

# Will You Remember Me In The Morning? Test-Retest Reliability of a Social Network Analysis Examining HIV-Related Risky Behavior in Urban Adolescents and Young Adults<sup>1</sup>

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*In recent years there has been a growing interest in applying social network models to the problem of adolescent substance use. However, there has been little research conducted examining the reliability of social network information within this population. The current study attempts to address this gap, specifically by examining social network test-retest reliability over a two week period among a sample of adolescent substance users. The results of the current study suggest that for social network variables dealing with substance use, reliabilities are at least moderate with correlations of .6 or above. However, there is a large degree of turnover with regards to the specific individuals being named in the network with only 62% of alters mentioned at Time 1 being mentioned at Time 2.*

## INTRODUCTION

Findings from recent research have generated widespread public concern about adolescent drug use with the highest rates of use appearing in youth between the ages of 16 and 25. Of particular concern has been a general rise in the popularity of marijuana, viewed by researchers and the

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public as an important "gateway" drug leading to the use of "hard drugs" such as cocaine and heroin, (Kandel, Yamaguchi, and Chen, 1992; Kandel, and Yamaguchi, 1993; Newcomb and Bentler, 1986; Osgood, Johnston, O'Malley, and Bachman, 1988). Questions arise as to why youth continue to use drugs, how new drugs diffuse into new populations of youth and young adults, and how youth make choices about which drugs to use for what purposes.

Peer influence through personal networks is recognized as central to promoting increased use of drugs, and the introduction of new drugs into existing drug use repertoires. Thus, social networks may hold the key to understanding the initiation and progression of drug use over time. Social network analysis at both the personal and the macro level locates risk not at the individual level but in the interaction between or among members of the social network. Networks have the potential to influence drug use patterns through peer persuasion, imitation, and/or close interaction with friends and acquaintances that share or sell drugs and by promoting participation in activities where drug use is common and drugs can be easily obtained (Hawkins, and Fraser, 1985; Westermeyer and Neider, 1988). Friedman (et al, 1997) notes the likelihood that sexual risk taking and hard drug use will be present in peer groups of adolescent problem drinkers, and calls for network studies to expand our understanding of the ways in which these behaviors of network members influence individual youth.

Social network research depends on the reliability of self report, as well as the accuracy of reporting on alters. The efficacy of these studies is determined in part by whether change in networks is a consequence of inaccurate recall or actual change in network composition and reported behavior. Some studies suggest low levels of informant accuracy in social network data while others suggest that recall accuracy varies with behavior, type of relationship between ego and alters and other situation-specific factors (Bernard and Killworth, 1977; Bernard, Killworth, Kronenfeld, and Sailer, 1985; Bondonio, 1988; Killworth and Bernard, 1976, Freeman, Romney, and Freeman, 1987). Reliability and accuracy are particularly important in longitudinal studies of drug use (Johnson, and Mott, 2001) where changes in network characteristics are central predictors of change in patterns of drug use or drug sequencing. Many recent network studies of drug use and HIV risk over time – usually six month periods – have shown significant differences in network composition and characteristics across two or three time points (Clair, Weeks, and Borgatti, 2000; Clair, Singer, Heimer, et al, 2000; Neaigus, Friedman, Curtis, et al , 1994; Miller and Neaigus, 2001) which are not easily interpretable for these reasons.

There are two types of variables that have been examined in social network test-retest reliability studies. The first set examines aggregate level variables over time with network size being the most frequent variable assessed (McFarlane, et al, 1981; Sarason, et al, 1990; Barrera, 1980; Brewer, 2000). For example, Sarason and colleagues (1990) found that the number of people mentioned on the social support questionnaire had a test-retest reliability of .90 with a 4-week follow-up period. The second set of studies looks at the recall of named individuals across both time points (Marsden, 1990; Barrera, 1980; Brewer et al, 1999; Brewer, 2000). Looking at social support relations Barrera (1980) found that recall rates ranged from 48% of those providing material aid in the past month to 73% for typical sources of material aid, given up to a 10 day follow-up period. Looking at behavioral relations Brewer and colleagues (1999) found that 86% of sexual partners mentioned at time one were recalled at time two and 78% of injection partners mentioned at time 1 were recalled at time 2 with a follow-up of seven days.

There are currently two lines of research that offer predictions as to which alters are more likely to be recalled. First, is the belief that those with closer more intense ties will be more likely to be recalled (Marsden, 1990; Brewer and Yang, 1994). The other line of research looks at the name generators used to create the list of alters and suggests that specific wording will cue the recall of specific individuals (Smith, 2002; Kirke, 1996; Bailey and Marsden, 1999; Straits, 2000; Bernard, Shelley and Killworth, 1987, White and Watkins, 2000). Based on past research we hypothesize that those alter variables at Time 1 that directly relate to the name generator questions will be predictive of recall at Time 2. For example, one of the name generators asks about those that you have used drugs with, so we hypothesize that those alter variables that assess drug use with ego will be predictive of recall at Time 2. In addition, those alter variables that do not directly relate will not predict recall at Time 2. So, given the name generator above, we would not expect gender to be a significant predictor of recall.

This paper reports on the reliability of self report on social networks among adolescent drug users, using data from a pilot study of 60 adolescents designed to test a survey instrument to be used in a larger study of transitions to hard drug use. Sixty adolescents were recruited from two youth serving centers in two urban areas of Connecticut, representing the target populations for the larger study – African American and Puerto Rican male and female youth between the ages of 16 and 24. Twenty-five of the adolescents were re-interviewed approximately two weeks later to establish test-retest reliability of the survey instrument. The instrument included a social network component. This component asked participants to identify up to fifteen members of their personal social networks including family members, friends and other people important to them. Participants then answered approximately 25 questions about their alters. In addition they answered three questions about every alter's relationship with every other – whether the alter knew, did drugs or had sex with each of the others. The data we report on here are drawn from the social network component of the pilot survey.

## **METHODOLOGY**

### **Participants**

All study participants were from two large metropolitan areas within Connecticut. Participants were recruited through outreach that met the selection criteria for the Pathways project. Specifically: 1) they were between the ages of 16 and 24 and 2) they had reported using at least one drug other than alcohol, tobacco, or marijuana in the last 30 days. The analyses presented here are based solely on those participants who completed both an initial survey and a second survey which was completed within two weeks of the initial survey. There were 25 participants from the total sample that met these criteria.

### **Procedure**

The participants were asked various questions about their social networks as part of a longer survey interview examining risky behavior in this population. Four name generators were used to create the list of alters for the current study: 1) Please tell me the names of all the different people who you spend a lot of time with, more than a few hours a week, or talk with on the phone often. 2) Please tell me the names of all the different people who you have used any kind of drugs with in the last 6 months. 3) Please tell me the names of all the different people who are close to you. 4) Please tell me the names of all the different people who you have had sex with in the last 6 months. The interviews were conducted individually by trained project staff. Interview rooms were selected that

allowed for privacy for the respondent and nobody other than the respondent and the interviewer were present in the rooms during the interviews. Informed consent was obtained prior to all interviews and the participants were assured of confidentiality. The importance of the participants answering as thoughtfully and honestly as possible was emphasized. Participants were paid \$20 for their participation.

## Measures

The network instrument inquired about several different facets of the participants' social networks. To assess the demographic characteristics of the networks we asked about the gender, ethnicity, age, and neighborhood of residence for the network members. We also asked about a number of different types of relational measures such as the length of time known, how important the person was to them (on a 5-point scale), how much they trust the person (on a 5-point scale), nature of the relationship with the network member (kin or non-kin), and frequency of contact. Finally we inquired about a number of different risk behaviors of network members and if the risk behaviors were performed with ego. Specifically, we asked if their network members used alcohol, marijuana, or other drugs, and whether the network members used any of these substances with ego. We also asked if ego had sex with any of their network members.

## RESULTS

### Overview

To examine the relative stability and reliability of networks over the two-week period we will conduct two different sets of analyses. First, we will examine the structural characteristics of the aggregate level information by assessing the test-retest reliability of a variety of important network indices. This will allow us to examine the aggregate level reliability over time. For example, does an individual have the same number of friends that use drugs over time irregardless of whether or not these are the same individuals. Second, we will examine the characteristics that distinguish between those network members listed at time 1 who are recalled at time 2 and those network members listed at time 1 that are not recalled at time 2. This will allow us to examine the predictors of recall for specific individuals. This helps to answer the question of what network member characteristics make them more likely to be remembered. Given the number of variables that will be examined we will use an alpha value of .01 to determine statistical significance.

### Reliability of Ego Network Indices

To assess the test-retest reliability of the network variables we calculated the correlations for 11 pairs of network variables measured at both time points. These eleven variable pairs included: overall network size, number of males in the network, number of kin in the network, number of important persons in the network, number of network members that used alcohol, number of network members that used alcohol with ego, number of network members that used marijuana, number of network members that used marijuana with ego, number of network members that used other drugs, number of network members that used other drugs with ego, and the number of network members ego had had sex with. For ten of the eleven pairs of variables the correlations among the paired variables were statistically significant ( $p < .01$ ). The one variable that was not significant was for the number of sex partners ( $r = .47, p = .04$ ) and the largest correlation was for the number of network members that used marijuana with ego ( $r = .89, p < .001$ ) (see Table 1 for details).

**Table 1. Test-retest Reliability**

Variable	r	Time 1 Mean	Time 2 Mean
Network Size	0.66**	6.64	6.16
# of Males	0.62**	3.75	3.12
# of Kin	0.58*	1.32	1.44
# of Important Persons	0.59*	3.08	3.16
# Who do Alcohol	0.67**	4.75	4.25
# Who do Alcohol With You	0.73**	4.27	3.90
# Who do Marijuana	0.69**	4.43	4.65
# Who do Marijuana With You	0.89**	3.83	3.78
# Who do Drugs	0.83**	4.30	4.43
# Who do Drugs With You	0.62**	3.56	3.52
# of Sex Partners	0.47	1.30	1.80

\* p&lt;.005

\*\* p&lt;.001

### Network Characteristics Effect on Recall

The reliability of the ego-network indices addresses the reliability at the macro level. At the micro level it is important to determine if the same specific individuals are remembered over time and what characteristics predict recall at time 2. To assess reliability at this level we first examine the total recall estimates and conduct t-tests, on various characteristics of the network member (demographics, risk behaviors, etc). We then assess whether relationship characteristics (days contact, how important, ask for advice, etc) are significantly related with recall at time two. For the 25 participants that completed the survey 161 alters were named at time 1. At time 2, 147 alters were named including 100 of the alters mentioned at time 1, approximately 62% of those named at Time 1, and 47 new alters. Put another way 68% of those listed at Time 2 were also listed at Time 1.

There were 21 variables assessed for their potential role in alter recall at time 2. The three demographic variables (gender of alter, age of alter, and whether the alter lived in the same neighborhood) were not significantly associated with recall at time 2 ( $p > .45$ ). The seven risk variables that were assessed included: does the alter use alcohol, has ego used alcohol with the alter, does the alter use marijuana, has ego used marijuana with the alter, does the alter use drugs (other than marijuana or alcohol), has ego used drugs (other than marijuana or alcohol) with the alter, and has ego had sex with the alter. Two of the seven risk variables, used marijuana with ego and used drugs with ego, were associated with recall at time 2 (see Table 2 for details). In each case for the risk variables the more risk the person represented (using drugs with ego) resulted in them being more likely to be remembered at time 2. So, for example if someone named an alter at time 1 that they used marijuana with they were more likely to recall that person at time 2 compared to an individual they did not use marijuana with.

**Table 2. Demographic and Risk Variables and Recall**

Variable	t	Sig. (2-tailed)
Gender	0.74	0.46
Age	0.67	0.51
Live in Your Neighborhood	0.46	0.64
Alter Uses Alcohol	0.87	0.39
Alter Used Alcohol with You	1.15	0.25
Alter Uses Marijuana	2.47	0.015
Alter Used Marijuana with You	3.99	0.001**
Alter Uses Drugs	2.14	0.035
Alter Used Drugs with You	2.94	0.004*
Alter had Sex with You	2.28	0.024

\* p<.005  
\*\* p<.001

The remaining 11 variables that were assessed included six social dynamics variables and five social support variables. The six social dynamics variables included: how close ego rated alter (on a scale of 0 to 4), how important ego rated alter (on a scale of 0 to 4), how much they trust the alter, how much time they spend with alter, the number of days ego has been in contact with alter in the last 30, and the number of years ego had known the alter. Of the six, four significantly predicted recall at time 2 ( $p<.01$ ) with the exceptions being the number of years ego had known the alter and how much they trusted the alter. The five social support variables included: if the alter gives ego good advice, if the alter asks ego for advice, if ego could get money from alter, if alter is someone ego would give money to, and if alter is someone they could go to if they needed a place to stay. Of the five, one significantly predicted recall ( $p<.01$ ) whether ego would give money to the alter (for details see Table 3). For all 11 social variables the pattern was the same with the closer social relationships resulting in a greater likelihood of recall at Time 2. So, if the alter is rated as important, or someone that ego would give money to they were more likely to be recalled at Time 2.

## DISCUSSION

The popularity of social networks analysis is growing rapidly in the area of adolescent substance use despite the lack of research conducted on the reliability of this data. The current study begins to address this important issue by looking at the reliability of social network data over a two-week interval for twenty-five 16 to 24 year olds. Two distinct types of reliability were examined: 1) an aggregate level reliability that addresses the level of function and 2) a micro level that looks at specific individuals being named in the network. At the aggregate level the test-retest reliabilities on a series of network variables of interest showed reliabilities ranging from .47 for number of sex partners to .89 for the number of network members ego smoked marijuana with. Using conventional estimates for reliability .89 is acceptable but the .47 warrants some caution. It is worth noting that all six of the drug use variables had correlations above .6.

**TABLE 3. Social Dynamics and Social Support and Recall**

Variable	t	Sig. (2-tailed)
Spend Time With	2.77	0.007*
How Close	4.59	0.001***
Years Known	0.06	0.95
Days Contact	2.89	0.005**
How Important to You	3.47	0.001***
How Much Trust	2.3	0.023
Give You Good Advice	-1.14	0.26
Ask You for Advice	2.07	0.04
Get Money From	2.16	0.033
Give Money To	2.71	0.008*
Go To If Need a Place to Stay	2.37	0.02

\* p<.01  
\*\* p<.005  
\*\*\* p<.001

Shifting to the micro level, only 62% of the alters mentioned at Time 1 were also listed at Time 2 two weeks later and an additional 47 names were listed at Time 2 that were not mentioned at Time 1. Clearly there is a great deal of variability in the specific individuals mentioned over time despite the relatively short time frame of two weeks. To examine the question of recall the current study hypothesized that those alter variables at Time 1 that directly related to the name generator questions will be predictive of recall at Time 2. The current study results support this hypothesis with one notable exception.

Two of the name generators dealt with social dynamics and social support type relations. Specifically they asked for participants to report those individuals that were close to them and those that they spend a lot of time with. Examining the social dynamics and social support variables in the current study we found that spending a lot of time with the alter, reporting that you were very close to the alter, the number of days in contact with the alter, rated importance of the alter, and the tendency to give money to the alter were all significantly related to recall at Time 2. This pattern of findings is consistent with past research that has found that close ties are remembered better (Brewer and Yang, 1994; Hammer, 1984). Another similarity with past research was that the length of time ego had known the alter was not a significant predictor of recall (Hammer, 1984).

The remaining name generators asked the participants to list the people they had used any kinds of drugs with or had sex with in the last 6 months. The two variables that significantly predicted recall were did the alter use marijuana with you and did the alter use drugs with you. The variable had sex with you was not a significant predictor of recall at Time 2. In addition, the general drug use and alcohol use by alter items did not significantly predict recall. These findings suggest that researchers should be very precise in the wording of the name generators they choose. In the current study the name generator specified those individuals that had used drugs with ego and as a

result partners who used drugs but not with ego were more likely to be forgotten. Also, the lack of recall for sex partners in the current study is particularly troubling though having a specific timeframe attached to the name generator may account for some of the lack of consistency (Brewer, 2000) and other research has begun to look at how this can be improved (Brewer et al, 1999).

A number of factors can effect network reliability as others have noted (Killworth and Bernard, 1976) these include memory and the salience of the individual as well as the rapport between the individual and the interviewer. In the present study there were no prompts given at the retest regarding who ego had named at Time 1 so it was essentially a “worst-case scenario” for recall. If the names of the alters given at Time 1 were included at Time 2 very likely the number of individuals listed at both time points would have increased. However, for the current study we wanted to develop a baseline estimate for specific recall. In addition, the sample for the current study was only 25 individuals because of the small sample it is difficult to know how generalizable the current study findings are. Future studies should assess reliability of network measures with larger samples.

Given the lack of research to date in the area of network reliability for adolescent drug research there is a lot of work left to be done. Looking at the effectiveness of various prompts in increasing recall as has been conducted in other topical areas is needed. In addition, future research should examine the relative reliabilities of network variables to better determine which ones should be used more cautiously in future research. It is also clear from the current research that one important aspect of network reliability is the specific wording chosen for the name generators so particular attention should be given to this issue. Given the importance of understanding adolescent substance use patterns, it is critical that the issues surrounding the reliability of the social network information provided be addressed more fully in the future.

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