 2016), and may be an effective way to reduce stigma towards substance dependence (Kennedy-HendricksBarry et al., 2017). However, despite the known benefits of positive social contact, considerably less research addresses the factors contributing to the establishment of such relationships (Manago and Krendl, 2022).

Whether two individuals will share a relationship that challenges stigmatizing views and promotes positive contact behaviors is likely influenced by the characteristics of the disease (e.g., severe or problematic nature, dangerousness to self or others) and the type of social roles connecting ingroup and outgroup member (e.g., family, friend, neighbor) (Corrigan and Nieweglowski, 2019; Perry et al., 2020; Pescosolido and Martin, 2015). Compared to other stigmatized conditions,

* Corresponding author. Department of Sociology, 431 Social Sciences & Humanities, Oklahoma State University, Stillwater, OK, 74078, USA.
E-mail address: ashley.railey@okstate.edu (A.F. Railey).
[1] AF Railey and AR Roth contributed equally.

https://doi.org/10.1016/j.socscimed.2022.115612
Received 4 August 2022; Received in revised form 10 November 2022; Accepted 9 December 2022
Available online 16 December 2022

non-medical drug use is viewed as dangerous and unmanageable, which drives elevated desires for social distance and the overall marginalization of PWUD (Perry et al., 2020). Social isolation of PWUD can similarly occur to mitigate negative intergroup interactions that stem from heightened drug use (Bowles et al., 2020; Wagner et al., 2014). Conversely, the intensity of the disease characteristics in the relationship may change when individuals are socially, emotionally, or economically obligated to maintain contact, such as connections to an outgroup member through a kinship tie (e.g., immediate family member) (Caetano et al., 2017; Corrigan and Nieweglowski, 2019). Kinship ties can increase the durability of relationships with stigmatized individuals (Perry, 2011) but also come with additional responsibilities to uphold the relationship (Fingerman et al., 2004), which may translate into more exposure to negative experiences and the desires to distance oneself from the stigmatized individual (Jorm and Oh, 2009; Mittal et al., 2014). Understanding how the disease characteristics and social roles surrounding non-medical drug use contribute to meaningful intergroup contact can help define how to promote positive relationships with people who use drugs to potentially reduce stigmatizing views and socially isolating behaviors that can disrupt recovery.

In the present study, we capture intergroup contact through a personal network approach by assessing the probability that respondents identify people they know who use drugs as occupying central roles in their core personal networks. Our approach focuses on intergroup contact with PWUD that extends beyond superficial, infrequent interactions to include positive, meaningful, and sustained relationships to align with recent research on improving the effectiveness of intergroup contact to reduce stigma (Perry et al., 2022; Pettigrew et al., 2011a). We extend traditional approaches that elicit attitudes toward socializing with a hypothetical PWUD by leveraging a unique survey where meaningful intergroup contact is observed across a large sample. The survey contains data on respondents' core networks (i.e., a small group of people with whom the respondent shares meaningful social ties) and a separate roster of people whom respondents know who have a history of non-medical drug use (i.e., person who uses drugs or 'PWUD' roster). These data allow us to define the social context in which respondents engage in intergroup relationships in their daily lives. We hypothesize that social roles and drug use characteristics separately and jointly interact to influence the probability of including a PWUD in one's core network. Our findings contribute to the understanding of social relationships surrounding drug use, which are important to reduce stigmatizing views and behaviors.

2. Personal network approach to intergroup contact

Intergroup contact theory posits that social contact between ingroup and outgroup members provides opportunities to correct inaccurate stereotypes and subsequently reduce stigma towards the outgroup (Allport, 1954). Contemporary research caveats this assertion by noting that beyond casual contact, positive contact (Pettigrew et al., 2011b; Pettigrew and Tropp, 2006a) and relationships that foster intimate exchanges between parties are effective to counter the negative emotions that can result in prejudice and discriminatory, socially isolating behaviors (Link et al., 1987; Perry et al., 2022; Pettigrew et al., 2011a; Pettigrew and Tropp, 2006b). Building on this body of research, we argue that meaningful social relationships—those characterizing personal social networks—serve as a platform for the type of intergroup contact which has been theorized to reduce stigmatizing beliefs and discrimination.

The personal network approach to studying social relationships captures a respondent's direct social connections and has the potential to define the probability of contact with outgroup members. Personal networks include the ties (i.e., relationships) between a focal individual (i.e., *ego*) and a specified set of their immediate contacts (i.e., *alters*), along with detailed information about each alter and relationship. Although there are numerous ways to delineate a personal network (Perry and Roth, 2021), network analysts often focus on a core group of alters with whom ego shares a meaningful relationship or exchange (e.g., individuals with whom respondents "discuss important matters") (Burt, 1984; Fischer, 1982; Perry and Pescosolido, 2010). Core networks consist of a relatively dense yet functionally broad group of people composed mainly of immediate family and close friends (Marin, 2004; Marsden, 1987; Wellman and Wortley, 1990). Analyzing these types of networks—and whether respondents name any PWUDs within their core networks—allows us to determine the prevalence of intergroup relationships.

The inclusion of a PWUD in one's core network is contingent on two factors: (1) whether ego knows a PWUD (and knows about their drug use), and (2) whether the ego has a meaningful relationship with the PWUD. An ego who has no previous interactions with or knowledge of a PWUD would be unable to report their presence within their core network even if they were open to having that individual in their network. In this scenario, the lack of inclusion of a PWUD should not be interpreted as social exclusion (i.e., desire for social distance) since there were no PWUDs to exclude. Properly addressing this issue of opportunity would therefore require the researcher to have data on ego's core network *and* a roster of PWUD who ego knows. Upon obtaining these data, the researcher could assess whether the ego shares a meaningful relationship with a PWUD given the opportunity in their daily lives. An ego who knows a PWUD but does not include them in their core network, meanwhile, can be interpreted as indirectly revealing their desire for social distance.

Our proposed network approach follows a small body of intergroup contact research that assesses people's tendencies for social contact through observed actions in everyday natural environments (Marmaros and Sacerdote, 2006; Moody, 2001). This approach allows for the assessment of revealed behavior while building generalizability through a large, diverse sample. Most closely aligned with economic traditions of revealed preferences, assessing people's real-world choices has considerable advantage when studying sensitive issues because it reduces hypothetical biases, particularly from social desirability reporting (Kahneman and Knetsch, 1992; Taylor and Brown, 1994), has strong predictive validity (Whitehead, 2005), and closely aligns with people's potential behaviors and support for public policy (List and Gallet, 2001; Murphy et al., 2005). Thus, capturing the real-world consequences of interacting with an outgroup member accounts for the potential challenges of intergroup contact and reveals the conditions in which those challenges may be overcome (Amir, 1969; Dixon et al., 2005).

3. Intergroup contact in the context of drug use

PWUD are often viewed significantly more negatively compared to people with mental illnesses or other psychiatric disorders (Barry et al., 2014; Link and Phelan, 1999). For example, people tend to believe that PWUD are unable to manage their disease or lead productive lives (Perry et al., 2020). As a result, PWUD disproportionately face social isolation and marginalization (Day and Rosenthal, 2019; Zoorob and Salemi, 2017). Similar to other stigmatized conditions, the robust and widespread bias associated with drug use can hinder the development of social relationships and, ultimately, reduce one's life chances (Aneshensel et al., 2013; Corrigan, 2004; Pescosolido et al., 1999; Pescosolido and Martin, 2015). In what follows, we consider the social processes that are likely to drive meaningful intergroup contact in the context of drug use.

3.1. Social roles

The majority of the general population maintains close relationships with multiple people (Fischer, 1982; Marsden, 1987; Perry et al., 2018). These relationships are often classified according to well recognized social roles (e.g., family member, friend, co-worker, neighbor), each of which is governed by a distinct normative expectation. Family members

are socially and emotionally obligated to support each another, even in the presence of difficult behaviors (Offer and Fischer, 2018; Silverstein et al., 2006). Yet even within the family, there exists a hierarchy of support such that certain, primary relationships (e.g., spousal ties, parent-child ties) are considerably more intimate than others (e.g., extended kin) and therefore more likely to endure unpredictable, unconventional or otherwise negative behaviors (Cantor, 1979). Non-kin relationships, meanwhile, tend to be viewed as voluntary and are thus more likely to dissolve or weaken in the presence of difficult behaviors (Fischer and Offer 2020). Given the normative expectations surrounding different social roles, we formulate our first hypothesis as it relates to intergroup relationships with PWUD:

H1. *Primary kinship ties (e.g., spouse, parent, child) will be more strongly associated with inclusion of PWUD in core networks compared to other types of ties*.

3.2. Disease characteristics

Although it is well established that the general public holds negative views towards drug use (Barry et al., 2014; Link and Phelan, 1999), there is further reason to expect considerable variation when it comes to the degree to which drug use influences intergroup relationships. More intense or heightened disease manifestations and how the disease manifests within social interactions may be met with less desire to establish meaningful relationships. This may occur due to the stigmatized individual's inability to meet expectations for seeking treatment or achieving recovery (Parsons, 1951) or stem from uncertainty regarding the PWUD's ability to uphold familial and work responsibilities (Pescosolido et al., 1999). Heightened perceptions of the disease characteristics may then appear to affirm widespread portrayal of PWUDs as dangerous or problematic, and, thus, deserving of punishment, blame, or social isolation (Kennedy-HendricksBarry et al., 2017; Link and Phelan, 1999; McGinty et al., 2016). Indeed, perceived dangerousness among network members with a mental illness inhibits positive interactions (Pullen et al., 2022) and can be tied to the desire for social distance (Perry et al., 2022). The strain of maintaining these types of relationships may further be detrimental to one's own psychological health (Offer, 2020). Thus, considering how the disease characteristics (i.e., severity, problematic behavior, danger to others or self) manifest in meaningful intergroup contact may help define the extent to which drug use defies expectations for social exchange. We formalize this claim in our second hypothesis:

H2. *PWUDs with more intense disease characteristics will have a lower probability of being included in a respondent's core network compared to PWUDs with less intense disease characteristics*.

3.3. Interaction of social roles and disease characteristics

As certain social relationships are more durable than others, it is worth considering how the type of social role that characterizes the intergroup relationship interacts with the characteristics of drug use. Whereas more peripheral social relationships (e.g., neighbors, co-workers, casual acquaintances) are likely to dissolve in the presence of a deviant behavior such as drug use, primary relationships are more likely to persist (Wellman, 2000). Yet there may exist a point where the problematic nature of the tie outweighs the benefits (Carpentier and Ducharme, 2005). Given the varying levels of obligation that accompany different social roles and the variation in the perception of drug use characteristics, we formulate our final hypothesis:

H3. *The association between social roles and the probability of including a PWUD in one's core network will be modified by the disease characteristics*.

4. Methods and materials

Data for the analysis come from the Person-to-Person Health Interview Study (P2P), a state representative survey that contains data on the demographics, health, and health attitudes of Indiana residents. The P2P uses a stratified probability sample to the block level with household quota sampling on sex, age, and employment status to reduce not-at-home bias of households in Indiana with an oversample of economically depressed, rural counties. In our study, we use a sub-sample, which includes 1663 respondents who participated in face-to-face interviews from October 2018 to March 2020, with 90% of observations collected between January 2019 and February 2020. From this sample, we use only respondents who currently know someone who uses drugs in a way not prescribed (n = 968). We apply a complete case analysis, using only the respondents who responded to all the questions in the analysis, to limit the final sample to 926 respondents.

The P2P elicits data on the respondents' core personal networks and a separate roster of persons the respondent knows who use drugs. Respondents first completed the network module using questions adapted from the PhenX Networks Battery toolkit (PhenX Toolkit 1991). Respondents were provided with four name generating prompts which asked about the people with whom they interacted over the past six months to: (1) discuss personal matters, (2) discuss health matters, (3) influence health behaviors, and (4) spend leisure time. There was no limit to the number of alters those respondents could name in response to any of the name generators. Alters were considered part of the core network if they were mentioned in at least one of the four generators.

After answering several other survey modules, respondents were asked to name up to five people they know who have a drug use problem (i.e., PWUD roster). For each person in the PWUD roster, the respondent reported their relationship to the PWUD, the severity of the drug use problem, whether the drug use 'causes you problems, creates stress, or makes your life difficult', and whether the PWUD was a 'danger to self' or 'danger to others'. The inclusion of the PWUD roster occurred after several survey modules. See Table A1 for specific question used in the network module and PWUD roster (Supplementary Material).

4.1. Dependent variable

Our unit of analysis is at the tie level (i.e., ego-alter relationship). The primary outcome is a dichotomous variable that indicates whether each PWUD was also mentioned in the respondent's core network (1 = core, 0 = non-core). Fig. 1 shows a hypothetical example of a respondent's PWUD roster and core network. In this example, Cal (respondent's cousin) was listed in the PWUD roster and was mentioned by the respondent as an alter in their core network. This respondent shares an intergroup relationship with Cal, but not Shane nor Marney. Co-presence in the PWUD roster and core network was based on matching the name and the relationship type. In cases with only initials as alter identifiers (n = 6), we matched the initials with the name and

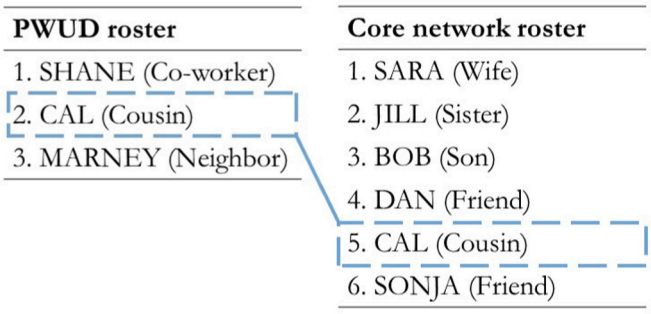

Fig. 1. Hypothetical example of a P2P respondent's PWUD roster and core network.

relationship type followed by matching the strength of the tie to verify the match. We include whether the ego is still in contact with the PWUD. It is worth noting that some respondents may be unaware that they knew a PWUD (e.g., one of their friends has a history of drug use without their knowledge). We argue that in such a scenario a respondent's failure to mention the PWUD as part of their core network should not be taken as an indicator of desire for social distance because they would not be aware of the role that the alter's drug use played in the first place.

4.2. Independent variables

Upon enumerating the PWUD roster, respondents were asked a series of name interpreting questions about the disease characteristics for each PWUD. Respondents first reported how much each PWUD's drug use "causes you problems, creates stress or makes your life difficult" with responses ranging from 1 (not at all) to 10 (very much). Respondents were next asked about the severity of the drug problem and the dangerousness of the alter to others and self. These also ranged from 1 (not at all) to 10 (very much). See Figure A1 (Supplementary Materials) for visual distributions of these variables. Finally, we categorized the relationship between respondent and PWUD as either 'spouse/partner,' 'child,' 'parent,' 'sibling,' 'relative' (e.g., grandparent and other kin), 'friend,' or 'non-kin' (e.g., neighbor, coworker).

4.3. Covariates

At the respondent level, we include the following variables: age, gender (woman or man), race (white or non-white), education (less than college, some college, completed college), core network size, and proportion kin in core network. We adjust for self-reported personal experience with non-medical opioid, other illicit opioids, or heroin ('have you ever used prescription opiates in a way that was not prescribed to you?', "have you ever, even once, used heroin or other illicit opioids such as fentanyl or carfentanyl?" 1 = yes to either question, 0 = no).

4.4. Analytical approach

Our analysis examines the probability that respondents mention a PWUD in their core networks, given they first know and are in contact with a PWUD. Limiting the focus to only those who know a PWUD leverages the presence of any relationship with a stigmatized person to promote intergroup contact. This is achieved by estimating a series of multilevel models with fixed effects for the respondent characteristics and random intercepts for the characteristics of the relationship with the alter (Perry et al., 2018). Specifically, a random-intercept model is used with Level-1 alters nested in Level-2 ego respondents where the random intercept applies to each ego and adjusts for the lack of independence between observations from the PWUD roster. Formally, the probability p of ego j mentioning a PWUD alter i in their core network is modeled as:

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2ij} + \zeta_j$$

where ζ_j represents the random component of the model while the other components are fixed. In this notation, X_{2ij} captures the hypothesized relationships of the social roles in the respondent-PWUD relationship (H1), the PWUD disease characteristics (H2), and the intralevel interaction terms between disease characteristics and relationship type (H3). The ego characteristics are captured in X_{1j}. Survey weights are included in each model estimation. The results are reported as marginal effects where continuous variables are interpreted as the average probability change in the outcome for a one-unit change in the independent variable and categorical variables are interpreted as a discrete change from the reference level.

5. Results

5.1. Descriptive characteristics

The descriptive characteristics of the respondent (ego), alter's drug use, and the relationship between respondent and alter appear in Table 1. The average age of the respondents who know a PWUD was around 50 years old, ranging from 19 to 95 years old. The majority of respondents were female (62%) and identified as White (83%) whereas a plurality of respondents held a college degree (40%). A minority of respondents who know a PWUD reported personal experience with non-medical drug use at least once in their lifetimes (18%). Bivariate comparisons of the average network size show that those who included a PWUD in their core network had larger networks (6.27 alters vs. 5.35 alters, $p < 0.001$)and named a greater number of people in the PWUD roster (2.91 alters vs. 2.06 alters, $p < 0.001$).

Table 1
Descriptive characteristics of ego, alter and relationship.

	Overall n (%)	Non-core n (%)	Core n (%)	P value
Ego characteristics (n = 926)				
Age, m (sd)	49.6 (17.3)	49.9 (17.3)	48.2 (17.1)	0.26
Gender				0.11
Male	346 (38.1)	293 (39.4)	53.0 (32.7)	
Race				0.61
White	756 (83.4)	623 (83.7)	133 (82.0)	
Education				0.47
No college	314 (34.7)	252 (33.9)	62.0 (38.2)	
Some college	226 (24.9)	185 (24.9)	41.0 (25.3)	
College degree	366 (40.4)	307 (41.3)	59.0 (36.4)	
Personal non-medical drug use				<0.001
Yes	165 (18.2)	121 (16.3)	44.0 (27.2)	
Core network size, m (sd)	5.51 (2.84)	5.35 (2.74)	6.27 (3.14)	<0.001
Proportion of kin in network, m (sd)	0.62 (0.28)	0.61 (0.28)	0.66 (0.25)	0.18
Number of PWUD alters, m (sd)	2.21 (1.37)	2.06 (1.29)	2.91 (1.49)	<0.001
PWUD characteristics (n = 2079)				
Drug disorder is severe (1–10), m (sd)	7.43 (3.01)	7.46 (2.97)	7.26 (3.13)	0.21
Drug disorder is problematic (1–10), m (sd)	4.36 (3.52)	4.15 (3.46)	5.00 (3.64)	<0.001
Dangerous to others (1–10), m (sd)	3.98 (3.27)	4.01 (3.24)	3.91 (3.37)	0.55
Dangerous to self (1–10), m (sd)	5.77 (3.60)	5.83 (3.58)	5.59 (3.69)	0.21
Relationship characteristics (n = 2079)				<0.001
Spouse/partner	75.0 (3.75)	36.0 (2.35)	39.0 (8.28)	
Child	112 (5.59)	61.0 (3.98)	51.0 (10.8)	
Parent	183 (9.14)	125 (8.16)	58.0 (12.3)	
Sibling	139 (6.94)	88 (5.75)	51.0 (10.8)	
Relative	503 (25.1)	414 (27.0)	89.0 (18.9)	
Friend	659 (32.9)	528 (34.5)	131 (27.8)	
Non-kin	331 (16.5)	279 (18.2)	52.0 (11.0)	

Notes: Descriptive statistics of raw data. Percentages may not add to 100 due to rounding. m = mean; sd = standard deviation.

The 926 respondents in our sample listed ties to a total of 2079 PWUD. On a scale of 1–10, across both core and non-core PWUD ties, substance use is ranked as relatively severe (mean = 7.26 and 7.46, p = 0.21). Problematic behavior was significantly worse for PWUD core ties compared to PWUD non-core ties (5.00 vs. 4.15, p < 0.001). Approximately half of the alters from the PWUD roster fulfill friendship or other non-kin roles. As shown in the bottom of Table 1, spouses or partners make up the smallest group of PWUD followed by children, parents, and then siblings. Relatives account for the remaining quarter of the relationships.

5.2. Multilevel regression models

Table 2 presents the marginal effects from the multilevel models assessing co-presence in one's core network and PWUD roster. Respondents with larger core networks had a greater probability of including a PWUD in their core network compared to respondents with smaller networks. The probability of co-presence also differed depending on a respondent's relationship to PWUD. As shown in Models 2 and 3, respondents were significantly less likely to include a PWUD in their network if the PWUD was their child, parent, sibling, relative, friend, or non-kin than if the PWUD was their spouse/partner. Fig. 2 plots the predicted probabilities of the PWUD in the core network by relationship type as estimated from Model 3. As shown in this figure, PWUD spouses/partners had a 0.46 probability of being in the core network (95% CI: 0.29, 0.63). Finally, Model 3 shows that none of the PWUD disease characteristics were independently associated with PWUD co-presence in the core network.

Fig. 3 plots the predicted probability of naming the PWUD in the core network based on the interaction between PWUD disease characteristics and relationship social roles. The figure showing the association between severity of disease (top-left panel) and PWUD co-presence in the core network indicates substantial variation across relationship type. Specifically, as the disease goes from 'not' severe (i.e., severity = 1) to 'very' severe (=10), the probability of a spouse/partner being in the core-network dramatically decreases. Respondents who had a PWUD spouse/partner with low severity (i.e., severity = 1) had a 0.91 (95% CI: 0.74, 1.07) probability of naming them in their core network whereas respondents who had a PWUD spouse/partner with high severity (i.e., severity = 10) had significantly lower probability of co-presence (0.27, 95% CI: 0.07, 0.47). A similar negative association between the PWUD disease characteristic and co-presence of the spouse/partner in the core network was also found across 'causes me problems' and 'danger to self,' but not 'danger to others.' In contrast, there were no detectable associations between the PWUD disease characteristics and co-presence in the core-network among any of the other social roles. The probability of including a non-spouse PWUD in one's core network is relatively low regardless of the disease characteristics. See Table A2 in the Supplementary Material for corresponding models with the interaction terms shown in Fig. 3.

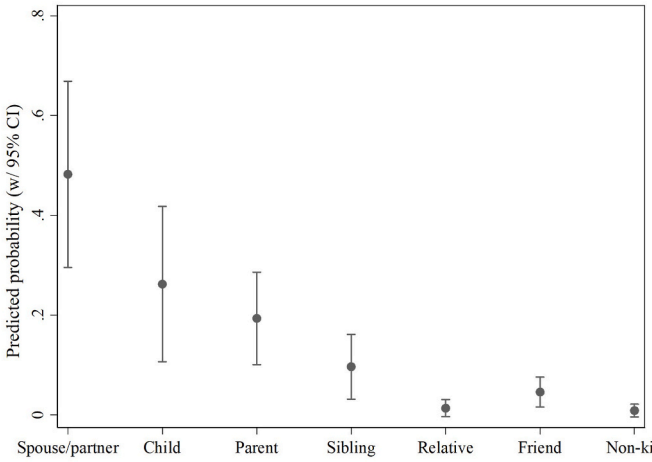

Fig. 2. Predicted probability of PWUD co-presence by relationship and PWUD characteristics.

Table 2
Multilevel logit model of the marginal effects of PWUD co-presence in the core network.

	Model 1		Model 2		Model 3	
	ME	SE	ME	SE	ME	SE
LEVEL 2 (n = 926)						
Respondent characteristics						
Age	0.00	(0.00)	0.00	(0.00)	0.00	(0.01)
Female	0.01	(0.02)	−0.02	(0.02)	−0.02	(0.02)
White	0.01	(0.02)	−0.01	(0.02)	−0.01	(0.02)
Education (ref: *No college*)						
Some college	0.04	(0.03)	0.03	(0.03)	0.02	(0.02)
College degree	0.03	(0.03)	0.02	(0.02)	0.02	(0.02)
Drug misuse	0.06+	(0.03)	0.03	(0.02)	0.03	(0.02)
Core network characteristics						
Size	0.01**	(0.03)	0.01***	(0.003)	0.01**	(0.00)
Prop Kin	0.03	(0.04)	0.01	(0.03)	0.01	(0.02)
LEVEL 1 (n = 2079)						
Relationship characteristics						
Spouse/partner			Reference		Reference	
Child			−0.22+	(0.11)	−0.23*	(0.06)
Parent			−0.29**	(0.10)	−0.29**	(0.10)
Sibling			−0.39***	(0.10)	−0.37***	(0.10)
Relative			−0.48***	(0.10)	−0.47***	(0.10)
Friend			−0.46***	(0.10)	−0.44***	(0.10)
Non-kin			−0.49***	(0.10)	−0.47***	(0.10)
PWUD disease characteristics						
Severity of disease					0.00	(0.0)
Causes me problems					0.00	(0.00)
Danger to others					0.00	(0.00)
Danger to self					0.00	(0.00)
Rho	0.53***	0.06	0.60***	0.07	0.66***	0.07

Notes: Continuous variables interpreted as the average probability change in the outcome for a one-unit change in the independent variable. Categorical variables interpreted as discrete change from 0 to 1. P value: + p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001.

5.3. Sensitivity analyses

The underlying assumption motivating this study was that respondents shared a meaningful relationship with the alters named in the core network—an assumption that is supported by previous research on these types of networks (Marsden, 1987; Wellman and Wortley, 1990). Yet it is possible that respondents are not equally close with all members of their core network (Small, 2013). To test this, we first compared the mean values of emotional closeness and frequency of contact (each measured as continuous variables from 1 to 10) for core PWUD against non-core PWUD (see Table A3 in Supplementary Material). Respondents were emotionally closer to the core PWUDs than non-core PWUDs (7.83 vs. 6.07, p < 0.001) and interacted with the former group more often than the latter group (7.50 vs. 5.31, p < 0.001). Second, we re-estimated the multilevel logistic regression models from the main analysis, this time including emotional closeness and frequency of contact as predictor variables (see Table A4 in supplementary material). Important for our study, the key findings from the main analysis (e.g., interaction terms between relationship type and disease characteristics) held consistent in these latter supplementary models.

An inherent challenge with the network approach is dealing with respondents who failed to name any network members. Although the majority of respondents (n = 926) in our sample knew at least one PWUD, we had to omit 737 respondents from the analysis because they had no known contact with a PWUD and thus could not include them in

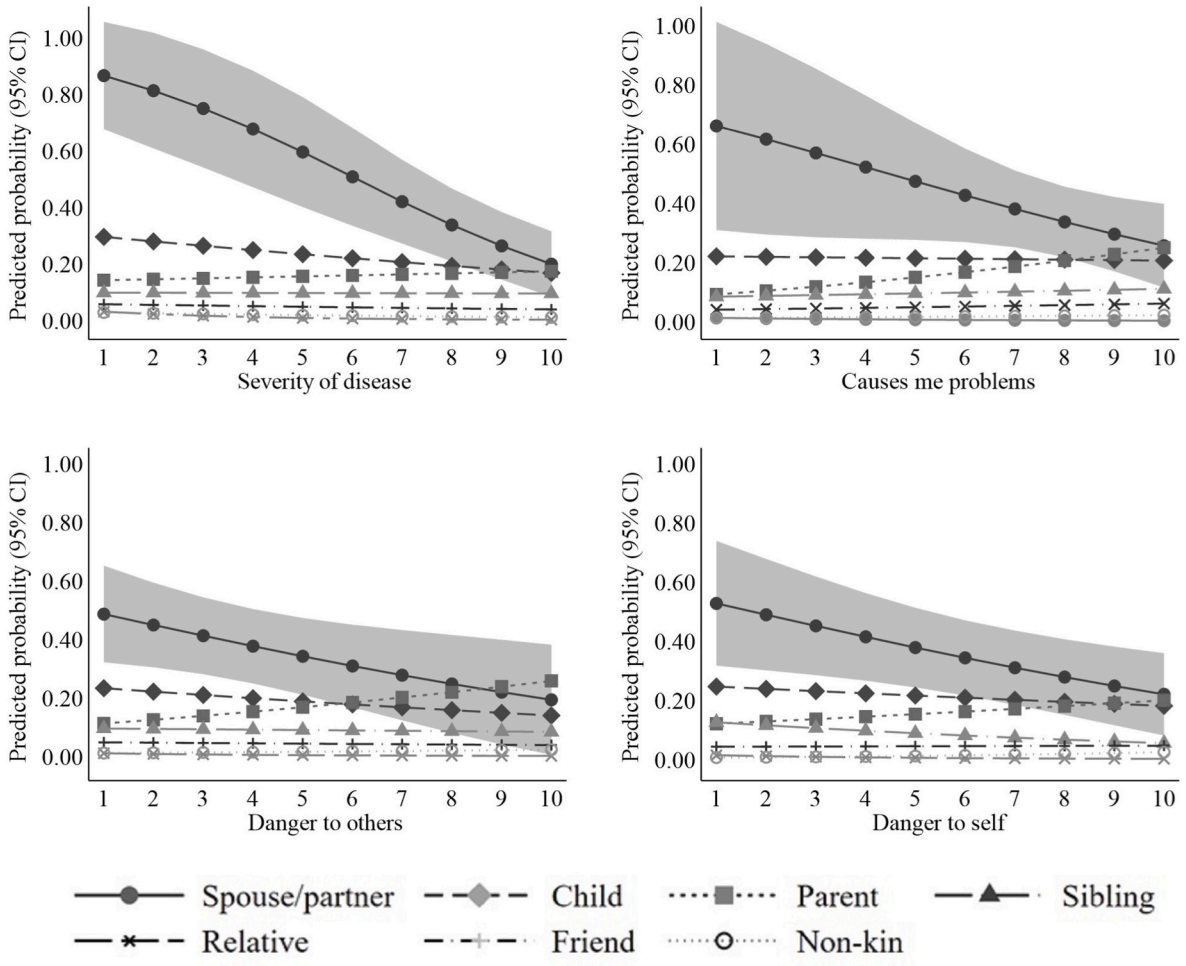

Fig. 3. Predicted probability of PWUD co-presence by relationship and PWUD characteristics.

their core network even if they wanted to. As part of a sensitivity analysis, we compared the descriptive statistics for respondents who know a PWUD (analytic sample) and respondents who do not know a PWUD to assess whether there were any clear differences between the two groups (see Table A5 in the Supplementary Material). There were no significant differences across gender, race, education, nor proportion of kin in the core network. There were, however, differences in age, personal non-medical drug use, and core network size. Respondents who knew a PWUD were significantly younger (49.6 years old vs 54.07 years old, $p < 0.001$), more likely to have a history of personal non-medical drug use (18.2% vs 9%, $p < 0.001$), and had larger networks (5.51 vs 4.97 alters, $p < 0.001$) compared to respondents who did not know a PWUD.

6. Discussion

Our study contributes to a growing body of research on the association between people's social network ties and intergroup contact by evaluating meaningful relationships with people who use drugs. Using a large, representative sample we assessed the probability that respondents named a PWUD in their core network, given that they first knew a PWUD. Adopting a network perspective allowed us to observe respondents' propensity to form or maintain meaningful ties across groups in everyday life. Such an approach is particularly relevant given that past behavior of the respondent provides a relatively accurate prediction for the respondent's future behavior (Ouellette and Wood, 1998). By focusing on the dyadic relationships (i.e., ego-alter) nested within each respondent's personal network, we demonstrated how the nature of intergroup contact can shape the types of relationships that have been shown to help reduce stigmatizing attitudes and the behavioral barriers to recovery, such as social isolation. Two main points emerged from our analyses.

First, the nature of the relationship between respondent and PWUD (as measured by social role) was highly predictive of whether the respondent considered the PWUD as part of their core network. Partners—arguably the most intimate social role one can fulfill—were the most likely to be nominated as a core network member, followed by children, whereas the more peripheral social roles had a relatively low probability of appearing in the respondents' core networks. This is expected given that the vast majority of the general population includes their partner and children (provided they have them) in their core networks or among those with whom they share important matters and socialize (Marsden, 1987; McPherson et al., 2006; Wellman and Wortley, 1990). It is worth emphasizing, however, that in the present study these partners and children were known to have a drug problem yet a majority of them were still included in the respondents' core networks. This would align with the strength of family in intergroup contact (Corrigan and Nieweglowski, 2019), the durability of primary relationships in the face of adverse health (Perry, 2011), and the complexity of core ties—especially family—as exhibiting multiple social, financial, cultural, and emotional obligations, such that a problematic relationship is also likely to be characterized by positive interactions (Fingerman et al., 2004). These findings suggest that primary relationships can be leveraged to broker positive and meaningful contact between PWUD and other network members by creating opportunities for social interactions that disconfirm negative stereotypes

(Best et al., 2016; Daley, 2013; Panebianco et al., 2016).

Second, we found a significant moderating role of drug use characteristics on the association between relationships and the inclusion of PWUD in the core network. Although the probability of a PWUD being nominated as a core network member is consistently low among casual relationship types (e.g., neighbor, extended kin), it was equally low among the most primary relationships (i.e., partner, child) when the severity, problematic nature, and danger to self were intense. Only when the perceived burden of disease was relatively minor was there a significantly higher probability of sharing a meaningful relationship with a partner. This nuanced finding highlights the importance of primary, affinity-based relationships for empathetic views of disease characteristics (Perry et al., 2022) but also the limitations of improved attitudes in countering concerns for the safety of loved ones who use drugs. The lower likelihood of social contact at higher disease manifestations may signal perceived violations of the sick role (e.g., recovery) (Parsons, 1951). In other words, intense disease manifestations may counterbalance the benefits of affinity-based relationships such that motivation to maintain them becomes similar to casual, less intimate relationships that are more susceptible to socially distancing and marginalizing behavior towards PWUD.

Our main findings have broader implications for Allport's conditions of intergroup contact and for sustaining positive, meaningful contact beyond brief social interactions. The results related to the moderation of the effects of social role by intense disease characteristics among partners supports the importance of stereotype disconfirming opportunities. Compared to other types of relationships, higher expectations and obligations define a partnership (Cantor, 1979), but also more intimate and consequential exposure to the stigmatized condition. In cases where drug use has negative implications for the relationship or is potentially harmful to network members, stereotypes are confirmed, negating the heightened sympathy and lower stigma typically afforded to close ties (Goffman, 1963; Pescosolido and Manago, 2018). The resulting disequilibrium in role expectations can be addressed by increasing engagement in activities and obligations that leverage the PWUD's abilities while allowing the PWUD to make a positive impression. Practical examples that have been used in substance use interventions include adopting new family routines that are led by the PWUD and which strengthen their parenting abilities (Haggerty et al., 2008; Hogue et al., 2022) or engaging in recovery-oriented activities where the PWUD can excel (i.e., exercise programs) (Wang et al., 2014).

6.1. Strengths and limitations

Employing a personal network approach to studying intergroup contact enabled us to identify real-world examples of revealed behaviors towards PWUD, which has direct implications for issues of social isolation and potential pathways towards recovery. However, this approach is susceptible to recall bias, respondent burden, and social desirability bias (Brewer, 2000; Fischer, 2009; Latkin et al., 2017). Respondent burden was partially mitigated by not collecting data on the ties between PWUDs and the core network (unless the PWUD was named in response to this module), though this limits our ability to determine whether PWUDs were more likely to be named as a core network member based on their shared ties to other non-PWUD core members. We do find some evidence in our sensitivity analyses that exposure to drug use (e.g., personal non-medical drug use) differentiates knowing a PWUD from not knowing a PWUD. Furthermore, longitudinal data would be needed to properly assess the potential cyclic nature of drug use and intergroup relationships. This includes capturing severed ties or changes in frequency of drug use in response to weakening relationship and the duration of drug use. Whether the PWUD in question is engaging in active drug use or is in recovery has implications for the social and instrumental burden of the relationship (Francis, 2020; Francis et al., 2020). Next steps would include assessing approaches to address drug use amongst primary relationships, measuring the relationship between PWUD co-presence and stigmatizing views or social isolation, and testing how Allport's conditions for intergroup contact affect the establishment or maintenance of relationships surrounding drug use.

7. Conclusion

This study used a personal network approach to identify the social context under which people are likely to engage in meaningful relationships with a PWUD given the opportunity—an outcome that has been empirically linked to lower stigma and socially isolating behaviors. Through our unique approach, we advance the intergroup contact literature to show that primary kinship relationships are more likely to sustain meaningful and positive interactions with PWUD compared to other types of social roles, but they are not impervious to negative attitudes at intense disease manifestations, which can limit social contact and sympathy-building. Changing expectations about drug use, particularly within these primary relationships, represents an important step in efforts to promote positive intergroup contact.

Author contributions

Ashley F Railey: conceptualization, methodology, formal analysis, writing (original draft and revisions). Adam R Roth: conceptualization, methodology, formal analysis, writing (original draft and revisions). Anne C Krendl: data curation, writing (reviewing and editing), investigation, funding acquisition. Brea L Perry: data curation, writing (reviewing and editing), investigation, funding acquisition.

Data availability

The authors do not have permission to share data.

Acknowledgements

We acknowledge financial support from the Offices of the Vice President and Vice Provost at Indiana University through the Grand Challenges Precision Health Initiative. There are no grant numbers associated with this funding. We are thankful to the three anonymous reviewers for their helpful comments and suggestions.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2022.115612.

References

Ahern, Jennifer, Jennifer Stuber, Galea, Sandro, 2007. Stigma, discrimination and the health of illicit drug users. Drug Alcohol Depend. 88 (3), 188–196. https://doi.org/10.1016/j.drugalcdep.2006.10.014.

Ahmad, F.B., Rossen, L.M., Sutton, P., 2021. Provisional Drug Overdose Death Counts. National Center for Health Statistics.

Allport, Gordon W., 1954. The Nature of Prejudice. Addison-Wesley, Oxford, England.

Amir, Yehuda, 1969. Contact hypothesis in ethnic relations. Psychol. Bull. 71 (5), 319–342. https://doi.org/10.1037/h0027352.

Aneshensel, Carol S., Phelan, Jo C., Bierman, Alex (Eds.), 2013. Handbook of the Sociology of Mental Health. Springer Netherlands, Dordrecht.

Barry, Colleen L., McGinty, Emma E., Pescosolido, Bernice A., Goldman, Howard H., 2014. Stigma, discrimination, treatment effectiveness, and policy: public views about drug addiction and mental illness. Psychiatr. Serv. 65 (10), 1269–1272.

Best, David, Beckwith, Melinda, Haslam, Catherine, Alexander Haslam, S., Jetten, Jolanda, Mawson, Emily, Dan, I., Lubman, 2016. Overcoming alcohol and other drug addiction as a process of social identity transition: the social identity model of recovery (SIMOR). Addiction Res. Theor. 24 (2), 111–123.

Bowles, J.M., Smith, L.R., Verdugo, S.R., Wagner, K.D., Davidson, P.J., 2020. 'Generally, you get 86′ed because you're a liability': an application of integrated threat theory to frequently witnessed overdoses and social distancing responses. Soc. Sci. Med. 260, 113190 https://doi.org/10.1016/j.socscimed.2020.113190.

Brewer, Devon D., 2000. Forgetting in the recall-based elicitation of personal and social networks. Soc. Network. 22 (1), 29–43.

Burt, Ronald S., 1984. Network items and the general social survey. Soc. Network. 6 (4), 293–339.

Caetano, Raul, Patrice, A., Vaeth, C., Canino, Glorisa, 2017. Family cohesion and pride, drinking and alcohol use disorder in Puerto Rico. Am. J. Drug Alcohol Abuse 43 (1), 87–94. https://doi.org/10.1080/00952990.2016.1225073.
Cantor, Marjorie H., 1979. Neighbors and friends: an overlooked resource in the informal support system. Res. Aging 1 (4), 434–463.
Carpentier, Normand, Ducharme, Francine, 2005. Support network transformations in the first stages of the caregiver's career. Qual. Health Res. 15 (3), 289–311. https://doi.org/10.1177/1049732304270813.
Corrigan, Patrick, 2004. How stigma interferes with mental health care. Am. Psychol. 59 (7), 614–625. https://doi.org/10.1037/0003-066X.59.7.614.
Corrigan, Patrick W., Katherine, Nieweglowski, 2019. How does familiarity impact the stigma of mental illness? Clin. Psychol. Rev. 70, 40–50. https://doi.org/10.1016/j.cpr.2019.02.001.
Corrigan, Patrick, Schomerus, Georg, Shuman, Valery, Kraus, Dana, Perlick, Debbie, Harnish, Autumn, Kulesza, Magdalena, Kane-Willis, Kathleen, Qin, Sang, David Smelson, 2017. Developing a research agenda for understanding the stigma of addictions Part I: lessons from the mental health stigma literature: understanding the stigma of addictions. Am. J. Addict. 26 (1), 59–66. https://doi.org/10.1111/ajad.12458.
Crapanzano, Ka, Hammarlund, R., Ahmad, B., Hunsinger, N., Kullar, R., 2018. The association between perceived stigma and substance use disorder treatment outcomes: a review. Subst. Abuse Rehabil. 10, 1–12. https://doi.org/10.2147/SAR.S183252.
Daley, Dennis C., 2013. Family and social aspects of substance use disorders and treatment. J. Food Drug Anal. 21 (4), S73–S76.
Day, Brendan F., Rosenthal, Geoffrey L., 2019. Social isolation proxy variables and prescription opioid and benzodiazepine misuse among older adults in the us: a cross-sectional analysis of data from the national survey on drug use and health, 2015–2017. Drug Alcohol Depend. 204, 107518.
Dixon, John, Kevin, Durrheim, Tredoux, Colin, 2005. Beyond the optimal contact strategy: a reality check for the contact hypothesis. Am. Psychol. 60 (7), 697–711. https://doi.org/10.1037/0003-066X.60.7.697.
Fingerman, Karen L., Hay, Elizabeth L., Birditt, Kira S., 2004. The best of ties, the worst of ties: close, problematic, and ambivalent social relationships. J. Marriage Fam. 66 (3), 792–808.
Fischer, Claude S., 1982. To Dwell Among Friends: Personal Networks in Town and City. University of chicago Press.
Fischer, Claude S., 2009. The 2004 GSS finding of shrunken social networks: an artifact? Am. Socio. Rev. 74 (4), 657–669.
Fischer, Claude S., Shira, Offer, 2020. Who is dropped and why? Methodological and substantive accounts for network loss. Soc. Network. 61, 78–86.
Francis, Meredith W., 2020. Transitions of women's substance use recovery networks and 12-month sobriety outcomes. Soc. Network. 63, 1–10. https://doi.org/10.1016/j.socnet.2020.04.003.
Francis, Meredith W., Taylor, Leigh H., Tracy, Elizabeth M., 2020. Choose who's in your circle: how women's relationship actions during and following residential treatment help create recovery-oriented networks. J. Soc. Work. Pract. Addict. 20 (2), 122–135. https://doi.org/10.1080/1533256X.2020.1748975.
Goffman, Erving, 1963. Stigma: Notes on the Management of Spoiled Identity. Prentice Hall, Englewood Cliffs, NJ.
Haggerty, Kevin P., Skinner, Martie, Fleming, Charles B., Gainey, Randy R., Catalano, Richard F., 2008. Long-term effects of the focus on families project on substance use disorders among children of parents in methadone treatment. Addiction 103 (12), 2008–2016. https://doi.org/10.1111/j.1360-0443.2008.02360.x.
Hammarlund, R., Crapanzano, K.A., Luce, L., Mulligan, L., Ward, K.M., 2018. Review of the effects of self-stigma and perceived social stigma on the treatment-seeking decisions of individuals with drug- and alcohol-use disorders. Subst. Abuse Rehabil. 9, 115–136. https://doi.org/10.2147/SAR.S183256.
Hogue, Aaron, Schumm, Jeremiah A., MacLean, Alexandra, Bobek, Molly, 2022. Couple and family therapy for substance use disorders: evidence-based update 2010–2019. J. Marital Fam. Ther. 48 (1), 178–203. https://doi.org/10.1111/jmft.12546.
Jorm, Anthony F., Oh, Elizabeth, 2009. Desire for social distance from people with mental disorders. Aust. N. Z. J. Psychiatr. 43 (3), 183–200. https://doi.org/10.1080/00048670802653349.
Kahneman, Daniel, Knetsch, Jack L., 1992. Valuing public goods: the purchase of moral satisfaction. J. Environ. Econ. Manag. 22 (1), 57–70. https://doi.org/10.1016/0095-0696(92)90019-S.
Kennedy-Hendricks, Alene, Barry, Colleen L., Gollust, Sarah E., Ensminger, Margaret E., Chisolm, Margaret S., McGinty, Emma E., 2017. Social stigma toward persons with prescription opioid use disorder: associations with public support for punitive and public health-oriented policies. Psychiatr. Serv. 68 (5), 462–469. https://doi.org/10.1176/appi.ps.201600056.
Latkin, Carl A., Catie Edwards, Melissa A., Rothwell, Davey, Tobin, Karin E., 2017. The relationship between social desirability bias and self-reports of health, substance use, and social network factors among urban substance users in baltimore, Maryland. Addict. Behav. 73, 133–136.
Link, Bruce G., Phelan, Jo C., Bresnahan, Michaeline, Stueve, Ann, Pescosolido, Bernice A., 1999. Public conceptions of mental illness: labels, causes, dangerousness, and social distance. Am. J. Publ. Health 89 (9), 1328–1333.
Link, Bruce G., Cullen, Francis T., Frank, James, Wozniak, John F., 1987. The social rejection of former mental patients: understanding why labels matter. Am. J. Sociol. 92 (6), 1461–1500.
List, John A., Gallet, Craig A., 2001. What experimental protocol influence disparities between actual and hypothetical stated values? Environ. Resour. Econ. 20, 241–254.
Manago, Bianca, Krendl, Anne C., 2022. Cultivating contact: how social norms can reduce mental illness stigma in college populations. Stigma and Health. https://doi.org/10.1037/sah0000363.
Marin, Alexandra, 2004. Are respondents more likely to list alters with certain characteristics?: implications for name generator data. Soc. Network. 26 (4), 289–307.
Marmaros, David, Sacerdote, Bruce, 2006. How do friendships form? Q. J. Econ. 121 (1), 79–119.
Marsden, Peter V., 1987. Core discussion networks of Americans. Am. Socio. Rev. 122–131.
McGinty, Emma E., Kennedy-Hendricks, Alene, Niederdeppe, Jeff, Gollust, Sarah, Barry, Colleen L., 2016. Criminal activity or treatable health condition? News media framing of opioid analgesic abuse in the United States, 1998-2012. Pscyhiatric Services 67 (4), 405–411. https://doi.org/10.1176/appi.ps.201500065.
McPherson, Miller, Smith-Lovin, Lynn, Matthew, E., Brashears, 2006. Social isolation in America: changes in core discussion networks over two decades. Am. Socio. Rev. 71 (3), 353–375.
Mittal, Dinesh, Corrigan, Patrick, Sherman, Michelle D., Chekuri, Lakshminarayana, Han, Xiaotong, Reaves, Christina, Mukherjee, Snigdha, Morris, Scott, Sullivan, Greer, 2014. Healthcare providers' attitudes toward persons with schizophrenia. Psychiatr. Rehabil. J. 37 (4), 297–303. https://doi.org/10.1037/prj0000095.
Moody, James, 2001. Race, school integration, and friendship segregation in America. Am. J. Sociol. 107 (3), 679–716.
Murphy, James J., Geoffrey Allen, P., Stevens, Thomas H., Weatherhead, Darryl, 2005. A meta-analysis of hypothetical bias in stated preference valuation. Environ. Resour. Econ. 30, 313–325.
Offer, Shira, 2020. They drive me crazy: difficult social ties and subjective well-being. J. Health Soc. Behav., 0022146520952767
Offer, Shira, Fischer, Claude S., 2018. Difficult people: who is perceived to Be demanding in personal networks and why are they there? Am. Socio. Rev., 0003122417737951
Ouellette, Judith A., Wood, Wendy, 1998. Habit and intention in everyday life: the multiple processes by which past behavior predicts future behavior. Psychol. Bull. 124 (1), 54–74. https://doi.org/10.1037/0033-2909.124.1.54.
Panebianco, Daria, Owen, Gallupe, Carrington, Peter J., Colozzi, Ivo, 2016. Personal support networks, social capital, and risk of relapse among individuals treated for substance use issues. Int. J. Drug Pol. 27, 146–153. https://doi.org/10.1016/j.drugpo.2015.09.009.
Parsons, Talcott, 1951. The Social System. Routledge, London, UK.
Perry, Brea, 2011. The labeling paradox: stigma, the sick role, and social networks in mental illness. J. Health Soc. Behav. 52 (4), 460–477. https://doi.org/10.1177/0022146511408913.
Perry, Brea L., Pescosolido, Bernice A., 2010. Functional specificity in discussion networks: the influence of general and problem-specific networks on health outcomes. Soc. Network. 32 (4), 345–357. https://doi.org/10.1016/j.socnet.2010.06.005.
Perry, Brea L., Roth, Adam R., 2021. On the boundary specification problem in network analysis: an update and extension to personal social networks. In: Small, M.L., Perry, B.L., Pescosolido, B., Smith, E. (Eds.), 509–24 in *Personal Networks: Classic Readings And New Directions In Egocentric Analysis*. Cambridge University Press, New York, NY.
Perry, Brea L., Pescosolido, Bernice A., Borgatti, Stephen P., 2018. Egocentric Network Analysis: Foundations, Methods, and Models. Cambridge University Press.
Perry, Brea L., Pescosolido, Bernice A., Krendl, Anne C., 2020. The unique nature of public stigma toward non-medical prescription opioid use and dependence: a national study. Addiction 115 (12), 2317–2326. https://doi.org/10.1111/add.15069.
Perry, Brea L., Felix, Elizabeth, Bolton, Megan, Pullen, Erin L., Pescosolido, Bernice A., 2022. Public stigma and personal networks: confronting the limitations of unidimensional measures of social contact. J. Health Soc. Behav., 00221465211072311 https://doi.org/10.1177/00221465211072311.
Pescosolido, Bernice A., Manago, Bianca, 2018. Getting underneath the power of 'contact': revisiting the fundamental lever of stigma as a social network phenomenon. The Oxford Handbook of Stigma, Discrimination, and Health 397–411.
Pescosolido, Bernice A., Martin, Jack K., 2015. The stigma complex. Annu. Rev. Sociol. 41 (1), 87–116. https://doi.org/10.1146/annurev-soc-071312-145702.
Pescosolido, B.A., Monahan, J., Link, B.G., Stueve, A., Kikuzawa, S., 1999. The public's view of the competence, dangerousness, and need for legal coercion of persons with mental health problems. Am. J. Publ. Health 89 (9), 1339–1345. https://doi.org/10.2105/AJPH.89.9.1339.
Pettigrew, Thomas F., Tropp, Linda R., 2006a. A meta-analytic test of intergroup contact theory. J. Pers. Soc. Psychol. 90 (5), 751–783. https://doi.org/10.1037/0022-3514.90.5.751.
Pettigrew, Thomas F., Tropp, Linda R., 2006b. A meta-analytic test of intergroup contact theory. J. Pers. Soc. Psychol. 90 (5), 751.
Pettigrew, Thomas F., Tropp, Linda R., Wagner, Ulrich, Christ, Oliver, 2011a. Recent advances in intergroup contact theory. Int. J. Intercult. Relat. 35 (3), 271–280.
Pettigrew, Thomas F., Tropp, Linda R., Wagner, Ulrich, Christ, Oliver, 2011b. Recent advances in intergroup contact theory. Int. J. Intercult. Relat. 35 (3), 271–280. https://doi.org/10.1016/j.ijintrel.2011.03.001.
Pullen, Erin, Ekl, Emily A., Felix, Elizabeth, Turner, Christopher, Perry, Brea L., Pescosolido, Bernice A., 2022. Labeling, causal attributions, and social network ties to people with mental illness. Soc. Sci. Med. 293, 114646 https://doi.org/10.1016/j.socscimed.2021.114646.

Silverstein, Merril, Gans, Daphna, Frances, M., Yang, 2006. Intergenerational support to aging parents: the role of norms and needs. J. Fam. Issues 27 (8), 1068–1084.
Small, Mario L., 2013. Weak ties and the core discussion network: why people regularly discuss important matters with unimportant alters. Soc. Network. 35 (3), 470–483.
Taylor, Shelley E., Brown, Jonathon D., 1994. Positive illusions and weil-being revisited: separating fact from fiction. Psychol. Bull. 116 (1), 21–27.
Timpson, Hannah, Eckley, Lindsay, Sumnall, Harry, Pendlebury, Marissa, Hay, Gordon, 2016. 'Once you've been there, you're always recovering': exploring experiences, outcomes, and benefits of substance misuse recovery. Drugs Alcohol Today 16 (1), 29–38.
PhenX Toolkit, 1991. Retrieved. https://www.phenxtoolkit.org/protocols/view/211101.
Wagner, Karla D., Davidson, Peter J., Iverson, Ellen, Washburn, Rachel, Burke, Emily, Kral, Alex H., McNeeley, Miles, Bloom, Jennifer Jackson, Lankenau, Stephen E., 2014. 'I felt like a superhero': the experience of responding to drug overdose among individuals trained in overdose prevention. Int. J. Drug Pol. 25 (1), 157–165. https://doi.org/10.1016/j.drugpo.2013.07.003.
Wang, Dongshi, Wang, Yanqiu, Wang, Yingying, Li, Rena, Zhou, Chenglin, 2014. Impact of physical exercise on substance use disorders: a meta-analysis. PLoS One 9 (10), e110728. https://doi.org/10.1371/journal.pone.0110728.
Wellman, Beverly, 2000. Partners in illness: who helps when you are sick? Complementary and Alternative Medicine: Challenge and Change 1, 143À162.
Wellman, Barry, Wortley, Scot, 1990. Different strokes from different folks: community ties and social support. Am. J. Sociol. 96 (3), 558–588.
Whitehead, John C., 2005. Environmental risk and averting behavior: predictive validity of jointly estimated revealed and stated behavior data. Environ. Resour. Econ. 32 (3), 301–316. https://doi.org/10.1007/s10640-005-4679-5.
Young, Michael, Jennifer Stuber, Ahern, Jennifer, Galea, Sandro, 2005. Interpersonal discrimination and the health of illicit drug users. Am. J. Drug Alcohol Abuse 31 (3), 371–391. https://doi.org/10.1081/ada-200056772.
Zoorob, Michael J., Salemi, Jason L., 2017. Bowling alone, dying together: the role of social capital in mitigating the drug overdose epidemic in the United States. Drug Alcohol Depend. 173, 1–9. https://doi.org/10.1016/j.drugalcdep.2016.12.011.