TOWARD A CRIMINOLOGY OF INMATE NETWORKS

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Abstract

The mid-twentieth century witnessed a surge of American prison ethnographies focused on inmate society and the social structures that guide inmate life. Ironically, this literature virtually froze in the 1980s just as the country entered a period of unprecedented prison expansion, and has only recently begun to thaw. In this manuscript, we develop a rationale for returning inmate society to the forefront of criminological inquiry, and suggest that network science provides an ideal framework for achieving this end. In so doing, we show that a network perspective extends prison ethnographies by allowing quantitative assessment of prison culture and illuminating basic characteristics of prison social structure that are essential for improving inmate safety, health, and community reentry outcomes. We conclude by demonstrating the feasibility and promise of inmate

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network research with findings from a recent small-scale study of a maximum-security prison work unit.

Keywords

Incarceration; Social Networks; Inmates; Structure; Prison

> "..any effort to reform the prison – and thus to reform the criminal—which ignores this social system of the prison is as futile as the labors of Sisyphus."
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> Gresham Sykes, *Society of Captives*

In the mid-twentieth century, Gresham Sykes (1958/2007) conducted a seminal ethnography of New Jersey State Prison that heralded a "golden age" of criminological research focused on inmate social organization (Simon, 2000). During this era, functionalist scholars followed in Sykes' footsteps and argued that the *deprivations* (e.g., loss of liberty, heterosexual contact, security, autonomy, and material goods and services) of prison and other "total" institutions foster informal norms and social organizations to fill these voids (Goffman, 1961; Wheeler, 1961). In contrast, other prison researchers suggested that the biographies inmates *import* into prison are more important than institutional deprivations for prison culture and structure (Carroll, 1977; Clemmer 1940/1958; Irwin, 1970; Irwin & Cressey, 1962; Jacobs, 1974, 1978). For over two decades, these competing theoretical traditions placed inmate social organization at the core of criminological research and correctional reform. By the 1980's, however, prison ethnographies in the United States virtually disappeared just as the country entered a period of unprecedented prison expansion (Kruttschnitt & Gartner, 2005; Wacquant, 2002). Today, with the American imprisonment rate five times what it was in the 1970s, research of inmate society has only just begun to reemerge (Skarbek, 2014; Trammell, 2012) and remains dwarfed by sociological studies of the collateral consequences of incarceration (Clear, 2007; Wakefield & Wildeman, 2013; Wakefield & Uggen, 2010; Western, 2006). The latter provide compelling evidence of incarceration's social consequences, but tell us little about how prison social systems and the conditions of confinement differentially impact inmate behavior and post-release outcomes.

In this manuscript, we argue for returning inmate social systems to the forefront of criminological inquiry, and suggest that the burgeoning area of network science provides an ideal framework for achieving this end. Not only will a network perspective allow researchers to quantitatively test classic theories of prison processes—such as the competing hypotheses derived from deprivation and importation models—but it will illuminate the basic characteristics of prison informal structure that are essential for improving inmate safety, health, and successful community reentry. We therefore outline the theory, concepts, and measures of network science as applied to inmate social organization. We conclude with results from a pilot study that illustrate the feasibility and promise of such an approach.

Inmate Society through a Network Lens

Social network research has gained tremendous traction in the social sciences over the past two decades (Knoke & Yang, 2008). The allure of a network approach lies in its recognition

that the causes of phenomena are often not located in independent, individual units, but instead are found in the interdependent web of relationships connecting individuals (Wellman & Berkowitz, 1988). As such, network analysts incorporate measures of the social relations (e.g., friendship, communication, or resource exchange) that connect all individuals within a setting.[2] This allows researchers to widen the sociological lens beyond individual characteristics to encompass 1) how individuals assume positions within particular structural configurations (i.e., social embeddedness), 2) how individuals access, share, and utilize resources residing in network ties (i.e., social capital), 3) who individuals select as their ties and how these connections subsequently influence future behaviors (i.e., selection vs. influence), and 4) how structural properties constrain or facilitate the flow of information, resources, and behaviors across social networks (i.e., diffusion).

Within criminology, the network perspective has been particularly useful in operationalizing and testing social learning propositions (Carrington, 2011; McGloin & Kirk, 2010; Papachristos, 2014). Specifically, school-based friendship and behavioral data have allowed criminological researchers to isolate peer influence processes from peer-reported behaviors and the properties of social networks while simultaneously accounting for social selection processes (see Young & Rees, 2013, for a review).

The advantages of a "networked criminology" extend beyond tests of learning hypotheses. For example, network concepts are central to many macro-level criminological theories (Krohn, 1986) – such as theories of social disorganization, collective efficacy, subcultures, and routine activities (Carrington, 2011). Network data and methods thus allow community researchers to test these theories' core hypotheses (Tita & Boessen, 2011). Law enforcement and criminologists have also taken advantage of network data to map gang affiliations and locate crime "hot spots" (McGloin, 2005; Radil, Flint, & Tita, 2010). These and other contributions are elevating the network perspective to a central position within the field.

Important for our purposes, a network approach also gains leverage on three key research questions related to prison social order: (1) What is the informal social structure within prison? (2) What are the processes through which informal social structure is created and sustained? and (3) What are the consequences of informal social structure and inmate structural positions for prison and post-release outcomes? Though all fall under the rubric of social network research, each question invokes its own theoretical, data, methodological, and policy implications.

Inmate Social Structure

Classic prison ethnographies largely focused on the precursors of inmate social status and culture (i.e., the antecedents of inmate structure), but one may first ask, "What *is* the informal structure of inmate prison ties?" Answers to this question are necessarily descriptive, yet no less important as they help to define prison subgroups and inmate

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[2]This approach is distinct from sampling inmates and/or assessing relationships along dimensions such as social support or loneliness (e.g., Lindquist, 2000; van Harreveld et al., 2007). The latter do not provide information on who is connected to whom within the prison. We elaborate on this distinction below (see Smith & Christakis, 2008).

structural positions, which in turn influence a variety of social processes, including resource distribution, conflict, and communication.

Variability in a prison's informal network structure is perhaps easiest understood through hypothetical examples. Figure 1 presents three "ideal-type" prison networks, each with a distinct structure. Assume for now that the ties represent mutual "trust" or "friendship".[3] Each network contains the same number of inmates (20 circles), but differs in its tie distribution, resulting in dramatically different global structures. Network A is a core/periphery network discernible by a interconnected central group surrounded by a set of more loosely tied inmates on the structure's periphery. In this network, the centrally-positioned core group has greater network status, with the inmate at the center of the group seemingly occupying a leadership role. From a prison management perspective, guaranteeing prison stability with a core/periphery structure necessitates co-opting or controlling the core group, as its behavior should influence the behavior of peripheral members. The core is the key to system-wide outcomes.

Network B displays a fragmented structure with fewer ties and little clustering (i.e., internally connected subsets). Relative to Network A (and Network C), the arrangement of ties is much less organized. In many ways, this network is consistent with the goals of neo-classical prison management, in that the lack of well-connected inmate clusters (i.e., cohesive subgroups) allows for less resistance to formal control (Irwin, 2005). If an inmate in this network becomes violent or disruptive, he or she could be segregated with little impact to the global structure. However, the lack of cohesion in this network would also be associated with low capacity for social support. Loneliness and monotony could contribute to significant problems in such a structure.

Network C presents a structure with three similarly-sized cohesive subgroups (e.g., gangs) and few ties connecting the groups to one another. From a prison management perspective, this network is most difficult to control as the groups may have competing interests and conflict with one another (Papachristos, 2009; 2013). Note also that the leadership structures might vary between groups; for instance, one group may have centralized leadership (right and upper) whereas another is more egalitarian (left). This further complicates group negotiations and control efforts. The presence of a network bridge (the node lying between the bottom groups) could help to broker between-group agreements, but the structural instability of bridge nodes make them infrequent and tenuous (Granovetter, 1973). Given the potential challenges to prison administration posed by this global structure, it is easy to understand why prison administrators would want to disrupt group cohesion through inmate segregation or transfer, or at least foster a stable group hierarchy so as to limit violent between-group interaction.

To our knowledge, no recent research explicitly takes a network approach to understanding inmate social systems.[4,5] However, a modest body of work does attempt to understand inmates' subjective (i.e., self-reported) peer interactions or social support and thus provides

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[3]Depending on the nature of ties and the social context, the depicted structures may be interpreted differently (Borgatti, 2005). We offer a more detailed discussion of tie meaning and measurement later in the text.

clues to inmate social structure. For example, several studies document the prevalence and consequences of inmate social isolation. Through interviews or survey items of peer interactions, studies in this vein find semi- or complete social isolation a fairly common inmate adaptation and one often associated with deteriorated mental health (Goldweber, Caufmann, & Cillessen, forthcoming; Irwin, 2005; Kruttschnitt & Gartner, 2005; van Harreveld, van Der Pligt, Claasan, & van Dijk, 2007; but see Lindquist, 2000). These studies also find substantial variability in the peer involvement of non-isolated inmates, with some becoming highly invested in larger inmate collectives (e.g., "the mix"; Irwin, 2005) and others preferring to establish friendships with only small numbers of peers. This variability in social embeddedness suggests that multiple structures and roles are likely to be uncovered in an inmate network analysis.

Several recent qualitative studies highlight the importance of gangs for prison social order. Trammell's (2012) interviews of Californian ex-inmates found that gangs and their leaders (i.e., "shot callers") are essential to prison social order because they (1) establish in-group/out-group identities, (2) enforce sanctions when norms are transgressed, and (3) recruit and socialize new inmates to prison culture. Skarbek (2014) builds on Trammell's insights to argue that prison gangs are extralegal governance organizations that grew in importance when prison populations rapidly expanded in the 1980's and 1990's. Prison gangs, he asserts, provide essential stabilizing and structural support for growing illegal markets and inmate protection that are now exported outside prison walls. Both Trammell and Skarbeck provide important accounts of prisons that re-focus our attention on inmate informal order and its implications for prison rehabilitation, safety, and re-entry processes (see also Griffin, Pyrooz, & Decker, 2012).

A network approach complements and extends the above research in several key ways. First, it builds on self-report studies of peer integration by measuring the indirect ties between inmates and their peers, not just an inmate's subjective understanding of direct peer relationships (Smith & Christakis, 2008). In so doing, a network study allows researchers to understand the informal prison system as a whole, thus opening an avenue for examining the interplay between individual behavior and social structure. Without multiple and interconnected accounts, self-report (i.e., ego-centric) studies of inmate peer interactions are unable to address questions of group solidarity, social organization, and normative influence lying at the heart of early prison ethnographies. Second, a network approach extends qualitative research by increasing the numbers of measured subjective viewpoints to generate an abstract view of social interactions and social structure that is difficult to assess through interviews and observations alone (Fleisher, 2005). Aggregating individuals' perceived and interconnected social interactions thus allows network researchers to quantify important cultural concepts – such as status, values, and norms – without privileging specific individuals' perspectives. Compared to qualitative research, network studies are therefore better suited to test competing hypotheses (often derived from thick qualitative descriptions),

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[4]Interestingly, two of sociology's earliest network studies were conducted in correctional settings (MacRae, 1960; Moreno, 1932), but neither of these was aimed at understanding prison social organization or culture.
[5]See Clarke-McClean (1996) and Killworth and Bernard (1974) for examples of social network analysis in juvenile detention facilities.

statistically compare results across settings, and generalize findings to other related social contexts. Finally, a focus on the individual and network levels allows researchers to simultaneously examine the micro-level antecedents of structure (e.g., agentic social selection) and the macro-level consequences of structure for individual behavior (e.g., structural influence: Erickson, 2013).[6] The network approach explicitly recognizes that social relations are (1) culturally constituted through individuals' subjective meanings and (2) influential for individuals' future attitudes and behaviors (Pachucki & Breiger, 2010). Examining these dual processes is beyond the reach of qualitative research alone and helps bridge cultural and network perspectives.

Antecedents of Inmate Social Structure

Research on the antecedent *causes* of social structure treats the network as the dependent variable. Here, the goal is to understand the processes that lead to the observed network structure versus other structures that could exist. Variants of this question include, "Why do some ties exist whereas others do not?" or "Why are observed ties arranged in a particular way?" Answering questions like these can help to understand why inmates differ in their access to more powerful, central, or resource-rich positions.

Three classes of mechanisms may help explain prison network structure (Rivera, Soderstrom, & Uzzi, 2010). *Assortative* mechanisms emphasize how individual attributes draw people together. Occasionally, attribute differences foster social ties, such as complementary skills needed to perform a task. Most often, however, attribute similarity increases the likelihood of tie formation, leading to the homophily found in many types of social networks (McPherson, Smith-Lovin, & Cook, 2001). In prison contexts, similarity on immutable factors like race/ethnicity, age, criminal background, and sentence length are all likely to increase the probability of a tie between inmates.[7] This is because similarity reinforces people's identity, eases communication, and is a useful heuristic by which individuals judge others' trustworthiness. Furthermore, ties may form based on mutable factors (referred to as value homophily), but these factors may also change as a consequence of particular ties (Lazarsfeld & Merton, 1954). Inmates seeking protection may be especially prone to attitudinal change so as to gain or retain social ties. For instance, a new white inmate may increase racist opinions in order to fit in and obtain security from other white inmates (Trammell, 2012; Skarbek, 2014).

Attributes can also affect tie formation through their effects on individual popularity (propensity to receive ties) and sociality (propensity to send ties: Goodreau, Kitts, & Morris, 2009). For instance, the deprivation and importation models have competing expectations for the attributes most correlated with inmates' popularity and centrality in prison networks. The deprivation model posits that prison knowledge, physical prowess, and black market

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[6]As Erickson (2013) points out, emphases on agency and structural influence stem from opposing theoretical traditions (i.e., relationalism and formalism). We avoid resolving this conflict and agree with her that a pluralistic theoretical approach is perhaps best when considering social network applications.

[7]Our focus here is homophily that exceeds what would be expected by chance (e.g., baseline homophily; McPherson et al., 2001). In settings where minority groups are very small, high rates of within-group ties among the majority group are not unusual. Only if the observed proportion of same vs. cross-group ties exceeds chance levels can we infer that other selection processes (e.g., preference) are responsible for homophily.

entrepreneurship should increase inmate popularity and result in central network positions, whereas the importation model maintains that such positions are associated most with inmates' "street" acuity, criminal reputation, gang membership, and pre-existing demographic characteristics (e.g., race, family, and hometown). Formally testing these competing hypotheses would be a primary contribution of a prison-based network approach.

In addition to ties forming as a consequence of assortative mechanisms, ties often form via *relational* mechanisms, whereby the pattern of ties at one point in time encourages some ties over others at later time points. For instance, ties often form when individuals have a mutual acquaintance through a process of *triadic closure* (e.g., transitivity). The existence of a common friend may serve as an introduction, or provide the initial trust needed to initiate a friendship. Such mechanisms may be especially important in situations where trusting others is risky, such as prison, or when individuals come from different backgrounds (e.g. race/ethnicity) (Coleman, 1990; Gambetta, 2009). Conversely, should mistrust exist in a dyad, for instance between i and k, then i may avoid both k and those connected to k (Cartwright & Harary, 1956).

Lastly, *proximity* mechanisms explain the emergence of network ties via physical or spatial propinquity. Given that contact promotes tie formation, individuals who come into contact more often are more likely to develop a relationship. Several types of foci within the prison context can bring inmates into extended contact, including location of cells, work assignments, religious services, treatment groups, exercise facilities, etc. Some of these foci may also signal shared interests or background, further enhancing the chance of a tie (Feld, 1982). For instance, inmates with stronger educational backgrounds may be selected for employment opportunities that require reading and writing skills, which then brings them into contact with similarly-educated peers.

Several contextual factors are also likely to interact with network mechanisms to shape the structure of inmate ties. One issue is prison overcrowding, which brings inmates into closer proximity and may increase safety concerns, particularly among young and new inmates with fewer established relationships (Franklin, Franklin, & Pratt, 2006). The result may be that overcrowded prisons increase the importance of group identities, triadic closure, and the establishment of cohesive substructures (Skarbek, 2014). At the opposite extreme, "Supermax" prisons or solitary confinement units severely constrain inmate interactions to the point where social networks may be nonexistent or extend no farther than isolated dyads (Haney, 2003; Johnson, 2002). Prisons or units with extremely high turnover rates or inmate daily movement may similarly obstruct collective action (Irwin, 2005).

Gender composition is also likely to moderate inmate network ties. Women are more likely than men to be imprisoned for drug offenses and less likely to be imprisoned for violence (Carson & Golinelli 2013), resulting in women typically having shorter incarceration periods than men (Harner & Riley, 2013). Spending less time in prison may result in less stable and less densely connected networks in women's prisons compared to men's prisons. Conversely, because girls and women are socialized toward caretaking roles and maintaining interpersonal ties (Smith-Lovin & McPherson, 1993), inmate ties may have higher prevalence and be more consequential in female compared to male prisons (Glaze &

Maruschack, 2010; Harner & Riley, 2013). For example, prior research suggests that female inmates tend to place greater emphasis on consensual sexual relationships compared to male inmates (Giallombardo, 1966). Additionally, female inmates are more likely than male inmates to create pseudo-kinship networks with family-like roles of husband, wife, mother, grandmother or children (Giallombardo, 1966; Ward & Kassebaum, 1965). By statistically contrasting the properties and antecedents of inmate social networks across men's and women's prisons, a network approach is able to test the extent to which the above network processes differ by gender.

Consequences of Inmate Social Structure

Criminologists can also examine how inmate network structures and structural processes affect behavioral and health-related outcomes. The resources and social capital embedded in informal network ties are likely to affect inmate health and safety (Lin, 2001). For example, an inmate who receives many respect ties likely has power to influence the behavior of others, whereas an inmate peripheral in the "respect" network likely has little social influence and thus must react to the authority of others.

Beyond structure itself, the characteristics of inmates to whom one is tied are likely to matter for health-related behaviors and attitudes. As posited by social learning theories, direct connections to others provide important avenues for the conveyance and enforcement of group norms and behaviors (Sutherland, 1947; Akers, 2009). Thus, an inmate's own behavior is likely influenced, in part, by the beliefs and behaviors of the inmates who surround him or her (Bayer, Hjalmarsson, & Pozen, 2009). In this regard, the study and hypotheses of social influence in prison settings would differ little from criminological studies of social influence in gangs, schools, and communities. Perhaps the largest difference is that inmates are less likely than their non-inmate counterparts to have a mix of conventional and criminal ties. Given that prisons are saturated with the criminally involved, one hypothesis is that social isolation may reduce misconduct and mental health problems (Lindquist, 2000). Alternatively, since many inmates might genuinely want to change their lives in positive ways (or at least do their time in relative peace), inmates may help one another "stay straight" and develop conventional skills useful for successful community reentry, such as prison employment, educational attainment, or involvement in prison-based religious or other organized activities.

Above the individual level, the pattern of network ties can affect emergent aggregate outcomes such as violence or the spread of disease. Tightly integrated networks or gang structures may increase the magnitude of prison conflicts by allowing for quick, concerted action (Papachristos 2009; 2013). From a health perspective, network structure also affects inmates' exposure to disease and the capacity for its diffusion through the prison (Hammett, 2006; Massoglia, 2008). Indeed, the concentration of inmates in confined conditions and close proximities increases the potential for diseases to quickly spread throughout a prison, possibly becoming the incubator and epicenter of community endemics (Farmer, 2002).

Out-of-Prison Social Ties

Thus far, we have focused on ties within the prison, from inmate to inmate. Yet just as we know relatively little about the basic structure of inmate social networks, only recently have scholars begun to rigorously investigate how inmates' out-of-prison social ties shift and change over time and the associations between prison visitations and later (mis)behavior and health. Imprisonment disrupts the capacity for interaction with family, friends, and community members, but does not necessarily terminate such ties (Cobbina, Huebner, & Berg, 2012). A growing body of research demonstrates that inmate visitation is generally associated with reduced prison misconduct and post-release recidivism while increasing the likelihood of successful family reunification and post-release employment (see Cochran & Mears, 2013, for a review; but see Siennick et al., 2013, and Linquist, 2000, for opposing findings).

As with sociological studies of incarceration more broadly, prison visitation studies are able to document the consequences of out-of-prison ties for individual behaviors and adjustment, but have not considered how the effects of these ties are mediated or moderated by inmates' positions within the prison social structure. It might be that visitation matters more for inmates who are marginal in the informal peer network. It might also be that inmates highly invested in peer status are the least able to reactivate out-of-prison social ties with approaching release. The bidirectional association between out-of-prison and in-prison social ties is of valuable theoretical and policy importance and only accessible using a network approach.

Inmate Networks and Intervention Research

Network research can inform existing models of offender treatment and crime prevention. For instance, several network insights are inherent to the highly influential risk-need-responsivity (RNR) model. Making the formal connection to network theory and methods explicit may help improve such approaches. The central principles of RNR are that effective offender rehabilitation requires 1) identifying and directing rehabilitative services (especially intensive treatment) to moderate to high risk offenders and keeping low risk offenders away from higher risk offenders, 2) assessing and targeting the primary criminogenic needs of offenders based upon empirically supported dynamic risk factors, and 3) maximizing rehabilitative interventions through cognitive behavioral treatment tailored to offenders' learning styles, motivations, abilities, and strengths (Andrews, Bonta, & Wormith, 2011). As an important companion to the RNR framework, the treatment principle directs that program services should be theoretically sound and have solid empirical support from rigorous evaluation studies (MacKenzie & Zajac, 2013). There are three ways that a network approach can contribute to the RNR treatment model. First, five of RNR's central criminogenic risk/needs (i.e., antisocial associates, substance abuse, family/marital relationships, school/work circumstances, and pro-social recreational activities) are inherently *interpersonal* and embedded in networks of social relations. Further, three remaining risks/needs (i.e., antisocial attitudes, criminal history, and antisocial personality pattern) are also constructed, defined and mediated through social interactions. Yet, the networked aspect of these relations and their consequences for criminal involvement are

largely ignored. Within a prison setting, a network approach could be applied to individual risk/need assessment tools through relational and personal information collected directly from other inmates, coworkers, family, and correctional staff. Network data therefore situates the offender in his or her local social context and provides further evidence of the structural forces (peer influence, social status, opportunities, etc.) that enter his or her re-offending cost-benefit calculus.

Second, network methods can quantitatively assess the impacts of segregating low and high risk offenders. This principle is built on evidence that treatment for low risk offenders often has the counterintuitive effect of increasing recidivism because interventions bring low risk offenders into proximity with higher risk peers who reinforce criminal behavior (Bonta, Wallace-Capretta, & Rooney, 2000; Dishion, McCord, & Poulin, 1999). With network data and methods, such iatrogenic effects can be modeled by identifying low risk inmates and testing if their criminal involvement increases more than high risk offenders when both categories are embedded in criminal networks. One can also test what network selection mechanisms bring low risk and high risk offenders together, such as newly-arriving low risk offenders seeking affiliations with higher risk peers for security. Results from such a study could have important implications for inmate cell and program assignments.

Finally, a network design offers a powerful tool for assessing ongoing prison interventions, such as those based on the RNR model. For example, one can test if the segregation of high risk offenders into solitary confinement results in system-wide crime reductions, by disrupting behavioral diffusion processes. A network perspective allows researchers to test if an intervention aimed at the highest risk offenders has differential crime impacts when that individual is centrally located in the network compared to offenders who are more peripheral to the prison network. Networks can be used in planning interventions, whether to prioritize targets that are more strategically located in the prison network, or in predicting some of the consequences of interventions on prison relations.

Inmate Network Data Collection

The ability of network approaches to test innovative theoretical propositions or policy interventions stems from the unique data collected in network study designs. At its base, social network research requires data about a set of actors and some form of tie connecting them to one another. As with all data collection methods, network researchers make a variety of decisions tailored to their specific research questions. Some of these decisions may be straightforward, whereas some may be complex and challenging, particularly in prison settings.

One data decision is establishing the set of relevant actors and ties connecting them. There are three primary approaches to defining actors who constitute a network: formal membership, event participation, and social connectedness (Marsden, 2005). An approach based on formal membership is straightforward in a prison context, as institutional roles (e.g., inmates, correctional officers, visitors, etc.) are clearly defined. For certain types of questions, it might be useful to define actors based upon participation in particular prison activities, which could include a treatment program, worship services, or a work detail.

Finally, the set of relevant actors might be defined based upon their relations to prisoners. For instance, one may be interested in how prisoners acquire valued resources (e.g. cigarettes, alcohol, drugs, weapons, cellphones, etc.), in which case the network would include anyone involved in exchanges with inmates. This set would likely include other inmates, but also non-prisoners, such as staff or community members, who provide things like emotional support, commissary funds, etc.

Another data-related decision is to clearly define the relations between actors. Actors may be connected in many different ways, including close friendship or membership in the same informal group (Borgatti et al., 2009). For the present purposes, it is helpful to distinguish ties based upon roles (kin, cellmate, visitor, supplier, lender), affect (trust, friendship), reputation (perceived status), affiliation (time together), the nature of the interaction (positive, neutral, or negative) and its purpose (personal, instrumental, transactional, sexual). Which ties to measure, therefore, depends on the research question and theory guiding it. For instance, describing inmate status structures would require inmate nominations of respected peers. In addition, each type of tie likely differs in its duration. Interactional ties consist of a series of discrete events, such as trading food or receiving a service. By contrast, ties like kin and trust are states that likely persist across time. Though there is a conceptual distinction between interactional events and states, the two are often correlated—actors who regularly exchange social support (events) may come to regard one another as friends (state) (Borgatti & Lopez-Kidwell, 2011).

Just as researchers may measure various types of actors and ties, they may also measure network structures at different scales. Global networks (also called "whole" or "complete" networks) consist of a set of actors and the ties among them, and have been the primary focus in our theoretical discussion. Measuring a global network first requires specification of the network boundary, a common problem for social scientists that may result in arbitrary sampling decisions and the exclusion of potentially important information (Kossinetts, 2006; Marsden, 2005). An advantage of studying global networks in prison settings is that prison units and subunits have clear spatial and temporal boundaries that concentrate the majority of interactions within the prison walls. Moreover, prison administrators monitor connections made outside the prison setting (e.g. mail, phone-calls, visits), which could serve as additional data sources.

In contrast to global networks, local networks are smaller and defined by a focal individual and the set of actors connected to him/her. These are often called "ego-centric" networks because they are based on a single individual (ego) and the set of alters connected to ego. These networks can be extracted from global networks, but not vice versa. Thus, ego-centric data necessarily provides less information on network structure than global network data. Global data is often preferable as it allows for better controls for interdependence (i.e., selection into relationships) and can be used to examine supradyadic structures and processes, such as gangs, hierarchy, cohesion, and behavioral diffusion (Smith & Christakis, 2008). However, ego-centric network data is often the only feasible means to understand network effects when actors do not belong to well-bounded populations (Lin, 2001). Within prisons, global networks would be preferred for understanding inmate structure and status. However, questions about inmates' ties to the community (e.g., visitors, kin, etc.) may best

be answered with an ego-centric approach, or an approach that simultaneously measures ties to the community and ties to fellow inmates.

The prison setting provides several unique and interesting opportunities for network data collection, but it also has its own set of challenges. Obstacles range from gaining approval for inmate research from Institutional Review Boards unfamiliar with network methods to prison norms that restrict inmate reports of peer relationships. Below, we highlight some of these challenges and discuss potential means of surmounting them. We focus on the challenges facing global network data collection, as these networks were central to our theoretical discussion and the challenges posed by ego-centric data collection are milder and more similar to those typically encountered in other, non-network, inmate research.

The primary challenge to global network data collection is gathering complete data, which means having all members of the network report on their ties. Although simulation studies suggest that social network structural properties are generally robust to 20–30% random missingness (Kossinets, 2006; Smith & Moody, 2013), missing data may be a larger problem in prison settings because it is likely to occur non-randomly. For example, the response rate would likely suffer because a non-trivial number of inmates will have characteristics or traits (e.g., mental illness or anti-social personalities) that decrease the odds of survey compliance. In addition, prison policies (e.g., the use of segregation cells) may preclude the participation of specific inmates resulting in missing data on their outgoing ties. When a non-identifiable mechanism systematically produces missing data, then network samples may be considerably unrepresentative of the population (Handcock & Gile, 2010). Achieving a high response rate, both for the survey and for the network items in particular, is therefore a chief concern.

Inmate norms are likely to affect which social ties can be measured. For example, inmates may balk when asked to identify fellow inmates who sell or share drugs for fear of being labeled a "snitch."[8] Care should thus be taken to identify those ties that are both theoretically meaningful and acceptable for inmates to answer. Inmate nominations of peer respect, peers who they spend time with, get along with, or receive instrumental support from (e.g., "Who would you go to for help?") are all likely meaningful and important for prison social organization.

Obtaining data on sensitive questions regarding ties to other prisoners will require researchers to establish rapport and trust with respondents. At a minimum, this entails 1) a clear separation between the research staff and the prison administration, as the latter are likely to be distrusted by inmates (Fox, Zambrana, & Lane, 2011), and 2) the exclusion of questions that are too sensitive (such as informing on other inmates) or that threaten future probationary status. Finally, trust can be increased by making it clear that nominations made by inmates, although likely not anonymous, will be kept strictly confidential and later deidentified so as not to jeopardize respondent safety. Failure to earn inmate trust is particularly problematic for a global network study, as word-of-mouth travels fast in prison

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[8]Note that ego-centric network data can avoid this issue by keeping alters anonymous.

settings and response rates can quickly plummet if the study is negatively perceived by a critical mass of inmates.

Prisons are often divided into separate spatial structures (e.g., wings or units) that constrain inmate interactions. Researchers should be aware of the prison structure and use it to inform data collection design. For instance, researchers could focus initially on a smaller unit within the prison that holds inmates exhibiting good behavior or convicted of less severe crimes. Such a population may be more willing to extend the trust needed to complete the survey. This would provide researchers with useful experience and knowledge within the particular context, as well as legitimacy in inmates' eyes, all of which would facilitate data collection in subunits housing more serious offenders.

Final issues related to prison network data collection concern the number and openness of nominations in the network survey. Should the number of nominations be set at some fixed number (e.g., 5, 10, 15), or should inmates be able to nominate an unlimited number of peer ties? Should nominations be names entered freehand, or selections from a unit roster? There are no "correct" answers to these questions, but there are several data quality considerations that may sway decisions one way or another. Censoring social ties through fixed numbers of nominations may bias observed network structures (Kossinets, 2006), and given that we know little about how many ties inmates are likely to identify, unlimited nominations may be a good initial strategy. With regard to freehand or roster nominations, the former have been shown to lower data quality (Brewer, 2000) and create extra burdens for coders. Moreover, prison staff can easily generate up-to-date unit rosters that would encompass the population of possible within-unit ties and either be printed or transferred to a computer-based survey. These considerations favor roster over freehand (or write-in) peer nominations.

Inmate Network Analyses

An abundance of network analytical tools, from simple descriptive methods to cutting-edge agent-based simulations, provide ample means to test theoretical propositions for prison structure. Network data allow for an unprecedented glimpse into the global structure of inmate society, and the role of specific individuals within it.

Global Networks

As mentioned previously, global network data collection seeks to measure the personal attributes and social ties for all actors within a bounded setting (e.g., prison wing, unit, or organization). In the cross-section, the analysis of global network data allows researchers to identify cohesive subgroups (e.g., gangs). For example, community detection methods can quantify the extent to which a prison unit's global network is separated into discernible clusters. Network community detection algorithms assign inmates to groupings such that ties are concentrated within groups (i.e., communities), leaving few ties between (Moody, 2001; Porter, Onnela, & Mucha, 2009). The degree of clustering can be measured with a modularity score (Newman, 2006), which equals one when all ties are within groups and no ties are between. When the number of communities is unknown (typically the case in social networks), modularity scores can be used to select from among several possible solutions. Within inmate networks, community detection algorithms can discern the presence or

absence of cohesive subgroups that may be based on fixed (e.g., race or geographic origin) or behavioral (e.g., drug dealing) characteristics. Such groupings may be associated with intergroup conflict, in which case this information can help us understand how and why conflicts emerge in some units and not others, which may ultimately improve inmate assignment policies.

More sophisticated methods, such as exponential-family random graph models (ERGMs), can be used to identify the individual characteristics associated with observed cross-sectional network structural positions (Robins et al., 2007). Subsumed under 'model-based' frameworks that treat observed networks as realizations from stochastic processes, ERGMs explain the formation of social structure through localized substructures (Lusher, Koskinen, & Robins, 2013). While descriptive analysis of networks illustrates the extent and manner in which a social structure is organized, ERGMs extend these insights by comparing the observed network to what would occur by chance (conditioned on network size, density, and other structural features). One may therefore test competing hypotheses regarding the local mechanisms that generate global network structure, for instance whether specific inmate attributes predict ties, net of other network properties (e.g. transitivity).

Longitudinal network data allow for even more advanced statistical techniques that disentangle interrelated network-behavior processes, such as the effect of an individual on the network (e.g. selection) as well as the effect of the network on the individual (e.g. influence). For example, stochastic actor-based models (e.g., SIENA) use network panel data to differentiate selection and influence processes while simultaneously controlling for dependencies between actors inherent in network data (Snijders, van de Bunt, & Steglich, 2010). These innovative methods allow researchers to examine research questions regarding inmate social selection, social learning/peer influence, and how network structure affects behavioral diffusion. For instance, such an approach can test if inmates who create social ties with more violent inmates become more violent over time themselves, net of social selection (i.e., homophily) processes based on violence and related factors.

Ego-centric Networks

Ego-centric network data includes the set of ties and characteristics for individual actors and their immediate alters. Ego-centric data are useful when individuals (rather than structure) are the primary unit of analyses and dependence between observations is of less concern. For example, inmates have a set of prior and current out-of-prison ties that are largely independent from other prison inmates. The characteristics (e.g., size, behaviors, connectedness, etc.) of these out-of-prison networks can be incorporated as covariates in models of inmate behavior in and out of prison (Morselli & Tremblay, 2004). Additionally, one could connect inmates' structural characteristics within the prison with his or her out-of-prison ties. For example, in a hierarchical model predicting persistence of out-of-prison ties (i.e., ties nested within inmates), one could test if embeddedness in prison society (e.g., high peer status or network centrality) reduces the likelihood of maintaining ties to conventional out-of-prison alters. It could also be that the ability to manage social relations in prison (or prison-related social capital) translates to similar abilities when interacting with

conventional alters. Answers to such questions dive to the heart of issues of rehabilitation and successful community reentry.

An Empirical Demonstration

To illustrate the feasibility and potential contributions of an inmate network study, we implemented a pilot data collection in a Pennsylvania (PA) maximum-security men's prison in the summer of 2014. The goal was to administer a short survey (including basic demographic, behavioral, pre-prison social tie, and prison network information) in a prison work unit to test if 1) prison staff and administration would be comfortable with our procedures, 2) IRB would approve of an inmate network study, and 3) inmates would be comfortable enough answering peer nomination and relationship items to generate a sufficient response rate for unbiased global networks. We targeted a prison work unit due to its small size (*n*=21 inmates) and clear network boundary.[9]

In spring, 2014, we coordinated study approval and support from prison staff and PA Department of Corrections (PADOC) administrators. We also successfully negotiated the IRB process for the inmate consent and survey administration processes. In our first visit to the prison, we outlined the study's objectives to staff and inmates, clarified that our research was disconnected from the prison administration and would not affect parole decisions, and gathered written consent from 19 (90%) work unit inmates. On a subsequent visit, two interviewers with correctional-setting experience administered Computer-Assisted Personal Interviews (CAPI) to the 19 consented inmates in a single day (approximately 30 minutes per inmate). Interviewers sat next to the respondents to build trust and facilitate item comprehension. Interviews were conducted at one end of a work bay within eyesight, but not earshot, of security personnel. Of the 19 respondents, 11 (58%) were white, 6 (32%) had life sentences, and the average time already served was 13.15 years.

To ascertain inmate comfort with network data collection, we asked "How comfortable would you be answering questions about which inmates you 1) get along with, 2) dislike, 3) respect, and 4) broke prison rules with?" Inmates reported comfort with questions about peers they get along with (95% answered they would be comfortable) and respect (90% answered they would be comfortable). However, a large minority of inmates reported discomfort with questions about peers they disliked or peers they have broken prison rules with (37% reported discomfort with each of these questions). Results therefore suggest that inmate network researchers may want to avoid the latter nominations and focus on positive or reputational ties, which also benefits from being clearly tied to prison social support and status.

To capture the unit's global network structure, we asked each inmate respondent to nominate peers in the work unit that they "get along with most." Respondents could name as many work unit peers as they liked and the median number of nominations was five (ranging from 1 to 17). Contrary to a fragmented structure (Figure 1b), the relatively high number of

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[9]The unit was a Correctional Industries (CI) print shop responsible for executing government printing contracts, such as vehicle license registrations. Inmates are handpicked by unit staff and are unlikely to be representative of the general prison population, but provide a useful entry point for testing survey feasibility and construct validity.

nominations suggests that most unit inmates get along with some, if not most, of their peers. Perhaps this is not surprising for a work unit that requires cooperation to accomplish its daily tasks. Figure 2 presents a graph of the observed "get along with most" network. As can be seen in the figure, the structure is relatively dense (29% of possible ties were reported by respondents) and forms a single connected network component (i.e., group). The probability of a tie being reciprocated is .41, which is greater than would occur if ties existed at random (.31).[10]

The network data allow us to explore patterns of assortativity and status in the unit. For example, we find relationships among individuals are strongly organized by race homophily: same-race ties were more than twice as likely to occur as cross-race ties (OR=2.11). This tendency toward racial clustering is clearly visible in Figure 2, where, with the exception of several centrally positioned inmates, ties are predominantly within racial category. By contrast, prisoners are relatively unlikely to have ties to someone with the same sentence status (defined as life sentence or not). The odds of a tie between inmates with the same sentence are only .47 the odds of a tie between inmates with a different sentence. One explanation for such a pattern is localized status hierarchies where a life sentence provides inmates greater stature among their peers with shorter sentences. Indeed, we find more incoming ties among those inmates with a life sentence (polychronic correlation = 0.45), as well as those who have been incarcerated longer (Pearson's $r = .46$), suggesting that unit inmates with higher status committed more serious offenses and/or have served more time in prison.

Although the network's small size precludes more sophisticated multivariate network analyses (e.g., ERGM), our descriptive results provide evidence relevant for both deprivation and importation hypotheses. As predicted by importation perspectives, there is evidence that inmates cluster by pre-existing demographic attributes (i.e., race) and that status is associated with pre-prison behaviors (i.e., serious criminal offending resulting in a life sentence). Simultaneously, consistent with deprivation perspectives, inmates with the most prison experience (i.e., "old heads") wield the most structural status and power. These results point to a social structure where relationships are influenced by both immutable and endogenous inmate characteristics. It remains to be seen if similar patterns would occur in larger and more representative prison networks, but this simple descriptive analysis demonstrates that a network approach is both feasible and holds the potential to unlock important patterns of inmate structure and culture.

Discussion

In this paper, we outlined and implemented a network approach to prison inmate social structure. In Table 1, we summarize our key points related to hypotheses, data collection, and statistical analyses organized by type of question (inmate structure, structural antecedents, and structural consequences). As we illustrate, a network perspective provides access to a host of prison processes, including peer selection and behavioral influence,

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[10]Reciprocity is calculated as M/(M+A/2), where M is the number of reciprocated ties (20) and A is the number of unreciprocated ties (57) (Butts 2008). The number of mutual ties expected by chance was calculated as $gd^2 / 2(g-1)$, where g is number of inmates (19) and d equals mean degree of 5.2 (Wasserman & Faust, 1994).

diffusion dynamics (e.g., disease), gang structure and interactions, and individual-level social adaptations to prison entry or release. Additionally, a network approach allows quantitative testing of competing hypotheses for prison status (i.e., the deprivation and importation hypotheses) and helps to understand the association between inmates' in-prison and out-of-prison ties. Network data thus provide unprecedented opportunities for visualizing and analyzing prison informal social systems, and the information collected from prison-based network studies have the potential to inform prison policies aimed at increasing prisoner and ex-prisoner health and safety.

A prison network study is not without challenges, however. Perhaps the largest obstacle for such research is an adequate response rate required for unbiased estimates of network structure. In a pilot study, we implemented several strategies to increase inmate survey compliance, including building inmate trust and targeting units with lower security classification. The result was a 90% response rate, more than satisfactory for understanding the targeted network. It remains unclear if similarly high compliance would incur in larger units or more "high-risk" prison populations, but our results provide a measure of optimism for future investigations, to which we hope to contribute.

It should also be understood that inmate networks may not be interesting or relevant in all prison settings. For example, in "supermax" prisons or solitary confinement units, violent and unpredictable inmates are segregated into single occupancy cells for 23-hour periods, restricting peer interactions and likely limiting the impacts of inmate social networks. Additionally, a prison's physical and organizational structure will affect how and what network data should be collected. If inmates eat, sleep, and work in prison "pods" consisting of 20–30 inmates, then these structures serve as natural boundaries for network data collection and analyses. In other prisons, however, all inmates may congregate in shared social, work, and eating spaces, making the larger prison the appropriate network boundary. An advantage of a network approach is that different prison settings may be compared using common network metrics and properties.

A final challenge to prison network research is negotiating the various levels of prison bureaucracy to gain sustained access to a group of inmates necessary for a network study. Prisons are inherently closed institutions whose cultures and organizations vary substantially across location, so accessing them for research purposes requires strengthened academic-corrections collaborations. As demonstrated in our pilot experience, at least some correctional administrations are open to research with clear potential for institutional benefits. However, even a well-planned study may face challenges negotiating rigid prison routines and institutional actors who view research as disruptive. Fortitude, flexibility, and planning are essential for a study of the kind outlined in this paper.

Much of our discussion, particularly related to data and methods, may be criticized as overly structuralist or formalist to the neglect of the intersubjective cultural meanings that inmates attribute to their social relationships (i.e., relationalism: see Erikson, 2013). Indeed, we would agree that we prioritize structural forms and mathematical analyses at the expense of structural content and meaning. We would add, however, that such emphases are warranted precisely because they have been neglected by prior prison culture studies. Although

providing rich contextualized detail of inmate relations as understood by inmates themselves, classic prison ethnographies lacked quantifiable constructs to ease replication, falsification, generalizability, and adjudication of competing hypotheses. From our perspective, the lack of quantitative methods contributed to stagnation of the field, as there were limited means to test propositions raised in early seminal prison studies. Our argument here is that formal network analysis provides the next step in prison research.

Our emphasis on quantitative network analysis does not reduce the importance of cultural theories or qualitative methods in prison research. Networks only exist through contextualized narratives that continually arise in social interactions (White, 1992). We agree with authors such as Emirbayer and Goodwin (1994) that network researchers must show greater consideration for the dynamic meanings and agency inherent in social ties (see also Pachucki & Breiger, 2010). Our theoretical interest in the antecedents and consequences of structure, alongside methodological advances entailed in dynamic actor-based network analyses (e.g., SIENA), get us closer to the interplay of agency and structure inherent in a relational perspective, but remain insufficient to understand the unfolding meanings actors attribute to such ties or how actors dynamically interpret and construct meso-level structures like gangs. Revealing these interactional and discursive processes remains the strengths of qualitative and ethnographic research. We would therefore recommend complementing a quantitative approach with qualitative research that grounds statistical findings in lived experiences and provides a deeper understanding of the mechanisms and meanings attributed to observed structural patterns (Fuhse & Mutzel, 2011).

Approached in this way, earlier prison ethnographies are important as descriptive examinations presenting concepts and hypotheses to be operationalized and tested in a formal network design (Hollstein, 2011). The results of a rigorous network analysis should then feed back to inform theory and generate additional testable hypotheses. Formal network analysis followed by qualitative methods closes the loop begun by past prison ethnographies, allowing us to move from deductive to inductive reasoning and back again, all the while deepening our understanding of the meaning and measurement of inmate social relationships.

Finally, we would argue that research on prison networks, especially quantitative research, must have knowledge to the particular prison culture in order to truly understand the network under investigation. As Pachuki and Breiger (2010) propose, network processes and mechanisms can operate differently across cultural contexts. Local culture can moderate network processes, such that a network position that is individually advantageous in one context can be disadvantageous in a different context. For example, research has shown that occupying a brokerage position between otherwise disconnected individuals or groups can be profitable (Burt, 1992; Morselli and Tremblay, 2004). However, this advantage disappears in cultural contexts that prioritize collectivism, where actors not bound to a group through multiple ties are viewed with suspicion (see Pachuki and Breiger, 2010). Prisons have their own set of cultural values that require us to rethink how network processes function. If a prison culture is one that places a high emphasis on group identity (e.g., race), inmates occupying brokerage positions between racial groups may be less trusted. Brokerage might still be profitable if inmates can establish trust, but how do inmates navigate competing

groups, shift between identities, and frame their images to achieve and sustain such positions (see McLean, 1998)? By gathering systematic data on prison networks across a range of prison contexts, one could test hypotheses about how the returns to brokerage, as well as other network positions, are moderated by local culture.

Although many questions related to the intersection of prison culture and structure remain, this manuscript presents the theory, tools, and data collection requirements necessary to establish a criminology of inmate networks, and our pilot study demonstrated the feasibility of such an approach. Information gathered from larger and longitudinal prison network studies has the potential to aid policymakers in designing and evaluating more effective correctional interventions aimed at maximizing prison safety, inmate rehabilitation, and community reintegration efforts. We have provided a map for such research, and even though the road is long, winding, and relatively unpaved, it is not impassable. We hope this manuscript encourages others to follow a path similar to the one we have put forth

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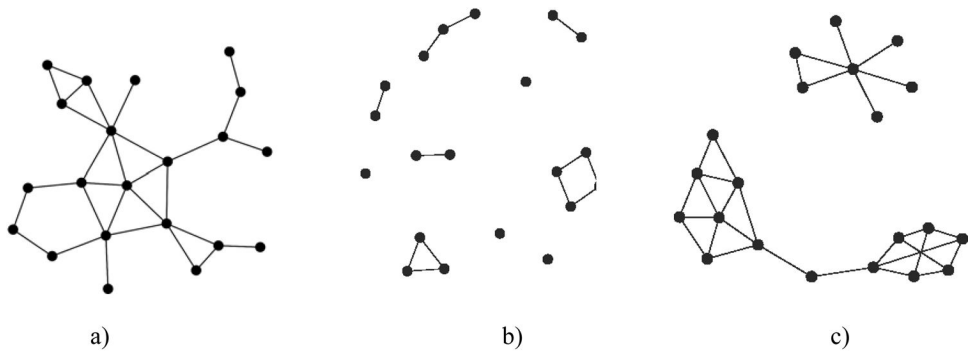
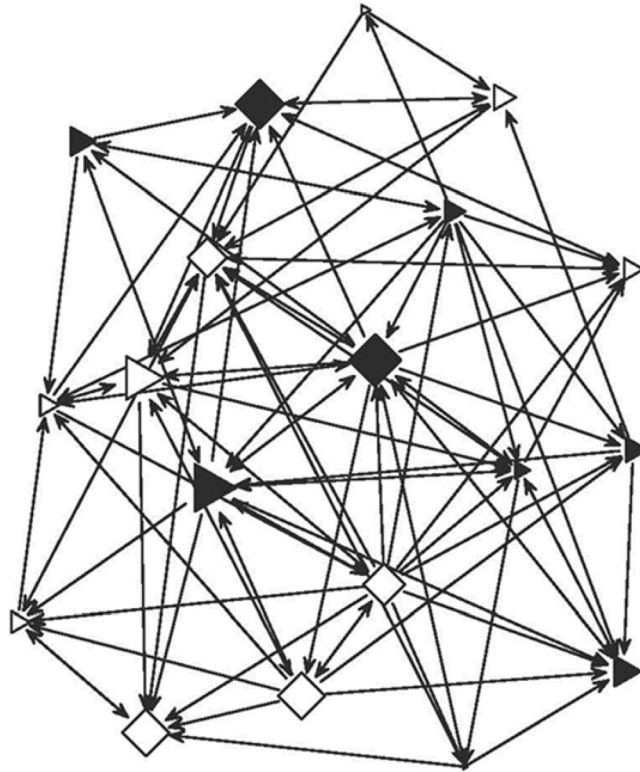**Figure 1.**
Three Hypothetical Prison Networks

Figure 2. Friendship Network in a Prison Work Unit
(Node color reflects inmate race [white=non-Hispanic white, black=other race/ethnicity].
Node size represents time served and diamond shape indicates life sentence.)

Table 1

Inmate Networks Conceptual Summary

Research Questions		Structure of inmate networks	Antecedents of inmate social structure	Consequences of inmate social structure
Hypotheses/Expectations		Descriptive/Inductive	Explanatory/Deductive	Explanatory/Deductive
	Global Level	*Sparse*: an inmate network that has low tie density and little clustering. Less resistant to formal control, but positive resources (e.g. social support) may be undeveloped or unevenly distributed.	*Deprivation Model*: global hierarchical structure based on amelioration of prison deficits. Core or central inmates possess prison experience, knowledge, physical prowess, and/or access to valued resources.	*Diffusion*: the spread of behaviors, attitudes, and disease depends on connectivity of prison network.
		Core/Periphery: an inmate network that has a densely connected group surrounded by a set of more loosely tied inmates on the structure's periphery.	*Importation Model*: subgroup structures derive from pre-existing regional, racial, ethnic divisions. Hierarchy based on street acuity and pre-existing criminal capital.	*Group Solidarity/Conflict*: the prevalence of riots and other collective activities depends on clustering within prison network.
		Cohesive Subgroups: densely connected groups with few cross-cutting connections. Between-group conflict and competition may frustrate formal control.	*Prison Policies/Structure*: prison cell assignments, demographic composition, physical layout, overcrowding, and behavioral management strategies can all affect network structure.	*Network Interventions*: Inmate segregation, integration, and treatment/inoculation efforts should alter inmate misconduct and health-related outcomes.
	Ego Level	*Network Roles*: inmates may be identified by their positions in the network structure: isolates, leaders, brokers, "hangers on", group members, etc.	*Assortativity/Selection*: inmates create ties to similar others. Stigmatizing attributes result in structural marginalization.	*Social Learning*: peer group norms influence inmate behavior.
			Relational Mechanisms: inmates' patterns of ties at one point in time affect their ties at later points in time. Examples include reciprocity and triadic closure/transitivity.	*Power/Hierarchy*: high status/central inmates likely control resource distribution and establish local norms. Low status/marginal inmates are at greater victimization risk.
			Proximity: spatial proximity and multiple shared contexts should increase the probability of inmate ties.	*Out-of-Prison Tie Continuity*: inmate prison positions alter ties to out-of-prison family and friends and affect community re-integration.

	Structure of inmate networks	Antecedents of inmate social structure	Consequences of inmate social structure
Data Considerations	*Roster Nominations:* prisons benefit from current and readily available lists of inmates necessary for network nomination rosters.	*Retrospective Behaviors and Ties:* testing importation model for global structure requires collection of inmates' pre-prison characteristics and social ties.	*Prison Behavioral Data:* official records or behavioral self-reports as outcomes of prison structure and inmate roles.
	Subprison Saturation: requires close to a "complete" network to identify global network structure. Selection of subprison structure (e.g., wing or unit) increases feasibility.	*Prison Experiences:* self-report surveys and official records can test prison-based correlates of status derived from deprivation model.	*Post-Release Surveys:* post-release surveys and records (e.g., marriage, employment, arrests, etc.) can measure outcomes of prison structure and inmate roles.
Network Analytic Designs	*Exponential-family random graph models:* provides structural parameters for cross-sectional networks.	*Ego-Network Characteristics as Outcomes:* predict prison structural characteristics (e.g., centrality) or post-prison ties from individual-level characteristics.	*Ego-Network Characteristics as Predictors:* predict inmate and reentry outcomes from prison or post-prison structural characteristics.
	Network Visualization: network analytical platforms often have visualization software for descriptive purposes.	*Stochastic Actor-Based Models:* provide estimates of tie selection in multiple global network panels.	*Stochastic Actor-Based Models:* provide estimates of behavioral influence in multiple global network panels.
	Group Clustering Algorithms: identification of groups for descriptive and inferential purposes.	*Hierarchical Models:* at the individual level, use prison network position to predict which out-of-prison ties persist over time.	