Therapeutic community graduates cluster together in social networks: Evidence for spatial selection as a cooperative mechanism in therapeutic communities

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H I G H L I G H T S

- Therapeutic community residents who graduate receive affirmations from more peers who graduate.
- This effect extends to a network path length of 2.
- Residents who receive more affirmations overall are somewhat less likely to graduate.
- We find no evidence that reciprocity in affirmations predicts graduation.
- These results confirm both theory and laboratory findings on spatial selection in cooperation.

A R T I C L E   I N F O

1. Introduction

Time in treatment and graduation are the best established predictors of long-term outcomes following therapeutic community (TC) treatment for substance abuse (Condelli & Hubbard, 1994; De Leon, Wexler, & Jainchill, 1982; Hubbard, Craddock, & Anderson, 2003; Jensen & Kane, 2012; Toumbourou, Hamilton, & Fallon, 1998). This has led to a body of research on the predictors of retention. Because TCs for substance abuse depend on mutual aid as their primary mode of treatment (De Leon, 2000), one finding of this literature is that the way in which residents relate to peers is an important predictor of retention (Carr & Ball, 2014; Mandell, Edelen, Wenzel, Dahl, & Ebener, 2008; Miles, Wenzel, & Mandell, 2008; Warren, Hiance, Doogan, De Leon, & Phillips, 2013).

Because TC residents live together and interact at meals, groups,

community meetings, work times and leisure times, they have numerous opportunities to form relationships of mutual aid with peers (De Leon, 2000; Hawkins & Wacker, 1986; Perfas, 2012; Stevens, 2013). The strict behavioral rules that characterize TCs make it safer to form these relationships (Debaere, Vanheule, & Inslegers, 2014). Qualitative studies of TCs find that residents who are committed to following the program seek out and find like-minded peers. Residents of TCs have discussed the importance of the close relationships they form with peers and reciprocity among residents (Loat, 2006; Miller, Sees, & Brown, 2006; Stevens, 2013). The sense of belonging that results from these relationships is likely critical to change in the TC (Pearce & Pickard, 2012).

From the point of view of evolutionary theory, the idea that TC residents would seek each other out and work together is unsurprising. Numerous experimental studies based on game theory models indicate

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that cooperation thrives when individuals who are predisposed to cooperate are able to find cooperative peers, a process known as spatial selection (Gallo & Yan, 2015; Rand & Nowak, 2013; Skyrms, 2004). The ability to update a network frequently is important in this process, since it allows individuals who wish to cooperate to easily find partners and to break links with partners who do not wish to cooperate (Rand, Arbesman, & Christakis, 2011). In an experimental study of reputation and cooperation, Fehl, van der Post, and Semmann (2011) find that their participants form clusters that include network paths of two links. These indirect connections are of particular interest because the experimental design only allowed for direct contact between participants; the authors describe these clusters as examples of self-organization.

A quantitative study of whether successful TC residents cluster together requires data on the connection between TC residents. TC clinical practice offers a source of such data, because residents are expected to affirm each other for prosocial acts. Usually referred to as "pushups" (De Leon, 2000), it is common for TCs to record affirmations so that they can be read at public occasions such as community meetings. Taken together, the affirmations form a directed social network; when resident A affirms resident B, there is a link from A to B, when resident B affirms resident C there is another arrow, and so on. An analysis of the social network of affirmations would extend our current understanding of the way in which relationships form in TCs in at least three ways. First, it supplements the current qualitative accounts with a systematic quantitative measure of the relationship. Second, it allows us to assess the impact of patterns in the geometry of network connectivity, such as path length between individuals or the degree of clustering across the network, of which an individual respondent might have no personal knowledge. Third, it allows the use of clustering as a predictor of outcomes.

2. Methods

2.1. Data

All data was drawn from clinical records kept at a 90 bed TC for men, located in a minimum security community based correctional facility in a large Midwestern state. The facility was a hierarchical TC in which residents received increased responsibility and increased privileges as they demonstrated appropriate behaviors in the program. The maximum stay at the TC was six months, divided into three phases: orientation, treatment and re-entry. During the re-entry phase residents could leave the TC during the daytime and potentially find employment in the community. Senior residents were expected to advise more junior residents on TC principles of recovery. Residents could graduate before six months depending on their progress through the phases, their willingness to assume responsibility and the resources available to them in the community. For instance, a resident who was employed and had a network of recovery supportive friends and relatives might graduate early. Residents were divided between four dormitories which were not assigned that were not assigned by phase.

The TC drew from a rural and suburban catchment area that consisted of eight counties. All residents were substance abusers and had committed felony offences, and had chosen to be there as an alternative to a longer prison sentence. Treatment did not vary by substance. About 36% of residents had co-occurring mental health problems, and residents were given mental health treatment and training in anger management. While TCs are for the most part secular programs (De Leon, 2000), in this one there was an expectation that residents would address spiritual issues as part of their recovery. They could choose to do so through twelve step meetings, Bible studies or meditation.

The data consists of a large network of written affirmations. The affirmations were recorded in a multistage process. First, a resident would write the affirmation on a form that included the sender of the affirmation, the receiver, the date and the content of the affirmation. A committee of senior residents and staff would then review the

affirmation for legitimacy. For instance, an affirmation had to specifically concern TC norms of prosocial behavior rather than a more general compliment. Once the affirmation had been reviewed it was read to the community either at morning meeting or at a meal. It was then entered into an electronic database for purposes of monitoring clinical progress and community functioning.

In addition to the peer affirmations, all residents were required to take the Level of Service Inventory-Revised (LSI-R) (Andrews & Bonta, 1995) at entry. The LSI-R is a 54 item scale that measures ten predictors of criminal recidivism: criminal history, education and employment, financial status, family & marital situation, current living accommodation, leisure and recreation skills, social companions, alcohol and drug abuse, emotional stability and attitudes toward crime. Studies have repeatedly found that it predicts success in treatment, including TC treatment (Hiller, Knight, & Simpson, 1999; Listwan, 2009; Warren et al., 2013). Only total LSI-R scores were available for this analysis. Demographic data on age and race was also available, as were entry and exit dates and graduation status.

2.2. Modeling strategy

Conventional modeling strategies assume that observations are conditionally independently and identically distributed (i.i.d.); conditional upon specified covariates, it is assumed that members of a therapeutic community do not interact with one another and influence each other's realized outcome values. For example, if individual A is connected to B, and B is connected to C, the i.i.d. assumption implies that (a) B's relationship with A does not affect B's relationship with C, (b) A and C have no relationship and do not affect each other in any way, and (c) no individuals are in any way affected by others to whom they are not directly connected.

Within the context of a TC, this assumption is particularly troubling. As previously noted, TCs are based on the concept of mutual aid; residents are expected to interact and help each other (De Leon, 2000; Hawkins & Wacker, 1986; Perfas, 2012; Stevens, 2013). As such, the likelihood that is maximized through most linear models will be biased to some extent, and may be sufficiently severe to cause major inferential errors (Cranmer & Desmarais, 2016; Cranmer, Leifeld, McClurg, & Rolfe, 2017). Moreover, treating residents as i.i.d. ignores the clinical dynamic of the peer-to-peer (direct) or peer-of-peer (indirect) effect of affirmations. This is to say that analysis not only ignores the direct effect of receiving an affirmation from a successful peer A on the success of B (peer-to-peer), but also ignores the indirect effect of the affirmations from successful peers C sent to A on the success of B (peer-of-peer). These "higher-order" effects are well documented within a variety of social systems, but have not been considered within the context of therapeutic communities (Christakis & Fowler, 2013).

To assess the role of a resident's network of affirmations on his or her prospects for successful graduation from the TC, we employ the Temporal Network Autocorrelation Model (TNAM) developed and implemented by Leifeld and Cranmer (2016). The TNAM is a network-based modeling framework that is capable of simultaneously incorporating exogenous covariates, endogenous network dependencies, and temporal dependencies into a variety of models, from generalized linear models (GLMs) to mixed effects models. As such, it provides the opportunity to resolve the bias inherent in treating resident outcomes as i.i.d. while simultaneously testing theoretically interesting dynamics (Leifeld & Cranmer, 2016).

To assess the effect of one's social network of affirmations on their subsequent graduation from the TC, we assess the effects of five endogenous network dependencies. First, we examine the number of successful peers who directly affirmed a resident. Are residents who are affirmed by peers who graduate themselves more likely to graduate? We expect a positive and statistically significant effect for this model term, which would reflect a process whereby the affirmations received from successful residents inform one's own success. Second, we examine