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Verbal Feedback in Therapeutic Communities: Pull-ups and Reciprocated Pull-ups as Predictors of Graduation

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Abstract

The most important proximal outcomes for residents of therapeutic communities (TCs) are retention and successful completion of the program. At this point there has been no quantitative analysis of the relationship between the exchange of corrective reminders, or pull-ups, between peers in TCs and graduation. This study draws on a database of pull-ups exchanged between 5,464 residents of three Midwestern TCs. Residents who send more pull-ups to peers and who reciprocate pull-ups with a larger percentage of peers are more likely to graduate. Residents who receive more pull-ups from peers and staff and a larger percentage of whose peers reciprocate pull-ups that they send are less likely to graduate. Implications of these findings for program theory and program improvement are discussed.

Keywords

Therapeutic Communities; Retention; Graduation; Social Network Analysis; Corrections

The most important proximal outcomes for residents of therapeutic communities (TCs) are retention and successful completion of the program. Residents who graduate have better long-term outcomes than those who do not (De Leon & Schwartz, 1984; De Leon, Wexler & Jainchill, 1982). Length of time in treatment has also been shown to predict post-graduation outcomes (Condelli & Hubbard, 1994; Hubbard, Craddock & Anderson, 2003; Mandell, Edelen, Wenzel, Dahl & Ebener, 2008) and aftercare participation (Messina, Burdon, Hagopian & Prendergast, 2006), itself an important predictor of long-term outcomes (Melnick, De Leon, Thomas, Kressel & Wexler, 2001).

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Researchers have therefore sought predictors of retention and graduation in TCs. Program participation is one of those predictors, increasingly seen as central to all substance abuse treatment (Broome, Simpson & Joe, 1999; De Leon, 2000) and a key factor in retention in treatment (Simpson, 2004; Simpson & Joe, 2004). Because TCs are based on mutual aid between residents, researchers have also tried to gauge interpersonal interactions as a measure of effective participation. Mandell, Edelin, Wenzel, Dahl & Ebener (2008) showed, using the Dimensions of Change Instrument (DCI), that more positive response to TC social processes at one week predicted retention among adult TC members at one month, while improvement in residents' social responses in the first 30 days of treatment predicted retention at three, six and nine months. In an earlier study, Condelli & De Leon (1993) found that the strongest predictor of retention was whether former TC residents who interviewed study participants believed that they would stay long enough to benefit from treatment.

This line of research suggests that interpersonal interactions between residents play an important role in determining retention. This is not surprising; such interpersonal interactions form the core of the TC philosophy that the community of residents is itself the method of treatment (De Leon, 2000). TCs have gone so far as to formalize a number of specific ways in which residents are expected to interact with peers. Residents are expected to affirm each other for acting in accord with TC norms, correct each other when acting contrary to TC norms, participate in encounters with peers, work at the TC, attend groups and act as role models for peers, among other behaviors (De Leon, 2000; Harvey, 2005).

Perhaps the most unique aspect of this list is the expectation that residents will monitor peer behavior and hold peers accountable for actions that deviate from TC norms (De Leon, 2000). The corrective feedback between residents that results from this process comes in the form of messages which residents give to peers. These messages are referred to as "pull-ups" (De Leon, 2000, pg. 169). Pull-ups address specific behaviors, which are seen as lapses of awareness of proper conduct within the TC. Even when it might be assumed that the behavior that is being pulled up represents an underlying attitudinal or motivational problem, it is expected that the pull-up itself will refer to a particular behavior. For example, De Leon (2000, pg. 219) writes, "Awareness lapses include time (e.g., punctuality, attendance), obligations (e.g., tools and personal property out of place, used cups not removed), motivation (e.g., slouching in posture, slowness of movement, delay in assuming a task), and manners or etiquette (e.g., saying please, thank you, excuse me)."

Residents can receive pull-ups from both peers and staff, and both peer and staff pull-ups are issued in identical formats. However, it is expected that residents will on the whole issue more pull-ups to each other--that is, primary responsibility for monitoring resident behavior lies with peers rather than staff (De Leon, 2000). Pull-ups can be either verbal or written. Written pull-ups are typically given for behavior that is seen as more serious, that has been repeated, or that violates minor house rules (De Leon, 2000).

TC clinical theory suggests that residents should benefit both from giving and receiving pull-ups, an idea that is based on social learning theory. A resident who receives a pull-up from a peer should learn from the experience. A resident who pulls a peer up is practicing his or her own recovery (De Leon, 2000). De Leon (2000) states, "Peers are expected to speak to (remind) members of lapses in expected behaviors or attitudes... The explicit intent of a pull-up is to raise the member's awareness of behaviors or attitudes that should change; however, pull-ups also reinforce changes in those who deliver them" (pg. 169).

Pull-ups are intended as an expression of "responsible concern" (De Leon, 2000, pg. 172) and a form of mutual aid that will teach respect for the community as a whole (Harvey,

2005). As one TC slogan has it, a resident is to be “my brother’s or sister’s keeper” (De Leon, 2000, pg. 172). A willingness to pull a peer up is seen as a necessary aspect of the development of a resident as a role model, which in turn is seen as a necessary step in the recovery process (De Leon, 2000; Hawkins & Wacker, 1986). Receiving a pull-up, in turn, may help a resident to change behavior that can be detrimental both to the individual and the community (De Leon, 2000; Harvey, 2005). Qualitative research offers some empirical support for this. In a qualitative study of a British therapeutic community for severely and persistently mentally ill individuals, Loat (2006) found that residents valued peer feedback regarding the impact of their actions on others.

Other qualitative studies suggest, however, that residents understandably do not like to receive pull-ups, regardless of any possible future benefits. TC residents speak of the necessity of feedback, the difficulty of hearing it and the challenge of trusting peers (Miller, Sees & Brown, 2006). Pull-ups may be accompanied by sanctions which residents may wish to avoid. A typical sanction is known as a learning experience, and might include writing a brief essay about the behavior that led to the pull-up, close monitoring by a peer, physical exercise or a variety of onerous cleaning tasks (De Leon, 2000; Hawkins & Wacker, 1986). Moreover, in one focus group composed of residents of a prison-based TC, participants stated that they felt that peers were in no position to correct them, since the peers were criminal offenders themselves (Patenaude, 2005). The role of pull-ups in the TC is therefore complex and potentially fraught with conflict.

Like any other form of interpersonal interaction, it is possible to treat the pull-ups exchanged between TC residents as a social network (Wasserman & Faust, 1994). A social network is simply a way of visualizing an interaction between two individuals as a tie between two nodes. The ties can take two possible forms. In an undirected network, all ties are by definition mutual. One might think of siblings (if A is B’s sibling, B is also A’s sibling) or mutual attendance at social events. The ties in an undirected network are simply shown using a line: A—B. On the other hand, some relationships are not necessarily mutual. If A loves B, it does not necessarily mean that B loves A. This is an example of a directed social network. In a directed social network, the ties between the individuals are shown as arrows. If A loves B, then the tie between them is A→B. If B loves A in return, there is a tie from B to A as well: B→A. In this case it is simpler to simply write A↔B. Mutuality of ties in a directed social network is known as reciprocity (Wasserman & Faust, 1994).

A network view is a natural framework for studying the peer interactions that form the core of clinical work in any TC. It focuses on observable behaviors rather than attitudes or perceptions. It automatically differentiates between the acts of sending and receiving pull-ups. These might relate to outcomes differently, since pulling a peer up is a choice that the individual resident makes, while receiving a pull-up is a choice that is made for him or her. It also allows the consideration of reciprocity as a predictor.

Reciprocal relationships are of interest in studying TCs since TCs are based on mutual aid, and reciprocity is a behavioral way of defining mutuality. If A has sent at least one pull-up to B (A→B) and B has also sent at least one pull-up to A (A←B) the relationship is reciprocal, A↔B. This is a potentially useful alternative to summative scales such as the DCI (Mandell et al, 2008) that measure residents’ subjective response to TC social processes.

Because reciprocity is a form of interaction it cannot be reduced to a simple comparison of the number of pull-ups sent and received. Rather, reciprocity scores measure the proportion of directed ties in the network, in this case defined by sending at least one pull-up from A to B, that point in both directions at once. Any individual in a network will have two

reciprocity scores. The first, known as in degree reciprocity, gives the proportion of peers *from whom the resident receives pull-ups without reciprocation* (Borgatti, Everett & Freeman, 2003). If a Resident A receives pull-ups from 20 peers and sends pull-ups to 5 of the same peers, he or she would have failed to deliver reciprocal pull-ups to 75% of the peers from whom pull-ups were received. The resident's in degree reciprocity would therefore be .75. The second score, known as out degree reciprocity, gives the proportion of peers *to whom the resident sends pull-ups without reciprocation*. If a resident sent pull-ups to a total of 20 peers and received pull-ups from 10 of them, 50% of the peers who received pull-ups from the resident failed to reciprocate. The resident therefore has an out degree reciprocity of .50.

It is important to understand that in degree and out degree reciprocity will not generally be the same. This is because the peers to whom a resident gives pull-ups and those from whom he or she receives them are likely to be different. If Resident A sends pull-ups to Residents B, C, D and E, while receiving pull-ups from residents D, E, F, G and H, she has had peers reciprocate two of the four pull-ups she sent (out degree reciprocity of .5, the proportion of peers who *failed* to reciprocate her pull-ups) while she has reciprocated pull-ups to two of the five residents from whom she received them (in degree reciprocity of .6, the proportion of peers to whom she *failed* to reciprocate pull-ups). This distinction means that one can use reciprocity to measure two fundamentally different aspects of mutuality in peer monitoring—the degree to which a resident has formed reciprocal relationships with peers, and the degree to which they have formed reciprocal relationships with him or her. These measures of reciprocity do not, however, give the temporal order in which the reciprocal relationships were established.

This study will analyze five social network variables as predictors of graduation. The first is the number of pull-ups that residents send to peers. TC clinical theory draws on social learning ideas to suggest that residents should learn from the pull-ups which they themselves send (De Leon, 2000). If this is true, residents who issue more pull-ups to peers should be more likely to graduate.

The second social network variable is the number of pull-ups that residents receive from peers. TC theory suggests that residents should be learning more prosocial ways of behaving as they receive pull-ups (De Leon, 2000). If this is true, those residents who receive more pull-ups should be more likely to graduate. This is not a completely obvious hypothesis, however, because research has established that residents' response to social processes is an important predictor of graduation (Mandell et al, 2008). It is possible that receiving pull-ups from peers, staff or both could lead to a negative response and therefore make graduation less likely. And, of course, residents who consistently violate TC norms should be likely to receive more pull-ups and also should be less likely to graduate.

The same reasoning applies to the third social network variable, the number of pull-ups that residents receive from staff.

The fourth social network variable is in degree reciprocity. Reciprocal feedback between residents is expected in TCs (Miller et al., 2006). Residents who more actively reciprocate the pull-ups which they receive from peers should therefore be more likely to graduate, since they are more intensely involved in the process of mutual feedback. Since in degree reciprocity is measured as the proportion of peers from whom a resident receives pull-ups to whom he or she does *not* reciprocate, this implies a negative relationship. As in degree reciprocity rises, meaning that a resident fails to reciprocate to a higher proportion of peers who have pulled him or her up, the likelihood of graduation should fall.

The same reasoning should apply to out degree reciprocity, the fifth social network variable. If peers do not reciprocate a resident's pull-ups, that resident is less involved in the system of mutual feedback and should be less likely to graduate. However, reciprocation of a pull-up is to some extent an ambiguous act, because that peer reciprocation may arise from a motive of revenge. (This is known in the experimental game theory literature as counter punishment (Nikiforakis, 2008)). It is therefore possible that as a higher proportion of peers reciprocate a resident's pull-ups the resident becomes more likely to develop a negative response to the TC social process. Since previous research indicates that a positive response to TC social processes correlates with an increased likelihood of graduation (Mandell et al, 2008), it is possible that increased out degree reciprocity, indicating that a lower proportion of peers reciprocate a resident's pull-ups, might actually predict increased graduation.

Methodology

Data

Participants—Data for this study was drawn from archival clinical records of pull-ups given and received by residents at three TCs funded by the Ohio Department of Rehabilitation and Correction. All of the TCs were community based correctional facilities, that is, minimum security correctional facilities that were not actually on the grounds of any state prison. All residents were felony offenders who had been adjudicated to the facilities for treatment as an alternative to a prison sentence. The catchment areas of two of these TCs consisted entirely of rural and suburban counties. The first of these TCs gathered data on pull-ups between 2002 and 2008. This TC included a male unit of 90 beds for this entire period and added a female unit of 16 beds in 2007. The second of these TCs gathered data on pull-ups between 2001 and 2008. This TC had one 60 bed male unit. The catchment area of the third TC included a mix of urban, rural and suburban counties. This TC had two 65 bed male units and one 85 bed female unit and gathered data on pull-ups between 2001 and 2008.

All facilities had a six-month maximum length of stay. The total number of cases at all three facilities was 5,991. However, some participants did not send pull-ups to peers, in which case out degree reciprocity was mathematically undefined due to division by zero. Others did not receive pull-ups, in which case in degree reciprocity was mathematically undefined due to division by zero. Thus, there were a total of 5,506 residents for whom out degree reciprocity was defined. For 5,563 residents in degree reciprocity was defined. For 5,464 residents both of these values were defined.

This represents a different source of missing data than the usual case of human error. Because this data was truly missing in the sense of being mathematically undefined, rather than being missing because of human error, it was decided to use list wise deletion for missing data rather than multiple imputation. This does mean, however, that results apply only to those residents who both gave and received pull-ups.

Measures—The three TCs in this study all tracked pull-ups in the same manner. Whenever a resident issued a pull-up to a peer, he or she would fill out a form that included the name of the sender, the name of the receiver, the date of the pull-up and the content of the pull-up. The form was then vetted through a committee of senior residents and staff for legitimacy. For instance, a resident would not be allowed to pull another up for a prosocial behavior such as helping a peer who was studying for the GED. Staff members were also aware of the possibility that residents might reciprocate pull-ups for purposes of revenge, and if this was thought to be the case the pull-up was disallowed. Those pull-ups that were judged to be legitimate were then read in front of the community at either meals or community meetings and subsequently entered into an electronic database. The UCINET 6.0 social network

analysis program was used to calculate all reciprocity scores (Borgatti, Everett & Freeman, 2003).

The dependent variable of interest was graduation from the program. There were a number of possible reasons for premature termination, with the most common being termination for disciplinary reasons. These reasons were not coded consistently from program to program, and even given consistent coding reasons for premature termination are not always clear. For instance, if a resident is administratively transferred to a different facility this may be because that facility is closer to family or it may be because of the resident's own dissatisfaction with treatment. Further, previous literature has typically treated program retention as a dichotomous dependent variable (Mandell et al, 2008). Graduation was therefore coded as one for successful graduation and zero for premature termination.

In addition to the number of pull-ups given and received, all facilities kept data on length of stay, obviously a function of graduation as well as a likely determinant of the number of pull-ups sent and received. It was therefore necessary to control for length of stay even though its relationship to graduation is tautological. All facilities recorded the age of residents at entry. All facilities recorded the gender of residents. All facilities also recorded data on race. For purposes of this analysis this data was coded as European-American or non-European-American.

Upon admission all residents completed the Level of Services Inventory-Revised (LSI-R) in a face-to-face interview with clinical staff members. The LSI-R is a standardized scale that measures risk of recidivism using questions about known risk factors including criminal history, education and vocational history, social milieu, attitudes toward crime, mental health and substance abuse history (Andrews & Bonta, 1995). Once a staff member had administered the LSI-R resident answers were summed according to the guidelines given in Andrews & Bonta, 1995.

All of the clinical data in this study was entered into electronic databases by TC staff and subsequently downloaded onto password-protected flash drives for transport to The Ohio State University, where it was uploaded onto a secure server.

Analysis—Multi-level logistic regression was used in the statistical analysis, with facility treated as level 2 and the individual treated as level 1. The number of facilities was too small to allow us to include group level predictors, but this did allow us to control for correlation within facilities. The analysis was done using forward entry in five steps. In the first, age, length of stay, ethnicity, gender and LSI-R were entered. In the second, pull-ups sent to peers, pull-ups received from peers and pull-ups received from staff were entered. In the third, in degree reciprocity was entered. In the fourth, in degree reciprocity was removed and out degree reciprocity was entered. In the fifth, both in degree and out degree reciprocity were entered. Like any forward entry procedure, this analysis allowed us to analyze confounding variables as we entered new blocks. All models were run using the multilevel logistic regression program in Stata version 12 (Stata Corp, 2011).

We chose not to explore mediating relationships among the social network variables. We made this choice because these variables are drawn from records of dynamic behaviors that play out simultaneously (and possibly in reaction to each other) over the entire course of TC treatment. It is therefore impossible to establish the temporal order in which the social network variables occurred, and there is no pre-existing theoretical framework that would suggest whether one causes another. Mediation analysis inevitably involves the specification of a causal chain (Kenny, 2009). In the absence of being able to specify either a temporal

framework or a theoretically grounded causal chain, mediation analysis is dubious and we chose not to attempt it with the five social network variables.

On the other hand, the demographic variables and LSI-R were measured upon program entry, while all of the social network variables were measured during residents' stay in the program and discharge occurred at the end of this stay. Because of this a causal chain is reasonable to assume. Therefore, any change in the relationship between the demographic variables or LSI-R and graduation after entering a social network variable into the model might reasonably be considered to be the result of a mediating relationship. We therefore held open the possibility of exploratory tests of mediation in this case, performed using the Stata 12 binary mediation program (Stata Corp, 2011). More generally, the forward entry procedure did allow for a systematic analysis of confounding relationships.

Finally, Spearman's Rho nonparametric partial correlations were used to analyze the relationships between several of the social network variables. The first partial correlation was calculated between pull-ups sent and pull-ups received from peers, controlling for length of stay. The second partial correlation was calculated between in degree reciprocity and out degree reciprocity, controlling for length of stay, number of pull-ups sent to peers and number of pull-ups received from peers. Because our data does not include information on the temporal ordering of these variables, these correlations should be regarded as exploratory. As stated above, they do not and cannot establish a framework of mediation.

Results

Descriptive Statistics

Successful graduation rates were high at all three TCs. At the first rural TC 81.2% of all residents successfully graduated, at the second rural TC 76% of all residents successfully graduated and at the TC with a mixed urban and rural catchment area 83.4% of all residents successfully graduated. This compares favorably with TC graduation rates that have been reported as between 30% and 70% (Lipton, 2010). The comparatively high graduation rates among these TCs may have been a function of their time-limited nature or the fact that the catchment area system meant that residents were typically close to family and friends.

Table 1 gives comparative statistics on all variables for graduates versus non-graduates. Age, race and gender do not differ between the groups at any statistically significant level. Mean LSI-R scores are higher for non-graduates than for graduates (32.5 for non-graduates versus 26.2 for graduates, $p < .001$). While length of stay differs greatly, this is tautological; by definition, graduates stay longer than non-graduates. Since graduates also have more time to send and receive pull-ups, the facts that they send a larger number of pull-ups (46.6 for graduates, 21.3 for non-graduates, $p < .001$) and receive a larger number from staff (5.7 for graduates, 3.8 for non-graduates, $p < .001$) and peers (43.4 for graduates, 35.7 for non-graduates, $p < .001$) also mean little without controlling for length of stay. Out degree reciprocity, the proportion of peers to whom residents gave pull-ups without reciprocation, is higher for graduates than for non-graduates, .9 versus .8 ($p < .001$). In degree reciprocity, the proportion of peers from whom residents received pull-ups without reciprocation, is lower for graduates than for non-graduates, .8 versus .9 ($p < .001$).

Reciprocity on the whole was low—for the most part, only 10–20% of residents who receive done or more pull-ups from a peer reciprocated. Non-graduates typically have higher LSI-R scores, with a mean score of 32.5 versus a mean score of 26.2 for graduates.

Multilevel Logistic Regression Analysis

Table 2 gives the results of the first multilevel logistic regression analysis, in which age, length of stay, race, gender and LSI-R were entered as predictors of graduation. Older residents were more likely to graduate at a rate of between one and three percent per year of age (OR = 1.02, 95% CI 1.01–1.03, $p = .003$). Length of stay was, by definition, a statistically significant predictor of graduation. There was a three-way interaction between LSI-R, race and gender. A five unit increase in LSI-R leads to roughly a fifty percent decrease in the odds of graduation for European-American males (OR = .48, 95% CI = .43–.54, $p < .001$). The same increase leads to a larger decrease in the odds of graduation for non-European-American males (OR = .36, 95% CI = .29–.43, $p < .001$), European-American females (OR = .31, 95% CI = .25–.40, $p < .001$) and non-European-American females (OR = .23, 95% CI = .18–.31, $p < .001$).

Table 3 gives the results of the second multilevel logistic regression analysis, with the number of affirmations sent to peers, received from peers and received from staff included. As predicted, residents who send more pull-ups are more likely to graduate (OR = 1.10, 95% CI = 1.05–1.14, $p < .001$, for a change of 10 pull-ups sent to peers). Residents who receive more pull-ups from peers or staff are less likely to graduate (OR = .82, 95% CI = .79–.84, $p < .001$ for a change of ten pull-ups received from residents; OR = .77, 95% CI = .64–.94, $p = .011$ for a change of ten pull-ups received from staff). Because the confidence interval for pull-ups received from staff is so wide, the comparative strength of the relationship of pull-ups received from peers or staff to graduation is impossible to judge.

When controlling for pull-ups sent, pull-ups received from peers and pull-ups received from staff, the relationship between age and likelihood of graduation falls well below statistical significance, while the point estimate of the odds ratio falls from about two percent per year of age to about one percent per year of age, a tiny difference for two individuals who are a year apart in age but a considerably more important one for two individuals who are a decade or more apart.

Four further analyses were conducted to more carefully specify the relationship between age, pull-ups sent and received and graduation. In the first three, we separately entered pull-ups sent to peers, pull-ups received from peers and pull-ups received from staff as predictors in order to see which of the three variables reduced the relationship between age and graduation below statistical significance. The relationship between age and graduation fell below statistical significance when pull-ups received from peers was included in the equation (OR = 1.01, 95% CI = .99–1.02, $p = .212$), but not when either pull-ups sent or pull-ups received from staff were included.

These results justified a test of mediation treating age as the independent variable, pull-ups received from peers as the mediating variable and graduation as the dependent variable. Because mediation analysis with a dichotomous outcome variable requires standardization of all the independent, mediator and outcome variables, all mediation results are expressed as B coefficients (Herr, 2010). The results of the OLS regression between age and pull-ups received from peers indicated that older residents received fewer pull-ups on average ($B = -.033$, $SE = .005$, $t = -6.49$, $p < .001$). A bootstrap test of the indirect path of age $\rightarrow$ pull-ups received $\rightarrow$ graduation conducted using 2000 replications indicated that this path was statistically significant ($B = .020$, $SE = .004$, 95% CI = .013–.027). Once this mediating path was taken into account, a bootstrap test indicated that the direct path between age and graduation fell below statistical significance ($B = .046$, $SE = .032$, 95% CI = $-.015$ –.109). The indirect path from age to pull-ups received from peers to graduation accounted for about 30% of the total relationship between age and graduation (proportion = .303). While post-hoc and therefore exploratory, this analysis suggests that the fact that older residents receive

fewer pull-ups from peers is one reason that they graduate at higher rates. This may, of course, also mean that they act as better TC citizens, breaking fewer TC rules and norms.

Table 4 adds in degree reciprocity, measured as the proportion of pull-ups that residents receive that they do not reciprocate, to the model. Thus, a higher value indicates less reciprocity. The results are consistent with the hypothesis that as residents reciprocate a smaller proportion of the pull-ups they receive, they become less likely to graduate, although the variable is not statistically significant at the .05 level (OR = .91, 95% CI = .82–1.01, $p = .082$). The statistical significance of all other variables remains unchanged when in degree reciprocity is added to the model.

Table 5 removes in degree reciprocity and adds out degree reciprocity, measured as the proportion of pull-ups that residents send which peers do not reciprocate. Out degree reciprocity is a statistically and practically significant predictor of graduation (OR = 1.17, 95% CI = 1.08–1.28, $p < .001$). As peers reciprocate a smaller percentage of the pull-ups that residents send, those residents become more likely to graduate. This was inconsistent with our hypothesis.

Table 6 includes both in degree and out degree reciprocity. Once both variables are included in the equation, out degree reciprocity becomes a stronger predictor of graduation (OR = 1.27, 95% CI = 1.15–1.41, $p < .001$) and in degree reciprocity becomes a stronger predictor which is statistically significant at the $p = .001$ level (OR = .80, 95% CI = .70–.91, $p = .001$). In this case, each variable confounds the other, and once both variables are included the relationship between each one and graduation grows stronger. Once both in degree and out degree reciprocity are included in the model, the relationship between pull-ups sent to peers and graduation drops slightly below statistical significance at the .05 level (OR = 1.05, 95% CI = 1.00–1.09, $p = .055$). This change did not occur when either in degree or out degree reciprocity was entered alone.

Finally, two Spearman's Rho partial correlations were run. The partial correlation between the number of pull-ups sent to peers and the number of pull-ups received from peers when controlling for length of stay was .427 ($p < .001$) (Cohen, 1988). The partial correlation between in degree and out degree reciprocity, when controlling for length of stay, pull-ups sent to peers and pull-ups received from peers was .483 ($p < .001$), again a moderate effect size (Cohen, 1988).

Discussion

This study addressed the question of predictors of graduation from TCs. It did so through an analysis of the relationship between graduation from three TCs and a set of demographic and risk variables (gender, age, race, LSI-R) as well as a set of social network variables (pull-ups sent, pull-ups received from staff and peers, in degree reciprocity and out degree reciprocity), while controlling for length of stay. The demographic and risk variables were measured at the time of entry into the TCs. The social network variables, on the other hand, arose through the interaction of residents with peers and with staff during their stay.

Among the demographic and risk variables, age did not predict graduation once the analysis controlled for the number of pull-ups sent and received. Mediation analysis indicated that the number of pull-ups that residents received from peers partly mediated the relationship between age and likelihood of graduation. LSI-R interacted with both race and gender such that it bore the strongest relationship with graduation for non-European-American women and the weakest for European-American men. In all cases, residents with higher LSI-R were less likely to graduate. Length of stay was by definition always a statistically significant correlate of graduation.

The social network variables—pull-ups sent and received from peers, pull-ups received from staff, in degree and out degree reciprocity--maintained statistical significance at the .10 level or lower despite the inclusion of these demographic and risk variables. In the final model, residents who sent more pull-ups were more likely to graduate ($p = .055$). Residents who received more pull-ups from staff or peers were less likely to graduate ($p = .039$ and $p < .001$, respectively). Residents with higher in degree reciprocity were less likely to graduate ($p = .001$) while those with higher out degree reciprocity were more likely to graduate ($p < .001$). When interpreting these findings it is important to remember that in degree reciprocity is defined as the proportion of peers from whom the resident received pull-ups and to whom the resident did not reciprocate. Out degree reciprocity is defined as the proportion of peers to whom the resident gave pull-ups who did not reciprocate. Thus, as residents reciprocate more of the pull-ups they receive, they become more likely to graduate. On the other hand, as peers reciprocate more of the pull-ups that residents sent, the residents become less likely to graduate.

Limitations

Any consideration of the implications of these results must take into account several weaknesses in the design. These TCs were already graduating a large percentage of their residents. While the ultimate goal of research on the predictors of graduation is to improve graduation rates, any such improvement is likely to be modest in a program already graduating 80% of all residents. Further, such high graduation rates are likely to reduce effect sizes, since there is comparatively little variability in the dependent variable to explain.

Calculation of the directed reciprocity statistics used as predictors in this analysis requires access to full networks. Thus, a cluster design involving random samples of residents drawn from a representative sample of TCs could not be used in this analysis. Since the data are drawn from only three TCs, the external validity of these findings is problematic. The analysis also does not include the timing of reciprocal pull-ups.

That having been said, the study uses a set of social network measures based on the exchange of pull-ups between residents to replicate recent work based on the Dimensions of Change Instrument (DCI) which indicates that successful TC participation, leading to retention and graduation, is a function of both individual actions and interactions with peers in the broader community (Edelen et al., 2007; Mandell et al., 2008). It is increasingly apparent that both individual participation and peer interaction are critical to retention in a TC. This general picture is consistent with TC clinical theory (De Leon, 2000).

Several of the specific relationships that the current study has found between social network variables and graduation are also consistent with that theory. In particular, resident participation as measured by the number of pull-ups sent to peers and in degree reciprocity predicts graduation in the hypothesized direction. As residents send more pull-ups to peers and reciprocate to a higher proportion of peers who send pull-ups to them, they are more likely to graduate.

On the other hand, residents who receive more pull-ups from peers and staff are less likely to graduate. This is not what one would predict if residents were learning from the pull-ups they receive. There are several possible explanations for this finding. Residents who receive more pull-ups are presumably violating TC norms more often, an effect which may simply overwhelm any learning that does occur through receiving pull-ups. However, this reasoning is hard to reconcile with the positive correlation between the pull-ups that residents send and those that they receive, since residents who send more pull-ups are thought to be acting as role models (De Leon, 2000). The use of LSI-R, a well validated measure of risk (Andrews

and Bonta, 1995) as a control variable also suggests that the relationship between pull-ups received and graduation is not simply a matter of bad actors receiving more pull-ups. It may be that as residents receive more pull-ups they become alienated from the program and therefore less likely to graduate. Similar reasoning would explain the relationship between out degree reciprocity and graduation. When a higher percentage of a resident's peers reciprocate pull-ups, the resident might have a more negative response to social processes, which is known to make retention less likely (Mandell et al, 2008). However, the behavioral data that underlies this study does not allow us to consider resident motives for reciprocity or their subjective reactions when receiving a pull-up. Further, we are unable to tell the temporal order in which reciprocal relationships are established. Therefore these explanations, while consistent with the analysis, remain speculative.

The complex set of relationships that this analysis reveals between pull-ups sent and pull-ups received from peers (positively correlated while predicting graduation in opposite directions) and in degree and out degree reciprocity (positively correlated, predicting graduation in opposite directions and confounding each other) means that considering any one of them in isolation is potentially deceptive. It is worth considering the implication of the positive correlation between pull-ups sent to peers and received from peers to illustrate this point.

Suppose that clinicians urge residents to participate more actively by giving more pull-ups to peers. This advice would be in line with the TC principle that pull-ups are a form of mutual aid, ultimately positive in intent, and a sign that a resident is acting as a role model (De Leon, 2000). The current analysis provides evidence that residents show roughly a five percent increase in the chance of graduation for every ten pull-ups they send (OR = 1.05, 95% CI = 1.00–1.09, $p = .055$). Even given that the 95% confidence interval includes an odds ratio of 1.00, it seems quite unlikely that sending more pull-ups to peers could harm one's chance of graduation.

However, residents who send more pull-ups to peers on average receive more pull-ups from peers ($Rho = .427$). Let us assume for the moment that this positive correlation arises because residents who send more pull-ups make themselves more visible to peers and therefore tend to receive more pull-ups. Since residents who receive more pull-ups from peers are less likely to graduate (OR = .84, 95% CI = .81–.87, $p < .001$), it is possible that increases in the likelihood of graduation as residents send more pull-ups to peers will tend to be offset by decreases in the likelihood of graduation as residents receive more pull-ups from peers. If this causal relationship were the case, in order to improve graduation rates by encouraging residents to send more pull-ups to peers one needs to either weaken the correlation between pull-ups sent and received or weaken the relationship between graduation and receiving pull-ups from peers. Of course, other causal relationships are possible and might lead to differing conclusions.

The same line of reasoning applies to changes in in degree reciprocity. Any improvements due to changes in in degree reciprocity might tend to be offset by changes in out degree reciprocity, since the two are positively correlated ($Rho = .483$). This would, however, depend on the causal relationship between the two variables, which cannot be established through a correlational analysis.

Conclusion

The results of this study imply that researchers and clinicians should consider the possibility of unintended consequences when they pursue interventions aimed at improving TC outcomes. TCs are complex systems in which resident and staff interactions give rise to a

community which becomes the method of treatment (De Leon, 2000; Perfas, 2004). As such, they carry an inherent element of unpredictability (Mitchell, 2009). In particular, the feedback loops that characterize complex systems often act to stymie attempts to create systemic change (Sterman, 2000).

At this point evidence from quantitative studies, including this one, indicates that resident participation and positive response to TC social processes are important predictors of the proximal outcomes of graduation and aftercare attendance (Melnick et al, 2001; Mandell et al, 2008). Evidence from qualitative studies indicates that TC residents value the lessons they learn from peers even as they struggle with trusting and accepting peer monitoring (Hawkins & Wacker, 1986; Miller et al, 2006; Patenaude, 2004). These are important steps, because they validate TC clinical theory and demonstrate challenges in implementing that theory. We believe that the next step in learning to overcome those challenges is to consider the ways in which specific social interactions reciprocally influence residents both while they are in the TC and once they have graduated. Social network analysis is an important tool for understanding such complex, reciprocal interactions (Milstein, 2008).

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References

- Andrews, DA.; Bonta, J. The Level of Service Inventory –Revised. Toronto, Canada: Multi-Health Systems; 1995.
- Bell DC. Connection in therapeutic communities. *Substance Use & Misuse*. 1994; 29:525–543.
- Borgatti; Everett; Freeman. UCINET 6.0. Lexington, Ky: Analytic Software; 2003.
- Broome KM, Simpson DD, Joe GW. Patient and program attributes related to treatment process indicators in DATOS. *Drug and Alcohol Dependence*. 1999; 57(2):127–135. [PubMed: 10617097]
- Condelli WS, De Leon G. Fixed and dynamic predictors of client retention in therapeutic communities. *Journal of Substance Abuse Treatment*. 1993; 10(1):11–16. [PubMed: 8383775]
- Condelli WS, Hubbard RL. Relationship between time spent in treatment and client outcomes from therapeutic communities. *Journal of Substance Abuse Treatment*. 1994; 11:25–33. [PubMed: 8201630]
- De Leon G, Schwartz S. Therapeutic communities: What are the retention rates? *American Journal of Drug and Alcohol Abuse*. 1984; 10(2):267–284. [PubMed: 6475892]
- De Leon G, Wexler HK, Jainchill N. The therapeutic community: Success and improvement rates 5 years after treatment. *International Journal of the Addictions*. 1982; 17(4):703–747. [PubMed: 7107092]
- De Leon, G. The therapeutic community: Theory, model and method. New York: Springer; 2000.
- Denant-Boemont L, Masclet D, Noussair CN. Punishment, counter punishment and sanction enforcement in a social dilemma experiment. *Economic Theory*. 2007; 33(1):145–167.
- Edelen MO, Tucker JS, Wenzel SL, Paddock SM, Ebener P, Dahl J, Mandell W. Treatment process in the therapeutic community: Associations with retention and outcomes among adolescent residential clients. *Journal of Substance Abuse Treatment*. 2007; 32(4):415–421. [PubMed: 17481465]
- Harvey, C., editor. Why we do what we do: Rationale and theoretical applications for therapeutic community activities in Ohio. Columbus, OH: Ohio Department of Alcohol and Drug Addiction Services; 2005.
- Hawkins, JD.; Wacker, N. Side bets and secondary adjustments in therapeutic communities. In: De Leon, G.; Ziegenfuss, JT., editors. *Therapeutic communities for addictions: Readings in theory, research and practice*. Springfield, Illinois: Charles C. Thomas; 1986. p. 141-155.

- Hubbard RL, Craddock SG, Anderson J. Overview of 5-year follow-up outcomes in the Drug Abuse Treatment Outcome Studies (DATOS). *Journal of Substance Abuse Treatment*. 2003; 25(3):125–134. [PubMed: 14670518]
- Kenny, DA. Mediation. 2009. Retrieved April 23, 2010 from website:<http://davidakenny.net/cm/mediate.htm>
- Lees J, Manning N, Rawlings B. A culture of enquiry: Research evidence and the therapeutic community. *Psychiatric Quarterly*. 2004; 75(3):279–294. [PubMed: 15335230]
- Lipton, DS. A therapeutic distinction with a difference: Comparing American concept-based therapeutic communities and British democratic therapeutic community treatment for prison inmates. In: Shuker, R.; Sullivan, E., editors. *Grend on and the emergence of forensic therapeutic communities: Developments in research and practice*. Chichester, England: John Wiley and Sons; 2010.
- Loat M. Sharing the struggle: An exploration of mutual support processes in a therapeutic community. *Therapeutic Communities: International Journal for Therapeutic and Supportive Organizations*. 2006; 27(2):211–228.
- Mandell W, Edelen MO, Wenzel SL, Dahl J, Ebener P. Do dimensions of therapeutic community treatment predict retention and outcomes? *Journal of Substance Abuse Treatment*. 2008; 35(3): 223–231. [PubMed: 18248942]
- Messina N, Burdon W, Hagopian G, Prendergast M. Predictors of Prison-Based Treatment Outcomes: A Comparison of Men and Women Participants. *The American Journal of Drug and Alcohol Abuse*. 2006; 32(1):7–28. [PubMed: 16450640]
- Miller S, Sees C, Brown J. Key aspects of psychological change in residents of prison therapeutic community. *The Howard Journal*. 2006; 45:116–128.
- Milstein, B. *Hygeia's constellation: Navigating health futures in a dynamic and democratic world*. Atlanta: Centers for Disease Control and Prevention; 2008.
- Nikiforakis N. Punishment and counter-punishment in public good games: Can we really govern ourselves? *Journal of Public Economics*. 2008; 92(1–2):91–112.
- Orlando M, Wenzel SL, Ebener P, Edwards MC, Mandell W, Becker K. The dimensions of change in therapeutic community treatment instrument. *Psychological Assessment*. 2006; 18(1):118–122. [PubMed: 16594821]
- Paddock SM, Edelen MO, Wenzel SL, Ebener P, Mandell W, Dahl J. Measuring changes in client-level treatment process in the therapeutic community (TC) with the Dimensions of Change Instrument (DCI). *The American Journal of Drug and Alcohol Abuse*. 2007; 33(4):537–546. [PubMed: 17668339]
- Pagano ME, Post SG, Johnson SM. Alcoholics Anonymous-related helping and the helper therapy principle. *Alcoholism Treatment Quarterly*. 2010; 29(1):23–34.
- Patenaude, AL. A qualitative exploration into a prison substance abuse treatment program: “I tell them what they want to hear”. In: Sims, B., editor. *Substance abuse treatment with correctional clients: Practical implications for institutional and community settings*. New York: The Haworth Press; 2005.
- Sacks S, Sacks JY, McKendrick K, Banks S, Stommel J. Modified TC for MICA offenders: Crime outcomes. *Behavioral Sciences and the Law*. 2004; 22:477–501. [PubMed: 15282836]
- Simpson DD. A conceptual framework for drug treatment process and outcomes. *Journal of Substance Abuse Treatment*. 2004; 27(2):99–121. [PubMed: 15450644]
- Simpson DD, Joe GW. A longitudinal evaluation of treatment engagement and recover stages. *Journal of Substance Abuse Treatment*. 2004; 27(2):89–97. [PubMed: 15450643]
- Skyrms, B. *The stag hunt and the evolution of social structure*. Cambridge, England: Cambridge University Press; 2004.
- Stata Corp. *Stata Statistical Software: Release 12*. College Station, TX: Stata Corp LP; 2011.
- Valente, TW. *Social networks and health: models, methods, and applications*. New York: Oxford University Press; 2010.
- Wasserman, S.; Faust, K. *Social network analysis: Methods & applications*. Cambridge, England: Cambridge University Press; 1994.

- Wexler HK, Melnick G, Lowe L, Peters J. Three-year reincarceration outcomes for Amity in-prison therapeutic community and aftercare in California. *The Prison Journal*. 1999; 79(3):321–336.
- Zemore SE, Kaskutas LA, Ammon LN. In 12-step groups, helping helps the helper. *Addictions*. 2004; 99(8):1015–1023.

Table 1

Summary Statistics for Non-graduates and Graduates

Variable	Non-graduates				Graduates				p-value
	N	Mean	SD	Median	N	Mean	SD	Median	
Age	1107	28.4	9.2	25.0	4883	28.9	8.7	26.0	0.091
Length of Stay	1108	78.3	52.3	78.0	4883	146.6	28.3	151.0	< 0.001
Out degree Reciprocity	764	80%	20%	80%	4742	90%	10%	90%	< 0.001
In degree Reciprocity	892	90%	10%	90%	4771	80%	10%	90%	< 0.001
Pull-ups Received (Staff)	1108	3.8	5.6	2.0	4883	5.7	6.4	4.0	< 0.001
Pull-ups Sent	1108	21.3	31.7	9.0	4883	46.6	42.8	37.0	< 0.001
Pull-ups Received (Peers)	1108	35.7	44.3	20.0	4883	43.4	40.2	32.0	< 0.001
LIS-R *	1031	32.5	6.0	33	4560	26.2	6.9	26	< 0.001
Variable	N	%			N	%			p-value
European-American	1108	70.4			4883	72.8			0.106
Female	1108	19.2			4883	21.3			0.133

* Level of Service Inventory-Revised

Table 2

Random-effects logistic regression, relationship of age, length of stay, LSI-R, race and gender to graduation.

Variable	OR	95% CI		p-value
Age, 1 year change	1.02	1.01	1.03	0.003
Length of Stay, 1 day change	1.06	1.06	1.07	< 0.001
5 point change in LSI-R *				
Non-European-American and male	0.36	0.29	0.43	< 0.001
European-American and male	0.48	0.43	0.54	< 0.001
European-American and female	0.31	0.25	0.40	< 0.001
Non-European-American and female	0.23	0.18	0.31	< 0.001

* Level of Service Inventory-Revised

Table 3

Random-effects logistic regression, relationship of pull-ups sent, pull-ups received (staff), and pull-ups received (peers) to graduation, controlling for all Table 2 covariates.

Variable	OR	95% CI		p-value
Age, 1 year change	1.01	0.99	1.02	0.253
Length of Stay, 1 day change	1.07	1.07	1.08	< 0.001
Pull-ups Sent, 10 pull-up change	1.10	1.05	1.14	< 0.001
Pull-ups Received (staff), 10 pull-up change	0.77	0.64	0.94	0.011
Pull-ups Received (peers), 10 pull-up change	0.82	0.79	0.84	< 0.001
5 point change in LSI-R *				
Non-European-American and male	0.36	0.29	0.44	< 0.001
European-American and male	0.48	0.42	0.54	< 0.001
European-American and female	0.35	0.28	0.44	< 0.001
Non-European-American and female	0.26	0.20	0.35	< 0.001

* Level of Service Inventory-Revised

Table 4

Random-effects logistic regression, relationship of in degree reciprocity to graduation, controlling for all Table 3 covariates.

Variable	OR	95% CI		p-value
Age, 1 year change	1.01	0.99	1.02	0.320
Length of Stay, 1 day change	1.07	1.06	1.08	< 0.001
Pull-ups Sent, 10 pull-up change	1.08	1.03	1.12	0.001
Pull-ups Received (Staff), 10 pull-up change	0.78	0.64	0.96	0.017
Pull-ups Received (Residents), 10 pull-up change	0.82	0.80	0.85	< 0.001
In degree Reciprocity, 0.10 proportion change	0.91	0.82	1.01	0.082
5 unit increase in LSI-R *				
Non-European-American and male	0.33	0.27	0.42	< 0.001
European-American and male	0.48	0.42	0.54	< 0.001
European-American and female	0.34	0.27	0.44	< 0.001
Non-European-American and female	0.24	0.18	0.33	< 0.001

* Level of Service Inventory-Revised

Table 5

Random-effects logistic regression, relationship of out degree reciprocity to graduation, controlling for all Table 3 covariates.

Variable	OR	95% CI		p-value
Age, 1 year change	1.00	0.99	1.02	0.505
Length of Stay, 1 day change	1.07	1.06	1.07	< 0.001
Pull-ups Sent, 10 pull-up change	1.08	1.03	1.12	0.001
Pull-ups Received (staff), 10 pull-up change	0.80	0.65	0.98	0.033
Pull-ups Received (peers), 10 pull-up change	0.82	0.80	0.85	< 0.001
Out degree Reciprocity, .10 proportion change	1.17	1.08	1.28	< 0.001
5 unit increase in LSI-R *				
Non-European-American and Male	0.34	0.27	0.42	< 0.001
European-American and Male	0.47	0.42	0.54	< 0.001
European-American and Female	0.29	0.22	0.39	< 0.001
Non-European-American and Female	0.21	0.15	0.29	< 0.001

* Level of Service Inventory-Revised

Table 6

Random-effects logistic regression, relationship of out degree and in degree reciprocity to graduation, controlling for all Table 3 covariates.

Variable	OR	95% CI		p-value
Age, 1 year change	1.01	0.99	1.02	0.417
Length of Stay, 1 day change	1.07	1.06	1.07	< 0.001
Pull-ups Sent, 10 pull-up change	1.05	1.00	1.09	0.055
Pull-ups Received (staff), 10 pull-up change	0.81	0.66	0.99	0.039
Pull-ups Received (residents), 10 pull-up change	0.84	0.81	0.87	< 0.001
Out degree Reciprocity, 0.10 proportion change	1.27	1.15	1.41	< 0.001
In degree Reciprocity, 0.10 proportion change	0.80	0.70	0.91	0.001
5 unit increase in LSI-R *				
Non-European-American and male	0.33	0.26	0.41	< 0.001
European-American and male	0.48	0.43	0.55	< 0.001
European-American and female	0.30	0.23	0.39	< 0.001
Non-European-American and female	0.20	0.14	0.28	< 0.001

* Level of Service Inventory-Revised