

SEX DIFFERENCES IN SOCIAL SUPPORT AND SUBSTANCE USE DISORDERS:
IMPLICATIONS FOR MECHANISMS OF CHANGE AND TREATMENT
OUTCOMES

By

DEENA PEYSER FALECK

A thesis submitted to the

Graduate School – New Brunswick

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Master of Science

Graduate Program in Psychology

Written under the direction of

Marsha E. Bates

And approved by

New Brunswick, New Jersey

January, 2016

ABSTRACT OF THE THESIS

Sex Differences in Social Support and Substance Use Disorders: Implications for Mechanisms of Change and Treatment Outcomes

By DEENA PEYSER FALECK

Thesis Director:

Marsha E. Bates, Ph.D.

Individuals with substance use disorders (SUDs) often draw on support from their social networks to perpetuate gains made during addiction treatment. Sex differences exist in the function of social networks, the ways in which individuals are influenced by their network members, and in substance use behaviors. We examined whether treatment-seeking men and women differed in the nature of their social support at treatment entry and whether individuals with abstinence versus substance using social support networks differed in substance use and work status at 12 months follow-up. This study included 469 women and 1,379 men from the combined Project MATCH (Matching Alcoholism Treatments to Client Heterogeneity) and Project ARC (Rutgers Alcohol Research Center) samples. Latent class analysis was used to identify unique groups of individuals based on the nature of social support for abstinence or use at treatment entry and the frequency of contact with network members. Individuals were then classified based on the probability of their network membership. Regression analyses were used to determine the relationship of social support class membership and sex to substance use and work status

at follow-up. Men and women differed in the makeup of their social support networks and all subsequent analyses were therefore performed separately for each. Men and women were classified separately into four and five social networks, respectively, based on the statistical and conceptual meaningfulness of the models. There was a significant difference in the substance using patterns at follow-up among men between the Limited Negative (LN) class and all other classes, with members of this class reporting the fewest days abstinent. Among women, no significant differences between classes in days abstinent were detected. Furthermore, the difference between classes in the quality of life (QOL) outcome measure, work status, was not statistically significant. The results highlight the impact of negative social support on substance use behaviors, particularly among men, and the potential importance of addressing the makeup of social networks in an effort to improve outcomes. Future studies should investigate further sex differences in the impact of social support for abstinence and substance use. This knowledge may offer providers insight into the development and maintenance of the disorders and the most beneficial treatment approaches.

Acknowledgements

I would like to thank several individuals for their guidance, support, and mentorship in helping me prepare and complete the present project. Firstly, it is with tremendous gratitude that I acknowledge the continuous help and mentorship of my advisor, Marsha E. Bates, Ph.D. Dr. Bates patiently guided me throughout the development of this thesis, generously provided the datasets for this study, taught me skills to effectively analyze the data, and offered ongoing support, feedback, and advice through its many iterations. I also owe a great debt of gratitude to Jennifer F. Buckman, Ph.D., who patiently trained me in the statistical software that I used to analyze the data and provided hands on support and feedback throughout the process. Finally, I would like to thank Robert Pandina, Ph.D. and Diana Sanchez, Ph.D. for serving on my thesis committee and providing helpful feedback, support, and encouragement.

Table of Contents

Abstract	ii-iii
Acknowledgements	iv
Table of Contents	v
List of Tables	vi
List of Figures	vii
Introduction	1
Study Rationale & Predictions	14
Methods	19
Results	28
Discussion	33
References	40
Tables	47
Figures	55
Appendix	67

List of Tables

<i>Page 46</i>	<i>Table 1: Demographic characteristics of Project MATCH and Project ARC</i>
<i>Page 47</i>	<i>Table 2: Important People and Activities Instrument</i>
<i>Page 48</i>	<i>Table 3: Men Latent Class Analysis Fit Statistics</i>
<i>Page 49</i>	<i>Table 4: Men Group Sizes</i>
<i>Page 50</i>	<i>Table 5: Women Group Sizes</i>
<i>Page 51</i>	<i>Table 6: Women Latent Class Analysis Fit Statistics</i>
<i>Page 52</i>	<i>Table 7: Percent Days Abstinent at Baseline and Follow-up for Men and Women</i>
<i>Page 53</i>	<i>Table 8: Work Status by Latent Class Membership and Sex</i>

List of Figures

<i>Page 54</i>	<i>Figure 1: Men Three Class Solution</i>
<i>Page 55</i>	<i>Figure 2a: Men Four Class Solution</i>
<i>Page 56</i>	<i>Figure 2b: Men Fourth Class</i>
<i>Page 57</i>	<i>Figure 3a: Men Five Class Solution</i>
<i>Page 58</i>	<i>Figure 3b: Men Fifth Class</i>
<i>Page 59</i>	<i>Figure 4: Women Three Class Solution</i>
<i>Page 60</i>	<i>Figure 5a: Women Four Class Solution:</i>
<i>Page 61</i>	<i>Figure 5b: Women Fourth Class</i>
<i>Page 62</i>	<i>Figure 6a: Women Five Class Solution</i>
<i>Page 63</i>	<i>Figure 6b: Women Fifth Class</i>
<i>Page 64</i>	<i>Figure 7: Percent Days Abstinent for Men by Latent Class Membership at 12-months Follow-up</i>
<i>Page 65</i>	<i>Figure 8: Percent Days Abstinent for Women by Latent Class Membership at 12-months Follow-up</i>

Introduction

Substance abuse and dependence, among the most prevalent psychological disorders, pose a significant public health concern. In 2013, approximately 21.6 million individuals ages 12 or older were diagnosed with a substance use disorder (SUD) based on criteria specified in the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV) (Association, 1994; Kadden, Carbonari, Litt, Tonigan, & Zweben, 1998). Alcohol and drug use disorders are chronic disorders with a high rates of poor treatment retention and relapse (McKay et al., 2005; Moos, 2007). Excessive alcohol and drug use increases one's risk for myriad of health and social problems as well as death (Kelley & Renner, 2008; Naimi et al., 2003). Understanding the factors that contribute to the initiation and maintenance of use, treatment retention, and treatment outcomes can enhance the design of treatment programs and interventions (Crits-Christoph et al., 2003; McKay, Merikle, Mulvaney, Weiss, & Koppenhaver, 2001). This thesis focuses on social support as a potential mechanism that may promote and sustain behavioral change among individuals receiving treatment for alcohol and drug use disorders..

Social Support

Social support is a multidimensional construct that can have a far-reaching impact on individuals' behavior, well-being, and overall functioning. This support comes from social networks that are comprised of a matrix of relationships that can have strong positive or negative influences on their members (Cohen, 2004). Whereas the term social networks typically refers to the structural makeup of social relationships, social support relates to their functional or behavioral content (House, 1987). Positive social support generally refers to any relationship that promotes healthy behaviors among its members,

whereas negative social support connotes the provision of reinforcement or encouragement for harmful or destructive behaviors.

Social networks can be comprised of friends, partners, family, and coworkers, and networks can differ in their size, structure, and function. The relationships that form the basis of the networks are highly variable in number, perceived importance, and quality. Relationships can also differ in the frequency of contact between members, their length, intimacy, and the level of support they provide (House, Kahn, McLeod, & Williams, 1985). Some individuals rely heavily on their networks for support and guidance and are easily influenced by the behaviors of their network members. Others function more independently and are less susceptible to the influences of their social network members. Social networks thus are complex and can range in significance, influence, function, and structure.

Individuals who are part of a supportive social network typically feel cared for, loved, and valued as well as a sense of belongingness. Additionally, they have people upon whom they can depend, trust, and communicate with openly (Cobb, 1976). Although social support is not a panacea, it has been linked to improved health-related outcomes in a wide range of physical and psychological diseases (Uchino, Cacioppo, & Kiecolt-Glaser, 1996) and can mitigate the development of physical and psychological disorders that result from stress, adversity, and life adjustment (Levy et al., 1990; Orth-Gomér & Undén, 1990). For example, high levels of social support may protect against depression (Cobb, 1976), moderate irritation and anxiety (Frese, 1999), and improve overall psychosocial functioning (Beattie et al., 1993). Conversely, individuals with fewer social relationships are at increased risk for negative health related outcomes (S.

Cohen, 1988), such as irritable bowel syndrome (Koloski, Talley, & Boyce, 2001). Both quantity and quality of social support consistently have been linked to morbidity and mortality (Uchino et al., 1996) and mortality is reportedly higher among socially isolated individuals (House, Landis, & Umberson, 1988). These findings highlight the powerful influence of a strong and supportive social network on one's physical and psychological well-being as well as the detrimental impact of a negative support network.

Social Support and Substance Use

Whereas an individual's biological and psychological makeup are undoubtedly significant determinants of progression from recreational or experimental use to regular alcohol or substance use, social and environmental factors assume a highly persuasive role as well (Fowler, Volkow, Kassed, & Chang, 2007; Kelley & Renner, 2008; McLellan, 2009; Rosenquist, Murabito, Fowler, & Christakis, 2010). As such, to foster long-term positive outcomes, patients would likely benefit from substance use treatment that targets their social environment in an effort to fortify positive influences and to mitigate social factors that increase substance use.

The need for clinical interventions that focus on factors that persist following traditional treatment is critical. Less than approximately 50% of patients remain abstinent 1-2 years post-treatment (McLellan, Lewis, O'Brien, & Kleber, 2000; Nathan, 1986), which is only slightly better than rates seen in individuals with "spontaneous remission," defined as cessation from substance use without formal treatment (Walters, 2000). These low long-term treatment recovery rates may be partially attributable to an individual's social setting and relationships post-treatment (Beattie & Longabaugh, 1997), which strongly influence substance use behaviors. Social support and one's social network may

be pivotal factors in maintaining gains made during treatment (Beattie & Longabaugh, 1997; Litt, Kadden, Kabela-Cormier, & Petry, 2009). Given the chronicity of substance use disorders, coupled with the persistence of the influences that trigger substance use behavior even beyond the end of treatment, it is important to assume a broad perspective to address substance misuse more effectively (Arria & McLellan, 2012; McLellan, 2009; McLellan et al., 2000). For long-term successful outcomes, treatment must address those factors that persist even after treatment completion, such as one's social support network.

Individuals suffering from substance use disorders exist within a complex network of social forces that exert a powerful influence on behavior. The structure and function of the social network of an individual with an alcohol or drug use disorder may either promote or impede successful treatment outcomes. The social networks of those who use substances can be composed of members who encourage and model abstinence or of members who support and enable use. Broadly speaking, positive support for alcohol and substance use, such as modeling and encouraging abstinence may have beneficial effects on individuals seeking treatment, whereas negative support for alcohol and substance use, such as promoting substance use and providing substances, may be destructive. A substantial literature has tried to dissect the facets of social support to understand the unique benefits and characteristics of positive support and the dangers of negative support. Dichotomizing positive and negative support, however, simplifies the complex nature of networks, which are typically neither all positive nor all negative, and which also are never stagnant. Understanding the unique nature of social support as well as the multifaceted relationship between social networks and substance use is particularly salient as it may help guide clinical services and improve treatment outcomes.

Support for Abstinence

Positive social support may play a protective role against the initiation of substance use, particularly in the presence of stressful life events. In general, individuals whose social networks are comprised of few heavy drinkers tend to drink less themselves (Beattie & Longabaugh, 1997; Zywiak, Longabaugh, & Wirtz, 2002). Likewise, individuals are more likely to remain abstinent if their social group has few members who support substance use and if they have little exposure to drugs and drug paraphernalia (Havassy, Hall, & Wasserman, 1991; Wasserman, Stewart, & Delucchi, 2001). The buffering model (Cohen & Wills, 1985) suggests that social support acts as a buffer against the harmful effects of stressors; given that harmful alcohol and substance use is often in response to life stressors, social support may be critical for safeguarding against misuse (Boardman, Finch, Ellison, Williams, & Jackson, 2001; Noone, Dua, & Markham, 1999).

Even among individuals with substance use disorders, positive social support can play an important role in encouraging healthy behaviors and promoting abstinence. For example, having a strong support network (Zywiak et al., 2002), having more non-drinking friends (Mohr, Avera, Kenny, & Del Boca, 2001; Zywiak et al., 2002), and receiving high levels of support for abstinence from even one individual prior to entering substance abuse treatment all predict lower relapse risk (Havassy et al., 1991). Strong social support networks also are linked to increased retention in treatment (Siddall & Conway, 1988; Westreich, Heitner, Cooper, Galanter, & Guedj, 1997), which is significant as patients who successfully complete their treatment course present a lower risk of relapse (Toumbourou, Hamilton, & Fallon, 1998). Siddall and Conway highlight

this idea by showing that the degree of social support and family involvement in treatment was directly related to both treatment retention and completion in a sample of patients in a residential drug treatment facility (Siddall & Conway, 1988). Therefore, abstinence-supporting (i.e., positive) social networks appear to promote treatment success by encouraging treatment initiation, promoting retention, and stabilizing treatment gains.

Having a positive support network remains of utmost importance for post-treatment recovery from alcohol and drug use disorders as well (Finney & Moos, 1992; Havassy et al., 1991; Humphreys, Moos, & Cohen, 1997; Moos & Moos, 1984). The presence of abstinence-specific support post-treatment is associated with a lower risk of relapse (Beattie & Longabaugh, 1999; Havassy et al., 1991), particularly in the presence of life stressors (S. A. Brown, Vik, Patterson, Grant, & Schuckit, 1995). Likewise, less support for drinking predicts increased abstinence (Longabaugh, Wirtz, Beattie, Noel, & Stout, 1995; Longabaugh, Wirtz, Zweben, & Stout, 1998; Project MATCH Research Group, 1997). Patients with high levels of positive social support, whose network members promote attainment or maintenance of abstinence, showed greater reductions in their post-treatment drinking compared to those with low levels of support (Beattie & Longabaugh, 1997). Furthermore, greater structural support, defined by levels of social integration and partner status, and greater partner support for abstinence, predicted lower relapse risk among alcohol, cigarette and opioid users in substance use treatment (Havassy et al., 1991). Having a better functioning marriage prior to alcohol treatment predicted lower rates of relapse (McCrady, Hayaki, Epstein, & Hirsch, 2002). Havassy et al. showed that higher levels of perceived emotional support predicted continued abstinence in cocaine users over a three-month post-treatment period. This study also

found that having no cocaine users in one's social network protected against relapse, whereas having no close friends increased relapse (Havassy, Wasserman, & Hall, 1995). McKay et al. found that self-help group participation significantly contributed to cocaine use in the six-month follow-up period (McKay et al., 2001). In a follow-up study, individuals with lower social support for substance use and greater attendance at self-help groups had better alcohol use outcomes (McKay et al., 2005). Positive social support therefore creates an environment of healthy living that extends from the early stages of use as far as post-treatment. Even after successful treatment, the role of a supportive network remains critical in promoting maintenance of gains through both modeling and encouraging abstinent-supporting behaviors.

Support for Substance Use

Social support can also have a powerful negative influence on substance use behaviors. Negative support, or support for alcohol and substance use, plays a critical role in the initiation and maintenance of substance use disorders, as well as in relapse and recovery (Moos, 2011; Stout, Kelly, Magill, & Pagano, 2012). Given the social nature of alcohol and substance use, interactions with friends, partners, and family members often stimulate and propagate their use (Duncan, Boisjoly, Kremer, Levy, & Eccles, 2005; Galea, Nandi, & Vlahov, 2004; Manuel, McCrady, Epstein, Cook, & Tonigan, 2007; Pagan et al., 2006). Similarly, individuals' substance use behaviors often parallel those of other members in their social network, increasing or decreasing in tandem (Rosenquist et al., 2010). Among injection drug users, for example, having a partner who injects drugs (Neaigus et al., 2001) and having a high-risk social network (Fuller et al., 2003) have been associated with the initiation of injection drug use. Exposure to cigarette smoking at

work or home makes smoking cessation less likely (Albertsen, Hannerz, Borg, & Burr, 2004) by both providing access to cigarettes and fostering a substance-supporting environment (Albertsen, Borg, & Oldenburg, 2006).

Beyond the role of social support in the initiation and maintenance of substance use, clear evidence supports the negative impact of sustaining relationships with alcohol and substance users during and after the course of rehabilitation (Marlatt, 1985; McCrady, 2004). Having family or friends who support drinking (Longabaugh et al., 1998) and having at least one social network member with the same primary drug of choice (Havassy et al., 1991) are prognostic indicators of poorer treatment outcomes. Whereas having an advocate for abstinence in one's social network is beneficial for recovery, having a "pro-drinker" offsets the positive influence of having a "pro-abstainer" (Stout et al., 2012). Unsupportive familial responses to drinking, such as withdrawing from the drinker, avoiding dealing with the drinking, or tolerating the drinking are associated with a poorer response to treatment (McCrady, Epstein, & Sell, 2003; McCrady et al., 2002). Social support networks also affect the risk of relapse. Among those who completed substance use treatment, patients whose partners had active substance use problems were less likely to maintain abstinence from alcohol and drugs one-year post treatment than those whose partners did not abuse substances (Tracy, Kelly, & Moos, 2005). Furthermore, maintaining drinking friends after treatment has been linked to poorer outcomes (Mohr et al., 2001) and the presence of even one person who drinks in an individual's social network increases the risk of alcohol relapse (Havassy et al., 1991). Similarly, the presence of a partner who smokes increases the likelihood of relapse one-year following smoking cessation treatment (Walsh et al.,

2007). Among individuals in a methadone maintenance program, those with an injection drug-using partner were more likely to share needles and inject themselves compared with those whose partners were not (Darke, Swift, Hall, & Ross, 1994; Kidorf, Stitzer, & Brooner, 1995). Among adult substance users, individuals with low levels of social support reported greater severity of alcohol and substance abuse at six months follow-up than those in the group with high social support (Dobkin, Civita, Paraherakis, & Gill, 2002). These studies demonstrate the detrimental effects of having a social support network that encourages or promotes substance use on one's entire trajectory of use – from initiation, to maintenance, and even relapse by acting as a stumbling block for those who have successfully completed treatment.

In conclusion, greater exploration and characterization of positive support networks, including identification of positive role models and support outlets, may be beneficial. Networks are complicated and have multiple moving pieces where positive elements coexist with negative ones, and the distinct effect of a particular positive or negative influence is often difficult to predict. This complexity affects one's understanding of social support and dictates a broader, multi-dimensional examination of the critical influence of one's network on substance use behaviors and quality of life (QOL) indicators.

Formal substance use treatment can serve as a catalyst for reduced substance use, more positive life outcomes, and an overall improvement in health, but may be insufficient by itself to sustain these gains over time (McLellan et al., 2000). The aforementioned literature highlights that positive support can influence substance use and abstinence at every juncture of the progression, from initiation of substance use through

treatment. Each of the studies highlighted above, however, focus on individual elements of positive support, such as the number of constituents, provision of substance specific versus general support, and spousal support. Most of these studies also explore the impact of social support on substance use initiation, maintenance, or treatment/relapse. Research into the multiple and integrated dimensions of social networks has been limited, and the net effect of networks of varying compositions has not been well elucidated. The interplay of different individuals and forces that comprise social networks and their impact on individuals' substance using patterns therefore warrants further exploration. A more holistic perspective that unifies these important but fragmented findings may have implications for enhancing the effectiveness of current treatments and may improve the development of clinical interventions that address and engage one's social support network. Specifically, recognizing that external social forces play a key role in SUD treatment outcomes may offer providers insight into the trajectory of the disorders and the most beneficial treatment approaches.

Sex

Men and women differ in what they seek from their social networks and in the ways in which they are influenced by the behaviors of their friends, family, partners, and colleagues. Women highly value their social networks (Manuel et al., 2007) and typically rely heavily on their friends, family, partners, and coworkers for support. Typically, women are more social than men and have larger networks in which they are more emotionally involved (Belle, 1987). Furthermore, their networks tend to be more supportive than men's (Olson & Shultz, 1994) and involve stronger relationships with friends (Bell, 1991). Men and women also place different levels of importance on their

social networks, with women turning to their support system in times of adversity more often than men (Kendler, Myers, & Prescott, 2005). These results suggest that women may benefit more from the positive aspects of their social networks than men, given that they are more social beings and more involved with and influenced by their networks members. They also may be more susceptible, however, to the dangers of negative influences. The structure and role of general social support networks thus seems to differ between men and women, but whether this difference extends to the effects on substance misuse is less apparent.

Given the influence of social factors on substance use, this distinction in social behavior between men and women may underlie the sex differences that have been found in substance use behaviors and treatment outcomes. Among individuals in an outpatient drug treatment program, women had lower drug use relapse rates than men despite the fact that women had higher levels of emotional distress, suicidality, and depression, which are psychological risk factors often associated with relapse (Florentine, Anglin, Gil-Rivas, & Taylor, 1997). Florentine et al. used the social support hypothesis to explain this paradox and suggested that women are nonetheless less likely than men to relapse because they have higher levels of social support, which facilitates recovery. They further attributed the lower relapse rate to higher attendance at group counseling sessions by women as compared to men (Florentine et al., 1997). Women have also shown better alcohol outcomes than men with a treatment approach that builds on social network support, specifically, Twelve Step Facilitation (T. G. Brown, Seraganian, Tremblay, & Annis, 2002). These findings may suggest that despite the benefits of positive social support networks among both men and women (Havassy et al., 1991; Johnsen &

Herringer, 1993), women derive greater benefit from being surrounded by abstinence-supporting peers.

Furthermore, beyond quantifying treatment outcomes in terms of substance use specific outcomes, success can also be measured based on psychosocial and QOL indicators such as work stability (Longabaugh, Mattson, Connors, & Cooney, 1994). A positive social network that supports abstinence can increase an individual's daily QOL post-treatment in individuals with SUDs (Peyser, 2014). Broadening the evaluation of treatment success beyond substance use outcomes alone is an important consideration.

Despite their ability to derive benefit from a positive social network, women also suffer more from the negative effects of social support for drinking and drug use. As compared to men, women place more importance on their relationships with their drinking friends than do men (Mohr et al., 2001), are more influenced by the drinking habits of their partners (Manuel et al., 2007; McCrady et al., 2002), and are more likely to have partners who also abuse drugs (Kingree, 1995; Reed, 1985). Interestingly, women still rely on these networks for their social and emotional needs (Falkin & Strauss, 2003) and view their friends as more important to them than do men (Mohr et al., 2001). Women are also more likely to relapse in the company of a friend or a romantic partner, whereas men are more likely to relapse when alone (Rubin, Stout, & Longabaugh, 1996). Finally, women's substance abusing behavior may be more affected by social factors. For example, female cocaine users were more likely than male cocaine users to report interpersonal problems in the week prior to relapse (McKay, Rutherford, Cacciola, Kabasakalian-McKay, & Alterman, 1996).

Given the strong impact of social support on substance use and the differences

between men and women in the nature, role, and influence of social network members, social support may differentially impact the substance use behaviors of men and women. Although much research has focused on the influence of social support on alcohol and substance use, there has been less emphasis on sex differences in this area. Understanding the influence of sex on social network composition, substance use, and substance and psychosocial treatment outcomes can inform the development and implementation of effective and tailored interventions. For example, given women's increased reliance on their social networks, a treatment program designed to enhance the network support for abstinence may be beneficial and more effective for women than for men.

Study Rationale & Predictions

Social support is a multifaceted construct that is defined for each individual and within each relationship. Exploring substance use behaviors through a person-centered lens, with a focus on the individual and his/her social networks, offers a unique approach that can complement traditional variable-centered quantitative methods. Broadly defined, a variable-centered approach focuses on differences between individuals and explains behavior in terms of dimensional concepts or factors (Bates, 2000). Person-centered approaches, in contrast, offer a holistic view of the individual and focus on the dynamic synergy of influences within an individual. This approach can be beneficial to clinicians who focus on understanding the social factors that influence the trajectory of substance abuse and treatment outcomes within a particular individual.

To capture the complexity and integrated features of the social networks of individuals entering substance use treatment, latent class analysis (LCA) (McCutcheon, 1987), which groups individuals with similar phenotypic profiles, specifically with similar types of social support and social networks, was used. This person-centered, holistic approach captures the heterogeneity in patterns of support variables, at the individual level, by assessing the probability or likelihood that individuals belong to different classes based on their responses to specific questions which define one's social network and support system. Using this method, individuals were categorized into the fewest independent classes in order to identify a limited number of well-defined and unique social support groups. Further, building from prior evidence that men and women differ in their social support networks, latent classes were further examined separately for each sex to determine whether there were unique and specific characteristics of women

and men's social networks with regard to social support for substance use and abstinence. Lastly, studies using a variable-centered approach (e.g. regression or factor analysis) to explore the role of social support networks on treatment outcomes have identified abstinence role models, larger social networks, and the number of supportive relationships as most predictive of positive outcomes (Zywiak et al., 2002). As such, person-centered and variable-based analyses were combined to compare latent classes between sexes and identify the influence of social support on frequency of use as well as on the QOL outcome, work status.

Two prior studies have looked at the influence of social networks on substance use behavior using latent class analysis, but neither has focused on the impact of sex or QOL outcomes. The first study explored mechanisms of behavioral change that support positive treatment outcomes in individuals with alcohol use disorders and cognitive impairment. Using data from Project MATCH (Matching Alcoholism Treatments to Client Heterogeneity) (Project MATCH Research Group, 1997), three independent social support classes (frequent positive, limited positive, and negative) were identified (Buckman, Bates, & Cisler, 2007). The authors then replicated their findings with a smaller, more heterogeneous sample, the Rutgers Alcohol Research Center (Project ARC), that included individuals with alcohol and substance use disorders as well as other psychopathology including depression, anxiety, and antisocial personality disorder (Buckman, Bates, & Morgenstern, 2008). In the Project ARC sample, latent class structures, comparable to those that were developed in the previous study (Buckman et al., 2007), were identified. In both of these studies, however, both men and women were included together in the development of the latent classes. Given the sex specific nature

of social support, the present study examined sex differences in these samples with regard to the latent class structure of social support, and the relationship between latent class structure and substance use and the QOL outcome, work status.

Hypotheses and Predictions

This thesis aimed to better understand the role of social support as a mechanism of behavioral change in promoting and sustaining abstinence in individuals with substance use disorders, with a specific focus on sex differences.

Specifically, this study had the following aims and hypotheses:

Specific aim 1. To examine sex differences in the nature of social networks and support using latent class analysis.

Rationale. Sex differences exist in the functioning of social networks and relationships among network members. In previous studies using data from the Project MATCH and Project ARC samples (Buckman et al., 2007; Buckman et al., 2008), the analyses conducted did not take into account sex. Notably, in both studies, the majority of the participants were men. Thus, the derived latent classes likely were more representative of/driven by the men in the sample. Prior research suggests, however, that the social networks of women serve a different function and are more articulated, important, and influential. It was predicted, therefore, that the latent class analysis would show a different pattern of results for women.

Hypothesis a. To identify three unique classes of social support among men. Two with support for abstinence that differed in the amount of contact the men have with their network members (frequent positive and limited positive support) and one with support for alcohol and drug use (negative support). Thus, the results for the men were expected

to replicate those found in the Project MATCH and Project ARC samples as a whole.

Hypothesis b. To identify four unique classes of social support among men. Two with support for abstinence that differ in the amount of contact the women have with their network members (frequent positive and limited positive support) and two with support for alcohol and drug use that differ in the amount of contact the women have with their network members (frequent negative and limited negative support).

Specific aim 2. To assess differences in substance use and QOL outcomes between the identified latent classes in men and women.

Rationale. Sex differences exist in substance using behaviors as well in the functioning of social networks and relationships among network members. Therefore, it was hypothesized that the relationship between social support and substance and non-substance related treatment outcomes would differ by sex. Furthermore, treatment outcome is most often viewed as reduced substance use or abstinence; there has been substantially less focus on psychosocial or QOL indicators as indices of treatment success. The present study sought to quantify treatment outcomes in terms of frequency of substance use and in terms of work status, used as a QOL indicator. These findings aimed to highlight the clinical utility of broadening the evaluation of treatment success beyond substance use outcomes to benefit researchers and clinicians who wish to understand mechanisms that promote and sustain overall well-being in individuals with SUDs.

Hypothesis. Frequency of contact with social support network members would have a greater impact on women than on men such that women would be more influenced by the support characteristics of those with whom they had more frequent contact.

Therefore, women who entered substance use treatment with social networks that supported substance use were expected to show worse treatment outcomes as indicated by greater frequency of use and worse QOL outcomes as defined by fewer individuals employed. This relationship would be even more robust when the women had more frequent contact with their network members. In contrast, women who entered substance use treatment with social networks that supported abstinence were expected to show better treatment outcomes as indicated by lower frequency of use and higher employment rates. These findings would be even more robust when the women had more frequent contact with their network members. In contrast, men's social networks would have less of an influence on their substance use than women's social networks. Furthermore, men would be less influenced than women by frequency of contact with their network members.

Methods

The present study combined data across three samples that vary in substance use severity and treatment structure. Secondary analysis were performed using data from three samples: two from a multisite clinical trial for alcohol dependence that examined client-treatment matching hypotheses (Project MATCH) and one from a study of mixed alcohol- and drug-dependent participants in substance use treatment that was devoted to identifying mechanisms of change (Project ARC). All samples were independently examined for social support patterns and their relationship to substance use outcomes. Combining these samples allowed for a broader perspective on the continuum of substance use and treatment outcomes. Furthermore, it fostered a more in-depth analysis of the relationship between sex and social support thorough an exploration of the latent classes and the construct of one's social network and support system.

Participants

Project MATCH samples. Project MATCH (n=1,726) included two treatment samples: an outpatient (OP) sample (n = 952; female=297) and an aftercare (AC) (n =774; female=155) sample. Data from all participants in both samples were be used in the present study.

The OP sample was comprised of individuals with an average age of 38.9 ± 10.7 years (mean \pm SD) who were mostly male (72%) and single (64%). About half were employed; 80% were white, 6% black, 12% Hispanic, and 2% from other ethnic groups.

The aftercare sample (AC) was comprised of individuals with an average age of 41.9 ± 11.1 years (mean \pm SD) who were mostly male (80%) and single (66%). About half were employed; 80% were white, 15% black, 3% Hispanic, and 1% from other ethnic

groups (Table 1).

The OP sample differed from the AC sample in that in the former participants were recruited directly from the community or were referred from the intake unit of an outpatient treatment center whereas the latter participants were enrolled in the study after completion of at least seven days in inpatient or intensive day treatment. Furthermore, the participants in the OP sample were significantly younger, more residentially stable, and had less severe AUDs than the AC patients (Project MATCH Research Group, 1997).

Both samples had identical randomization procedures, assessment instruments, treatment procedures, and follow-up evaluations (Project MATCH Research Group, 1997). Participants were randomly assigned to one of three individually delivered psychosocial intervention conditions: cognitive-behavioral therapy (Kadden, 1995), motivational enhancement therapy (Miller, 1995), and 12-step facilitation therapy (Nowinski, Baker, & Carroll, 1992). All treatments were delivered over the course of 12 weeks. All participants had a primary diagnosis of an AUD either current (OP) or lifetime (AC) as assessed using the Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised* (APA, 1987), but had no other current drug dependence diagnosis, intravenous drug use for 6 months prior to the study, or symptoms of acute psychosis or severe organic impairment. Both samples had alcohol as the primary drug of abuse and active use during the 3 months prior to study entry (OP) or treatment stay (AC) (Project MATCH Research Group, 1997). All participants were at least 18 years of age and had at least a sixth-grade reading level. Additional study criteria common to both samples included a willingness to accept randomization to any treatment condition, residence within reasonable commuting distance, and completion of prior

detoxification when medically indicated. More than 90% of the clients in each arm participated in the 1-year assessment.

Exclusion criteria included DSM-III-R (APA, 1987) diagnosis of current dependence on sedative/hypnotic drugs, stimulants, cocaine or opiates, any intravenous drug use in the prior 6 months, current probation/parole, a history of organic brain dysfunction, Korsakoff's syndrome, severe dementia, psychotic disorder, serious medical problems that preclude testing, an alternative treatment for alcohol related problems (defined as more than 6 hours of non-study treatment except for self-help groups such as Alcoholics Anonymous during the 3 months of study treatment), an inability to read test materials, and less than 18 years of age. For more details see original study (Project MATCH Research Group, 1997).

Project ARC Sample. This sample was comprised of adults recruited from private, hospital-based substance use treatment programs offering residential or intensive day treatment ($n = 122$; female=50). One hospital served primarily working class patients in an urban area whereas the other served middle-upper class individuals in a suburban community (Morgenstern, Frey, McCrady, Labouvie, & Neighbors, 1996). This sample was comprised of individuals with an average age of 33.6 ± 9.4 years of age who were mostly male (59%) and single (54%) with 13.0 ± 2.6 years (mean \pm SD) of education. The sample was racially and ethnically diverse; 65.5% were white, 23.5% black, 5.9% Hispanic, and 5% from other ethnic groups (Table 1).

All participants met DSM-III-R (APA, 1987) criteria for a current psychoactive substance use disorder (45% alcohol, 27% drug, and 28% dual alcohol and drug diagnoses). Participants were assigned substance use disorder diagnoses using the

Structured Clinical Interview for DSM-III-R (Spitzer, Williams, Gibbon, & First, 1992).

At the 1-year assessment 75% ($n = 92$) of the clients participated. Exclusion criteria for Project ARC included a history of organic brain dysfunction, Korsakoff syndrome, severe dementia, psychotic disorder, serious medical problems that precluded testing, methadone maintenance treatment, inability to read test materials, and age less than 18 years.

Both the residential and intensive day treatment program structures were based on the traditional “Minnesota Model.” Accordingly, program features of each of these treatment facilities included (a) several hours daily of process-oriented and more structured group therapy (b) supervised milieu therapy (c) didactic lectures and films on alcoholism and drug addiction (d) attendance at in-house and community self-help group meetings (e) individual therapy and (f) family therapy. Treatments were delivered by certified alcohol and drug abuse counselors (Morgenstern et al., 1996).

All participants completed informed consent and all testing was conducted in compliance with National Institutes of Health guidelines for the ethical treatment of human subjects and approved by all relevant review boards, including the Rutgers University Institutional Review Board for the Protection of Human Subjects Involved in Research.

Measures

Social support variables. The Important People and Activities (IPA) inventory (Allen et al., 1997) is composed of two main sections. In the first, the participant identified up to 12 individuals in his or her social network during the past 6 months and provided characteristics of each member. In the second, participants selected the four (Project MATCH) or five (Project ARC) individuals, among those identified in the first

section, who had been most important to them in the past 6 months and noted their attitudes toward the participant's substance use, abstinence, and treatment. (Note: To make data consistent across samples, only the first four individuals reported in this section by the participants in the Project ARC sample were used). Table 2 shows details of the items from the IPA and the full IPA is included in the appendix.

Substance use variables. In Project MATCH, the Form 90 Interview, an interview procedure that combines calendar prompts and drinking pattern estimation methods, was used to assess the amount of alcohol consumed each day for the 90 days prior to each interview (Miller, 1996; Miller & Del Boca, 1994). In Project ARC, a modified version of the Timeline Followback interview (Sobell & Sobell, 1992) was used to assess the number of days during which the participant used either alcohol or other drugs for the 3 months prior to each interview. Based on these scales, frequency of substance use was measured as the percentage of days abstinent (PDA) over the assessment period. The number of "use" days was divided by the overall number of "valid" days, defined as any day on which the participant had the opportunity to use alcohol or other drugs (i.e. excluding days they were hospitalized or incarcerated).

Psychosocial and quality of life variables. In Project MATCH, Form 90 (Miller & Del Boca, 1994), a structured clinical interview, was administered at 12 months post-treatment to assess psychosocial and QOL indicators, including work status. In Project ARC, the Life Stressors and Events Inventory (LISRES) Revised – checklist (Moos & Moos, 1994) was administered at 12-months post-treatment to assess psychosocial and QOL indicators, including work status.

Demographic variables. Variables assessing participants' education status and

age were included in the model as covariates.

Procedures

In all samples, participants completed informed consent and were scheduled for intake assessments, during which demographic, social support, and drinking history data were collected and the Structured Clinical Interview for DSM-III-R (Spitzer et al., 1992) was administered. In Project MATCH, the Form 90 and was also administered at five follow-up assessments (beginning at the end of treatment and continuing at 3, 6, 9, and 12 months). In Project ARC, substance use was reassessed using the Timeline Followback interview at three follow-up assessments (6 weeks, 6 months, and 12 months).

To obtain data from consistent time frames across samples, only data from treatment entry and the 12 month follow-ups were used in the present study.

Data Analysis

Aim 1 Analyses. Eight binary variables (see Table 2, starred variables) were derived from the raw IPA data and dichotomized (0,1) for the LCA based on prior research (Buckman et al., 2007; Zywiak et al., 2002). For each of the eight variables, a code of “1” was assigned if (1) at least one network member was abstinent or a light substance user, supported the participant’s abstinence, and interacted three or more times per week with the client; (2) two or more nonusers were within the social network; (3) all members of the network supported abstinence; (4) at least one network member was a heavy substance user, supported the participant’s substance use, and interacted three or more times per week with the participant; (5) three or more heavy substance users were within the network; (6) all members of the network encouraged substance use; (7) daily contact was maintained with at least four network members; or (8) daily contact was

maintained with at least half of the members in the social network. The two contact measures differ from one another in that one measure (7) assesses whether a participant had multiple alternative sources of support, whereas measure (8) takes into account network size and assesses a participant's likelihood of using available support. It should be noted that IPA items in Project MATCH specified drinking behaviors only, whereas IPA items in Project ARC included both drinking and other drug use, given the makeup of the samples.

LCA analyses were performed using Mplus software (Muthén, 2004) to identify the fewest number of mutually exclusive homogenous groups (classes) of individuals based on the pattern of individual characteristics (McCutcheon, 1987). This person-centered statistical approach was used to identify the nature of unobserved, naturally occurring social support networks at treatment entry in the three samples. Characteristic profiles of each latent class, statistically independent patterns of endorsement probabilities that are stable among all members, and the probabilities of a given individual endorsing a given variable and of belonging to a specific latent class (based on the similarity of an individual's support profile to the class profile) were generated. Latent class models were fitted to the eight binary indices of social support using a maximum likelihood approach with missing data assumed to be missing at random (Little & Rubin, 1987). An initial model with one social support class was specified, classes were added in a stepwise fashion, and the goodness of fit model solutions were compared. Changes in the Bayesian Information Criteria (BIC)—in addition to entropy, class sizes, and interpretability of classes—were used to establish the best-fitting and most stable model. Within the Mplus framework, the BIC is a measure of goodness of fit

of a model. When considering which model “fits” the data best, the model with the lowest BIC should be considered. Entropy is defined on a scale from 0 to 1, with values near one indicating high certainty of classification and values of zero indicating low certainty (Muthén, 2004).

Models were estimated simultaneously for men and women and the equivalence of the identified classes for each sex were tested. Models that allowed the eight variables to vary freely were compared to models that constrained variables to be equivalent across sexes. A significant difference in model fit from the free to constrained model indicated that men and women had different social support characteristics.

Aim 2 analyses.

Based on the LCA, individuals were assigned to discrete classes based on their highest probability of membership. Effect size measurements (calculated as Cohen’s *d*, the mean differences between two latent classes, divided by the pooled standard deviation) were used to gauge differences between classes. Differences of 0.2-0.5 were considered small, 0.5-0.8 medium, and 0.8 or greater large; effect sizes below 0.2 were considered non-significant (J. Cohen, 1988).

Outcome measures collected from the 12 month follow-up included substance use variables (PDA) as well as a QOL variable (work status). These variables were examined individually for men and women. A linear regression model analysis was performed to assess the relationship between social support class membership and sex to substance use outcomes at 12 months follow-up. Variables that were clinically relevant or independently associated with the outcome measure, were included in the model as covariates.

A logistic regression model analysis was performed to assess the relationship between social support class membership and sex to work status at follow-up. Work status was included in the model as a binary variable which indicated whether an individual worked (defined as either full time or part time of at least 10 days/month) or did not work. All regression analyses were performed within SAS 9.3 (SAS Institute, Cary, N.C.).

Results

AIM 1: Latent Classes of Social Support at Treatment Entry.

In keeping with the hypothesis for Aim 1, initial analyses compared men and women in a combined sample containing data from all participants in Project MATCH and Project ARC. Models wherein all variables were allowed to freely vary across sex were compared to a three class model (Buckman et al., 2007; Buckman et al., 2008) that constrained all variables to be invariant across the male and female samples. A significant increase in the χ^2 and decrement in model fit ($\chi^2 = 46.624, 24 \text{ df}$) were noted in the constrained model. Thus, latent class analyses were subsequently conducted separately for men and women.

Fit statistics were compared between models that contained one to five classes (Tables 3 and 5) and the optimal class solution was determined based on changes in the Bayesian Information Criteria (BIC), entropy values indicating well-differentiated classes, class sizes (Tables 4 and 6), and theoretically meaningful groups (Muthén and Muthén, 1998-2004). Figures 1-6 show the probabilities of network support variable endorsement for each class (i.e., the probability that an individual in a given class would exhibit a given network support feature).

Among men, the three, four, and five class solutions were analyzed in detail given the results of the fit statistics and in keeping with the aims of this thesis. The results of the three-class solution paralleled those previously reported for the combined sexes in the literature (Buckman et al., 2007; Buckman et al., 2008) (Figure 1). The three classes were identified as the (1) Frequent Positive Support class (including clients with a high likelihood of support for abstinence and frequent contact with network members), (2)

Limited Positive Support class (including clients with a high likelihood of support for abstinence but limited contact with network members), and (3) Negative Support class (including clients with a high likelihood of support for substance use and limited contact with network members) (Figure 1). Despite the theoretical meaningfulness of these three classes, there was a significant reduction in the BIC and increase in the entropy value with the addition of a fourth ($\text{BIC } \Delta = 53.37; 0.817$) and fifth ($\text{BIC } \Delta = -25.75; 0.856$) class. The four (Figure 2a) and five (Figure 3a) class solutions were therefore considered in more detail.

The BIC was the lowest for the four class solution compared to the other models (Table 3), the entropy was high (0.817), and an additional and conceptually meaningful class emerged, which was termed Frequent Negative. This class included clients who had a high probability of endorsing having a substance use model (71%), having more than three heavy users in their network (36%), and having daily contact with network members (43%). This class differed from the Limited Negative class beyond just the degree of contact between the network members. In the Frequent Negative support class, network members were heavy substance users and did not support the individual's abstinence. In contrast, in the Limited Negative support class, network members were heavy users, yet they also encouraged the patient's abstinence (Figures 2a and 2b).

A five-class solution provided higher entropy (0.856) even though it yielded a BIC that was larger than that of the four-class solution (Table 3; $\text{BIC } \Delta = -25.75$). This additional class (Figure 3b), included clients who had a high likelihood of endorsing having a strong abstinence model, similar to those in the other models, but who did not have a high probability of endorsing any of the substance use or contact variables. This

class decreased parsimony and did not yield a conceptually meaningful new class; thus this solution was not considered further. Based on the criteria previously described, a four-class solution for men was used for all subsequent analyses.

Among women, fit statistics were likewise compared between models that contained one to five classes (Table 5). Figures 4-6 show the probabilities of network support variable endorsement for each class. As with the male sample, the three-class solution paralleled those observed in previous independent studies of the samples analyzed here (Buckman et al., 2007 & 2008). In this solution, however, the entropy (0.667) was low and therefore the four (Figure 5a) and five (Figure 6a) class solutions were considered in more detail.

The four class solution featured increased entropy (0.786) although the BIC increased as well (BIC Δ = -16.05). This additional class looked similar to the Limited Negative class found among men and included clients whose network members were heavy users themselves, but who also supported the client's non-using. Members of this class also had a high likelihood of endorsing having a positive model and 0% probability of having a negative model.

The five-class solution (Figure 6a) with the highest entropy (0.832) and a slight increase in BIC (BIC Δ = -29.91) was also examined. Based on the pattern of network support endorsement probabilities, this class was termed Frequent Negative (Figure 6b) and included clients with a high likelihood of endorsing having a substance use model (52%), having greater than three heavy users in their network (70%), having no greater than two non-users in their network (0%), having few abstinence supporters (12%), and having high levels of contact with network members (100%). Based on a balance of the

statistical strength and the conceptual meaningfulness of this model, the five-class solution was used for subsequent analyses for women. Among men and women, the Limited Positive class, which included clients with a high likelihood of endorsing support for abstinence but limited contact with network members was the modal group (Tables 4 and 6).

Substance Use Outcomes in the Latent Social Support Classes.

Linear regression model analyses were conducted to examine the relationship between social support latent class membership at treatment entry and substance use outcomes 12 months post-treatment. These analyses were performed separately for men and women. Substance-use outcomes were calculated as the percentage of days during which an individual remained abstinent (PDA) from alcohol and drugs. Baseline PDA was included as a covariate in the model as it was independently associated with PDA at follow-up. Age was included as a covariate in the model as it was negatively related to substance use.

Among men at treatment entry, there was significantly less PDA ($p < .05$) among those with Frequent Negative support (26.90) compared to those with Frequent Positive support (34.40, $d = -0.25$), and of those with Limited Negative support (24.10) compared to those with either Limited (32.00, $d = -0.27$) or Frequent Positive support (34.40, $d = -0.35$). There were non-significant differences in the PDA between the two positive classes and between the two negative classes. Among women at treatment entry, there was significantly less PDA ($p < .05$) among those with Frequent Negative support (17.60) compared to those in all classes ($d = -0.65$ vs. FP (38.30); $d = -0.73$ vs. LP (40.50); $d = -0.76$ vs. LN (41.80); $d = 0.57$ vs. other (34.60)). There were non-significant differences

between the PDA of all other classes at treatment entry (Table 7).

In the follow-up analyses, latent class membership significantly predicted PDA at follow-up among men, but not among women. The Frequent Positive and Limited Positive support classes showed significantly higher PDA (79.18 and 77.52, respectively) compared to the Limited Negative (68.76) support class (both $p < .05$) (Table 7). The effect size for these analyses was small (FP, $d = -0.33$; LP, $d = -0.27$, both as compared to LN). PDA in the positive support classes was not significantly different than PDA in the Frequent Negative (76.55) support class (FP, $d = -0.09$; LP, $d = -0.03$, both as compared to FN). Contrary to the hypotheses, the Limited Negative support class had significantly fewer PDA than the Frequent Negative class ($p < .05$, $d = -0.24$).

Among women, at follow-up, the overall regression model was significant ($p < .05$), but no individual class comparisons reached statistical significance for PDA when controlling for age and PDA at baseline. Furthermore, there were non-significant effect size differences for all comparisons ($d < 0.20$).

Quality of Life Outcome in the Latent Social Support Classes.

Logistic regression model analyses were conducted to examine the relationship between social support latent class membership at treatment entry and work status at 12 months post-treatment. These analyses were performed separately for men and women and age was included in the model as a covariate. Among both men and women, there were non-significant differences in work status between social support classes at 12 month follow-up (Table 8).

Discussion

This study investigated sex differences in alcohol-specific social networks at treatment entry and in the impact of these networks on substance use and work status 12 months following substance use treatment. Latent class analysis, a person-centered modeling approach, was used to analyze data from the Project MATCH and Project ARC datasets. This study aimed to replicate and extend two prior studies of individuals from these samples, which suggested that support received from an individual's social network influenced substance use outcomes (Buckman et al., 2007; Buckman et al., 2008). Initially, analyses were conducted using the combined sample of both men and women to ensure replication of findings. Consistent with previous research (Buckman et al., 2007; Buckman et al., 2008), three independent social support classes were identified at treatment entry in the combined sample, two that supported abstinence, one with frequent and one with limited contact, and one that supported substance use.

Given that sex differences exist in the makeup and functioning of social networks and the relationships among network members (Manuel et al., 2007), this investigation sought to characterize the relationship between sex and alcohol-specific social network composition using latent class analysis. Models that allowed eight alcohol-related social support variables to vary freely were therefore compared to models that constrained the alcohol-specific network indicators to be equivalent across sexes. Given significant differences in model fit, men and women were determined to have different alcohol-specific social network characteristics and classified separately based on unobserved patterns in their pretreatment alcohol-specific social support. Among men and women, a four and five class solution, respectively, were determined as the best fitting models,

based on the changes in BIC and entropy and the conceptual meaningfulness of the models.

Consistent with the literature on the general structure of social networks (Belle, 1987), men and women differed in the characterization of their alcohol-specific social support. Among men, contrary to the hypothesized three class solution, four independent alcohol-specific social support classes were identified at treatment entry, two that supported abstinence, one with frequent and one with limited contact, and two that supported substance use, one with frequent and one with limited contact. This fourth class, termed Frequent Negative, complemented the Limited Negative class, originally identified by Buckman and colleagues (Buckman et al., 2007; Buckman et al., 2008) and the two negative classes paralleled the two positive support classes previously observed. As such, this additional class was interesting, relevant, statistically salient, and in line with this study's hypotheses.

Among women, five independent alcohol-specific social support classes were identified at treatment entry. In line with this study's hypothesis, these classes included two that supported abstinence, one with frequent and one with limited contact, two that supported substance use, one with frequent and one with limited contact, and one that included clients whose network members were heavy users themselves, but who also supported the client's non-using. This class was conceptualized as the "do as I say, not as I do" class. Interestingly, the additional differentiated class termed Frequent Negative, that was originally identified in the male sample, only emerged in the female sample once the data were divided among five classes. The fifth class fit with the conceptual framework of the model and had a higher entropy value than the three and four class

solutions. A five class solution was therefore determined as the best fitting model.

Notably, this fifth class only comprised 3% of the sample, which suggests that only a small number of women surrounded themselves with frequent negative support.

Prior research has also shown that among individuals with substance use disorders, social support can influence the likelihood of maintaining abstinence (Beattie & Longabaugh, 1997; Zywiak et al., 2002). Individuals with a high probability of having a social network that uses and supports substance use typically report the most frequent substance use (Longabaugh, Beattie, Noel, Stout, & Malloy, 1993; Mohr et al., 2001; Beattie & Longabaugh, 1999). This study aimed to extend these findings by exploring sex differences in substance use outcomes among individuals with substance use disorders. The results revealed differences in the PDA among men, depending on their alcohol-specific social network membership.

Contrary to our hypotheses, the Limited Negative support class had significantly lower PDA than the Frequent Negative class. Although the Frequent Negative class was anticipated to have the lowest abstinence levels, this unexpected finding may relate to the unique composition of these classes. This Limited Negative class was characterized by individuals who had a higher probability (100%) of endorsing having more than three heavy users in their network and had a lower probability (0%) of endorsing having more than two non-users in their network, compared to those with Frequent Negative support (36% and 23%, respectively). Moreover, individuals in the Limited Negative class had a higher probability (16%) of endorsing having network members who encouraged their use compared to those in the Frequent Negative support class (4%). As such, despite more limited contact with their network members, individuals in the Limited Negative

support class had other attributes that may have contributed to the lower PDA outcomes.

Alternate explanations are also possible for the worse substance use outcomes in the Limited Negative class. As individuals increase their substance using behaviors, there is a tendency to socially isolate (Havassy et al., 1991). It is possible, therefore, that individuals in the Limited Negative class, who had the highest probability of having more than three heavy users in their network, became more reclusive and thus reported less frequent contact with their network members. It is also conceivable that these individuals intentionally limited their contact with network members prior to seeking treatment, recognizing the negative impact of these network members on their substance using behaviors. It is possible that this Limited Negative class had worse PDA outcomes due to social isolation factors, despite having more limited contact with network members than individuals in the Frequent Negative class.

In line with the study's hypotheses, these findings suggest that among men, frequency of contact is a less relevant factor in substance use outcomes than is the nature of the support. That is, having more heavy users and fewer non-users in one's network and receiving encouragement to use from these individuals appears to play a more critical role. In this sense, the present results offer further evidence of the importance of having non-users in one's social network, particularly among men, even if individuals are not in frequent contact with these network members.

Understanding factors that contribute to substance use outcomes can enhance the design of treatment programs and interventions (Crits-Christoph et al., 2003; McKay et al., 2001). These results, therefore, may have clinical implications for designing interventions that target a substance-using individual's social networks. Specifically,

these data suggest that enhancing the composition of an individual's network to include persons who support abstinence is essential, even if the individual will not have frequent contact with the network members. Among men, for example, treatments should emphasize the importance of establishing a positive support network and the dangers of being surrounded by negative influences, even infrequently.

Additionally, as predicted, the influence of social networks on substance use is different among men than among women. Among women, those in the Frequent Negative class had the lowest PDA of all the groups, though this finding did not meet statistical significance. This is likely due to the smaller group sizes in the female sample and the attendant lack of power to detect significant differences. Nonetheless, in line with the study's hypotheses, the data suggested that women may be more influenced by the frequency of contact with their social network members. Whereas this was not the case among the men in this study, the importance of frequent contact might hold true among women. This may suggest that clinicians should differentially address the social support networks of substance using men and women, focusing principally on the types of individuals in men's networks, while perhaps focusing more intently on the frequency of contact of women with their network members. This hypothesis, however, should be explored further using a larger sample of women.

Finally, beyond the impact of social networks on substance use outcomes alone, prior research has also shown that among individuals with SUDs, social networks can influence one's QOL following treatment (Prisciandaro, DeSantis, & Bandyopadhyay, 2012). Longabaugh and colleagues highlight the importance of looking at outcomes beyond changes in one's drinking and examining differences in societal roles, such as

work status, as factors that are likely affected by treatment (Longabaugh et al., 1994). In accordance with this insight, work status was chosen as a QOL measure and a potential marker of treatment efficacy. This factor is of particular interest from a societal perspective, as the extent to which substance users contribute to the productivity of society largely depends on whether or not they maintain abstinence (Beattie, Longbaugh, & Fava, 1992). Contrary to the hypotheses, however, the results of this study did not reveal statistically significant differences in post-treatment working status between individuals in the different latent classes. The work data available for analysis were binary, which may have affected the ability to detect more subtle differences in work involvement and satisfaction. Future research can look beyond whether or not someone worked and focus on more articulated aspects of work engagement, performance, and functioning that may be more sensitive markers of QOL.

These findings should be considered in light of the study's limitations. One limitation, which is an artifact of secondary data analysis, was that variables were to an extent predetermined and often limited. For example, follow-up work status was the only QOL variable that was measured using comparable assessment instruments in the two samples. As such, future research might include additional QOL variables to explore further dimensions of life that may be impacted by substance use treatment and alcohol-specific social support networks. Secondly, the present study did not address changes in alcohol-specific social support that may have occurred over time, especially in the context of substance use treatment, and that may have resulted in a transformation in one's social support network. Thus, research evaluating changes in alcohol-specific social support that occur from treatment entry to the end of treatment and beyond can contribute to the

understanding of sex differences in alcohol-specific social support as they relate to substance use and QOL outcomes. A final limitation was the moderate sample size among women, which limited statistical power once the data were parsed into five latent classes. Additional evaluations using a larger sample may yield further insights, which could conceivably contribute to the development and implementation of targeted interventions focusing on sex differences.

In conclusion, this study offered further insight regarding the importance of social support in recovery from SUDs with a novel focus on sex differences, given the varying nature of social support and treatment outcomes for men and women. The results suggested that men are most negatively influenced by having more heavy users, fewer non-users, and by receiving encouragement to use from network members. Women, in contrast, appeared to be less affected overall by their alcohol-specific social networks, though there was a suggestion that frequent negative contact may lead to worse substance use outcomes. These findings highlight the importance of understanding the unique and individualized risk factors that predispose individuals with SUDs to poor outcomes and the benefit of developing tailored interventions. Directly addressing a patient's social network composition and network members' influences and engaging network members in treatment might engender improved outcomes through targeting factors that influence support for abstinence and substance using behaviors.

References

- Albertsen, K., Borg, V., & Oldenburg, B. (2006). A systematic review of the impact of work environment on smoking cessation, relapse and amount smoked. *Prev Med*, 43(4), 291-305.
- Albertsen, K., Hannerz, H., Borg, V., & Burr, H. (2004). Work environment and smoking cessation over a five-year period. *Scandinavian journal of public health*, 32(3), 164-171.
- Allen, J., Mattson, M., Miller, W., Tonigan, J., Connors, G., Rychtarik, R., . . . Litt, M. (1997). Matching alcoholism treatments to client heterogeneity: Project MATCH posttreatment drinking outcomes. *Journal of studies on alcohol*, 58(1), 7-29.
- APA. (1987). *Diagnostic and Statistical Manual of Mental Disorders: Dsm-3-R*: American Psychiatric Assoc.
- Arria, A. M., & McLellan, A. T. (2012). Evolution of concept, but not action, in addiction treatment. *Subst Use Misuse*, 47(8-9), 1041-1048.
- Association, A. P. (1994). *Diagnostic and statistical manual of mental disorders (DSM)*. Washington, DC: American psychiatric association, 143-147.
- Bates, M. E. (2000). Integrating Person-Centered and Variable-Centered Approaches in the Study of Developmental Courses and Transitions in Alcohol Use: Introduction to the Special Section. *Alcoholism: Clinical and Experimental Research*, 24(6), 878-881.
- Beattie, M. C., & Longabaugh, R. (1997). Interpersonal factors and post-treatment drinking and subjective wellbeing. *Addiction*, 92(11), 1507-1521.
- Beattie, M. C., & Longabaugh, R. (1999). General and alcohol-specific social support following treatment. *Addictive Behaviors*, 24(5), 593-606.
- Beattie, M. C., Longabaugh, R., Elliott, G., Stout, R. L., Fava, J., & Noel, N. E. (1993). Effect of the social environment on alcohol involvement and subjective well-being prior to alcoholism treatment. *Journal of Studies on Alcohol and Drugs*, 54(3), 283.
- Beattie, M. C., Longbaugh, R., & Fava, J. (1992). Assessment of alcohol-related workplace activities: development and testing of "Your Workplace". *Journal of studies on alcohol*, 53(5), 469-475.
- Bell, R. A. (1991). Gender, friendship network density, and loneliness. *Journal of Social Behavior & Personality*.
- Belle, D. (1987). Gender differences in the social moderators of stress. *Gender and stress*, 257, 277.
- Boardman, J. D., Finch, B. K., Ellison, C. G., Williams, D. R., & Jackson, J. S. (2001). Neighborhood disadvantage, stress, and drug use among adults. *Journal of health and social behavior*, 151-165.
- Brown, S. A., Vik, P. W., Patterson, T. L., Grant, I., & Schuckit, M. A. (1995). Stress, vulnerability and adult alcohol relapse. *Journal of Studies on Alcohol and Drugs*, 56(5), 538.
- Brown, T. G., Seraganian, P., Tremblay, J., & Annis, H. (2002). Process and outcome changes with relapse prevention versus 12-Step aftercare programs for substance abusers. *Addiction*, 97(6), 677-689.

- Buckman, J. F., Bates, M. E., & Cisler, R. A. (2007). Social networks and their influence on drinking behaviors: differences related to cognitive impairment in clients receiving alcoholism treatment. *Journal of Studies on Alcohol and Drugs*, 68(5), 738.
- Buckman, J. F., Bates, M. E., & Morgenstern, J. (2008). Social support and cognitive impairment in clients receiving treatment for alcohol-and drug-use disorders: a replication study. *Journal of Studies on Alcohol and Drugs*, 69(5), 738.
- Cobb, S. (1976). Social support as a moderator of life stress. *Psychosom Med*, 38(5), 300-314.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd edition)*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health psychology*, 7(3), 269.
- Cohen, S. (2004). Social relationships and health. *American psychologist*, 59(8), 676.
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological bulletin*, 98(2), 310.
- Crits-Christoph, P., Gibbons, M. B. C., Barber, J. P., Gallop, R., Beck, A. T., Mercer, D., . . . Frank, A. (2003). Mediators of outcome of psychosocial treatments for cocaine dependence. *Journal of consulting and clinical psychology*, 71(5), 918.
- Darke, S., Swift, W., Hall, W., & Ross, M. (1994). Predictors of injecting and injecting risk-taking behaviour among methadone maintenance clients. *Addiction*, 89(3), 311-316.
- Dobkin, P. L., Civita, M. D., Paraherakis, A., & Gill, K. (2002). The role of functional social support in treatment retention and outcomes among outpatient adult substance abusers. *Addiction*, 97(3), 347-356.
- Duncan, G. J., Boisjoly, J., Kremer, M., Levy, D. M., & Eccles, J. (2005). Peer effects in drug use and sex among college students. *Journal of abnormal child psychology*, 33(3), 375-385.
- Falkin, G. P., & Strauss, S. M. (2003). Social supporters and drug use enablers: A dilemma for women in recovery. *Addictive Behaviors*, 28(1), 141-155.
- Finney, J. W., & Moos, R. H. (1992). The long-term course of treated alcoholism: II. Predictors and correlates of 10-year functioning and mortality. *Journal of Studies on Alcohol and Drugs*, 53(2), 142.
- Florentine, R., Anglin, M. D., Gil-Rivas, V., & Taylor, E. (1997). Drug treatment: explaining the gender paradox. *Subst Use Misuse*, 32(6), 653-678.
- Fowler, J. S., Volkow, N. D., Kassed, C. A., & Chang, L. (2007). Imaging the addicted human brain. *Science & practice perspectives*, 3(2), 4-16.
- Frese, M. (1999). Social support as a moderator of the relationship between work stressors and psychological dysfunctioning: a longitudinal study with objective measures. *Journal of occupational health psychology*, 4(3), 179.
- Fuller, C. M., Vlahov, D., Latkin, C. A., Ompad, D. C., Celentano, D. D., & Strathdee, S. A. (2003). Social circumstances of initiation of injection drug use and early shooting gallery attendance: implications for HIV intervention among adolescent and young adult injection drug users. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 32(1), 86-93.

- Galea, S., Nandi, A., & Vlahov, D. (2004). The social epidemiology of substance use. *Epidemiologic reviews*, 26(1), 36-52.
- Havassy, B. E., Hall, S. M., & Wasserman, D. A. (1991). Social support and relapse: Commonalities among alcoholics, opiate users, and cigarette smokers. *Addictive Behaviors*, 16(5), 235-246.
- Havassy, B. E., Wasserman, D. A., & Hall, S. M. (1995). Social relationships and abstinence from cocaine in an American treatment sample. *Addiction*, 90(5), 699-710.
- House, J. S. (1987). *Social support and social structure*. Paper presented at the Sociological Forum.
- House, J. S., Kahn, R. L., McLeod, J. D., & Williams, D. (1985). Measures and concepts of social support.
- House, J. S., Landis, K. R., & Umberson, D. (1988). Social relationships and health. *Science*, 241(4865), 540-545.
- Humphreys, K., Moos, R. H., & Cohen, C. (1997). Social and community resources and long-term recovery from treated and untreated alcoholism. *Journal of Studies on Alcohol and Drugs*, 58(3), 231.
- Johnsen, E., & Herringer, L. G. (1993). A note on the utilization of common support activities and relapse following substance abuse treatment. *The Journal of psychology*, 127(1), 73-77.
- Kadden, R. M. (1995). *Cognitive-behavioral coping skills therapy manual: A clinical research guide for therapists treating individuals with alcohol abuse and dependence*: DIANE Publishing.
- Kadden, R. M., Carbonari, J., Litt, M., Tonigan, S., & Zweben, A. (1998). Matching alcoholism treatments to client heterogeneity: Project MATCH three-year drinking outcomes. *Alcoholism, clinical and experimental research*, 22, 1300-1311.
- Kelley, J., & Renner, J. (2008). Alcohol-related disorders. *The MGH Textbook of Comprehensive Clinical Psychiatry*. Philadelphia: Mosby-Elsevier.
- Kendler, K. S., Myers, J., & Prescott, C. A. (2005). Sex differences in the relationship between social support and risk for major depression: a longitudinal study of opposite-sex twin pairs. *American Journal of Psychiatry*, 162(2), 250-256.
- Kidorf, M., Stitzer, M. L., & Brooner, R. K. (1995). Characteristics of methadone patients responding to take-home incentives. *Behavior Therapy*, 25(1), 109-121.
- Kingree, J. (1995). Understanding gender differences in psychosocial functioning and treatment retention. *The American journal of drug and alcohol abuse*, 21(2), 267-281.
- Koloski, N. A., Talley, N. J., & Boyce, P. M. (2001). Predictors of health care seeking for irritable bowel syndrome and nonulcer dyspepsia: a critical review of the literature on symptom and psychosocial factors. *The American journal of gastroenterology*, 96(5), 1340-1349.
- Levy, S. M., Herberman, R. B., Whiteside, T., Sanzo, K., Lee, J., & Kirkwood, J. (1990). Perceived social support and tumor estrogen/progesterone receptor status as predictors of natural killer cell activity in breast cancer patients. *Psychosom Med*, 52(1), 73-85.

- Litt, M. D., Kadden, R. M., Kabela-Cormier, E., & Petry, N. M. (2009). Changing network support for drinking: network support project 2-year follow-up. *Journal of consulting and clinical psychology*, 77(2), 229.
- Little, R. J., & Rubin, D. B. (1987). *Statistical analysis with missing data*: John Wiley & Sons.
- Longabaugh, R., Beattie, M., Noel, N., Stout, R., & Malloy, P. (1993). The effect of social investment on treatment outcome. *Journal of Studies on Alcohol and Drugs*, 54(4), 465.
- Longabaugh, R., Mattson, M. E., Connors, G. J., & Cooney, N. L. (1994). Quality of life as an outcome variable in alcoholism treatment research. *Journal of Studies on Alcohol, Supplement*(12), 119-129.
- Longabaugh, R., Wirtz, P. W., Beattie, M. C., Noel, N., & Stout, R. (1995). Matching treatment focus to patient social investment and support: 18-month follow-up results. *Journal of consulting and clinical psychology*, 63(2), 296.
- Longabaugh, R., Wirtz, P. W., Zweben, A., & Stout, R. L. (1998). Network support for drinking, Alcoholics Anonymous and long-term matching effects. *Addiction*, 93(9), 1313-1333.
- Manuel, J. K., McCrady, B. S., Epstein, E. E., Cook, S., & Tonigan, J. S. (2007). The pretreatment social networks of women with alcohol dependence. *Journal of Studies on Alcohol and Drugs*, 68(6), 871.
- Marlatt, G. A. (1985). Cognitive factors in the relapse process. *Relapse prevention*, 128-200.
- McCrady, B. S. (2004). To have but one true friend: implications for practice of research on alcohol use disorders and social network. *Psychology of Addictive Behaviors*, 18(2), 113.
- McCrady, B. S., Epstein, E. E., & Sell, R. D. (2003). Theoretical bases of family approaches to substance abuse treatment. *Treatment of substance abusers: Theory and technique*, 112-139.
- McCrady, B. S., Hayaki, J., Epstein, E. E., & Hirsch, L. S. (2002). Testing hypothesized predictors of change in conjoint behavioral alcoholism treatment for men. *Alcoholism: Clinical and Experimental Research*, 26(4), 463-470.
- McCutcheon, A. L. (1987). Latent class analysis. Quantitative applications in the social sciences series no. 64: Thousand Oaks, CA: Sage Publications.
- McKay, J. R., Foltz, C., Stephens, R. C., Leahy, P. J., Crowley, E. M., & Kissin, W. (2005). Predictors of alcohol and crack cocaine use outcomes over a 3-year follow-up in treatment seekers. *Journal of Substance Abuse Treatment*, 28(2), S73-S82.
- McKay, J. R., Merikle, E., Mulvaney, F. D., Weiss, R. V., & Koppenhaver, J. M. (2001). Factors accounting for cocaine use two years following initiation of continuing care. *Addiction*, 96(2), 213-225.
- McKay, J. R., Rutherford, M. J., Cacciola, J. S., Kabasakalian-McKay, R., & Alterman, A. I. (1996). Gender differences in the relapse experiences of cocaine patients. *The Journal of nervous and mental disease*, 184(10), 616-622.
- McLellan, A. T. (2009). Public accountability in addiction treatment. *Lancet*, 374(9697), 1220-1221. doi: 10.1016/S0140-6736(09)61764-5

- McLellan, A. T., Lewis, D. C., O'Brien, C. P., & Kleber, H. D. (2000). Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. *Jama*, 284(13), 1689-1695.
- Miller, W. R. (1995). *Motivational enhancement therapy manual: A clinical research guide for therapists treating individuals with alcohol abuse and dependence*: DIANE Publishing.
- Miller, W. R. (1996). *Form 90: A Structured Assessment Interview for Drinking and Related Behaviors: Test Manual*: US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism.
- Miller, W. R., & Del Boca, F. K. (1994). Measurement of drinking behavior using the Form 90 family of instruments. *Journal of Studies on Alcohol and Drugs*(12), 112.
- Mohr, C. D., Aversa, S., Kenny, D. A., & Del Boca, F. K. (2001). "Getting by (or getting high) with a little help from my friends": An examination of adult alcoholics' friendships. *Journal of Studies on Alcohol and Drugs*, 62(5), 637.
- Moos, R. H. (2007). Theory-based processes that promote the remission of substance use disorders. *Clinical psychology review*, 27(5), 537-551.
- Moos, R. H. (2011). Processes that promote recovery from addictive disorders *Addiction recovery management* (pp. 45-66): Springer.
- Moos, R. H., & Moos, B. S. (1984). The process of recovery from alcoholism: III. Comparing functioning in families of alcoholics and matched control families. *Journal of Studies on Alcohol and Drugs*, 45(02), 111.
- Moos, R. H., & Moos, B. S. (1994). *Life Stressors and Social Resources Inventory-Adult Form: Professional manual*: PAR Odessa, FL.
- Morgenstern, J., Frey, R. M., McCrady, B. S., Labouvie, E., & Neighbors, C. J. (1996). Examining mediators of change in traditional chemical dependency treatment. *Journal of Studies on Alcohol and Drugs*, 57(1), 53.
- Muthén, B. O. (2004). 1998-2004. Mplus technical appendices. *Los Angeles, CA: Muthén & Muthén*.
- Naimi, T. S., Brewer, R. D., Mokdad, A., Denny, C., Serdula, M. K., & Marks, J. S. (2003). Binge drinking among US adults. *Jama*, 289(1), 70-75.
- Nathan, P. E. (1986). Outcomes of treatment for alcoholism: Current data. *Annals of Behavioral Medicine*.
- Neaigus, A., Miller, M., Friedman, S. R., Hagen, D. L., Sifaneck, S. J., Ildefonso, G., & Des Jarlais, D. C. (2001). Potential risk factors for the transition to injecting among non-injecting heroin users: a comparison of former injectors and never injectors. *Addiction*, 96(6), 847-860.
- Noone, M., Dua, J., & Markham, R. (1999). Stress, cognitive factors, and coping resources as predictors of relapse in alcoholics. *Addictive Behaviors*, 24(5), 687-693.
- Nowinski, J., Baker, S., & Carroll, K. M. (1992). *Twelve step facilitation therapy manual: A clinical research guide for therapists treating individuals with alcohol abuse and dependence* (Vol. 1): US Dept. of Health and Human Services, Public Health Service, Alcohol, Drug Abuse, and Mental Health Administration, National Institute on Alcohol Abuse and Alcoholism.

- Olson, D. A., & Shultz, K. S. (1994). Gender Differences in the Dimensionality of Social Support1. *Journal of Applied Social Psychology*, 24(14), 1221-1232.
- Orth-Gomér, K., & Undén, A.-L. (1990). Type A behavior, social support, and coronary risk: Interaction and significance for mortality in cardiac patients. *Psychosom Med*, 52(1), 59-72.
- Pagan, J. L., Rose, R. J., Viken, R. J., Pulkkinen, L., Kaprio, J., & Dick, D. M. (2006). Genetic and environmental influences on stages of alcohol use across adolescence and into young adulthood. *Behavior genetics*, 36(4), 483-497.
- Peyser, D. B., Jennifer ; Heiss Sydney; Bates, Marsha E. (2014). Life Satisfaction After Substance Abuse Treatment May Be Linked To Quality Of Social Support.
- Prisciandaro, J. J., DeSantis, S. M., & Bandyopadhyay, D. (2012). Simultaneous modeling of the impact of treatments on alcohol consumption and quality of life in the COMBINE study: a coupled hidden Markov analysis. *Alcoholism: Clinical and Experimental Research*, 36(12), 2141-2149.
- Project MATCH Research Group. (1997). Matching Alcoholism Treatments to Client Heterogeneity: Project MATCH Posttreatment Drinking Outcomes. *Journal of studies on alcohol*, 58, 7-29.
- Reed, B. G. (1985). Drug misuse and dependency in women: The meaning and implications of being considered a special population or minority group. *Subst Use Misuse*, 20(1), 13-62.
- Rosenquist, J. N., Murabito, J., Fowler, J. H., & Christakis, N. A. (2010). The spread of alcohol consumption behavior in a large social network. *Annals of Internal Medicine*, 152(7), 426-433.
- Rubin, A., Stout, R. L., & Longabaugh, R. (1996). Gender differences in relapse situations. *Addiction*, 91(12s1), 111-120.
- Siddall, J. W., & Conway, G. L. (1988). Interactional variables associated with retention and success in residential drug treatment. *Subst Use Misuse*, 23(12), 1241-1254.
- Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back *Measuring alcohol consumption* (pp. 41-72): Springer.
- Spitzer, R. L., Williams, J. B., Gibbon, M., & First, M. B. (1992). The structured clinical interview for DSM-III-R (SCID): I: history, rationale, and description. *Archives of General Psychiatry*, 49(8), 624-629.
- Stout, R. L., Kelly, J. F., Magill, M., & Pagano, M. E. (2012). Association between social influences and drinking outcomes across three years. *Journal of Studies on Alcohol and Drugs*, 73(3), 489.
- Toumbourou, J. W., Hamilton, M., & Fallon, B. (1998). Treatment level progress and time spent in treatment in the prediction of outcomes following drug-free therapeutic community treatment. *Addiction*, 93(7), 1051-1064.
- Tracy, S. W., Kelly, J. F., & Moos, R. H. (2005). The influence of partner status, relationship quality and relationship stability on outcomes following intensive substance-use disorder treatment. *Journal of Studies on Alcohol and Drugs*, 66(4), 497.
- Uchino, B. N., Cacioppo, J. T., & Kiecolt-Glaser, J. K. (1996). The relationship between social support and physiological processes: a review with emphasis on underlying mechanisms and implications for health. *Psychological bulletin*, 119(3), 488.

- Walsh, P. M., Carrillo, P., Flores, G., Masuet, C., Morchon, S., & Ramon, J. M. (2007). Effects of partner smoking status and gender on long term abstinence rates of patients receiving smoking cessation treatment. *Addictive Behaviors*, 32(1), 128-136.
- Walters, G. D. (2000). Spontaneous Remission from Alcohol, Tobacco, and Other Drug Abuse: Seeking Quantitative Answers to Qualitative Questions 1*. *The American journal of drug and alcohol abuse*, 26(3), 443-460.
- Wasserman, D. A., Stewart, A. L., & Delucchi, K. L. (2001). Social support and abstinence from opiates and cocaine during opioid maintenance treatment. *Drug and alcohol dependence*, 65(1), 65-75.
- Westreich, L., Heitner, C., Cooper, M., Galanter, M., & Guedj, P. (1997). Perceived social support and treatment retention on an inpatient addiction treatment unit. *The American Journal on Addictions*, 6(2), 144-149.
- Zywiak, W. H., Longabaugh, R., & Wirtz, P. W. (2002). Decomposing the relationships between pretreatment social network characteristics and alcohol treatment outcome. *Journal of Studies on Alcohol and Drugs*, 63(1), 114.

Tables

Table 1: Demographic characteristics of Project MATCH and Project ARC

	MATCH (N=1726)	ARC (N=122)
Age	40.24 \pm 11.0	33.6 \pm 9.4
Years of Education	13.27 \pm 2.11	13.06 \pm 2.6
Gender (% female)	24.4	41
Ethnicity (%)		
Caucasian	80	65
African American	10	24
Hispanic/Latino	8	6
Other	2	5
Employed (%)	49.7*	50

Note. * = Full or part time employment

Table 2: Important People and Activities Instrument

IPA Section 1 [Up to 12 network members]	
Questions	Scale
Type of member (gender, years known)	Family, friend, etc.
Sex	Male = 1, female = 2
Years Known	1, 2 etc.
Frequency of contact *	1 = once, 7 = daily
Network member's drinking status *	1 = recovering, 5 = heavy user
Network member's drug use status *	1 = recovering, 5 = heavy user
Reaction to client entering treatment *	1 = opposed, 5 = support
IPA Section 2 [Up to 4 (PM) or (5) Important People Past 6 months]	
Questions	Scale
How much client likes network member	1 = not at all, 6 = extremely
Importance of network member	1 = not at all, 6 = extremely
Reaction to client's drinking/using drugs *	1 = left/made you leave, 5 = encouraged
Reaction to client's <u>not</u> drinking/using drugs *	1 = left/made you leave, 5 = encouraged

Note. * = Included in Latent Class Analysis

Table 3: Men Latent Class Analysis Fit Statistics

Models	Free parameters	BIC	Difference in BIC between models	Entropy
1 class	8	10,297.08		1
2 class	17	9,968.39	328.69	0.675
3 class	26	9,725.12	243.27	0.773
4 class	35	9,671.74	53.37	0.817
5 class	44	9,697.49	-25.75	0.856

Notes. **Bold** = optimal model. BIC = Bayesian Information Criteria.

Table 4: Men Group Sizes

Models	Frequent Positive	Frequent Negative	Limited Positive	Limited Negative	"Other"
3 class	161 (12%)		912 (66%)	306 (22%)	
4 class	218 (16%)	165 (12%)	788 (57%)	208 (15%)	
5 class	188 (14%)	76 (6%)	481 (35%)	242 (18%)	392 (28%)

Notes. N = 1379. Data reported as group sizes (percentage of the total sample).

Table 5: Women Latent Class Analysis Fit Statistics

Models	Free parameters	BIC	Difference in BIC between models	Entropy
1 class	8	3,726.21		
2 class	17	3,615.23	110.98	0.612
3 class	26	3,603.09	12.13	0.667
4 class	35	3,619.14	-16.05	0.786
5 class	44	3,649.05	-29.91	0.832

Notes. **Bold** = optimal model. BIC = Bayesian Information Criteria.

Table 6: Women Group Sizes

Models	Frequent Positive	Frequent Negative	Limited Positive	Limited Negative	"Other"
3 class	97 (21%)		267 (57%)	105 (22%)	
4 class	40 (9%)		213 (45%)	57 (12%)	159 (34%)
5 class	79 (17%)	15 (3%)	169 (36%)	57 (12%)	149 (32%)

Notes. N = 469. Data reported as group sizes (percentage of the total sample).

Table 7: Percent Days Abstinent at Baseline and Follow-up for Men and Women

Assessment point	Frequent Positive	Limited Positive	Frequent Negative	Limited Negative	Other
Men					
Treatment Entry	34.4 ± 31.6	32.0 ± 30.6	26.9 ^b ± 29.2	24.1 ^{ab} ± 26.8	
52-week follow-up	79.2 ± 30.0	77.5 ± 29.8	76.6 ± 30.4	68.8 ^a ± 33.8	
Women					
Treatment Entry	38.3 ± 35.0	40.5 ± 33.7	17.6 ^{cde} ± 28.4	41.8 ± 34.7	34.6 ± 31.2
52-week follow-up	80.4 ± 28.3	80.2 ± 28.4	74.3 ± 34.6	79.5 ± 29.1	77.6 ± 26.4

Notes. Variables reported as mean ± standard deviation. ^a Small effect size vs. Limited Positive; ^b Small effect size vs. Frequent Positive; ^c Medium effect size vs. Limited Positive; ^d Medium effect size vs. Frequent Positive; ^e Medium effect size vs. Limited Negative.

Table 8: Work Status by Latent Class Membership and Sex

Sex	Frequent Positive	Limited Positive	Frequent Negative	Limited Negative	Other
Men	138 (63%)	522 (66%)	111 (67%)	150 (72%)	
Women	39 (49%)	91 (54%)	5 (33%)	36 (63%)	87 (58%)

Notes. Data reported as number of individuals employed (percentage of class).

Figures

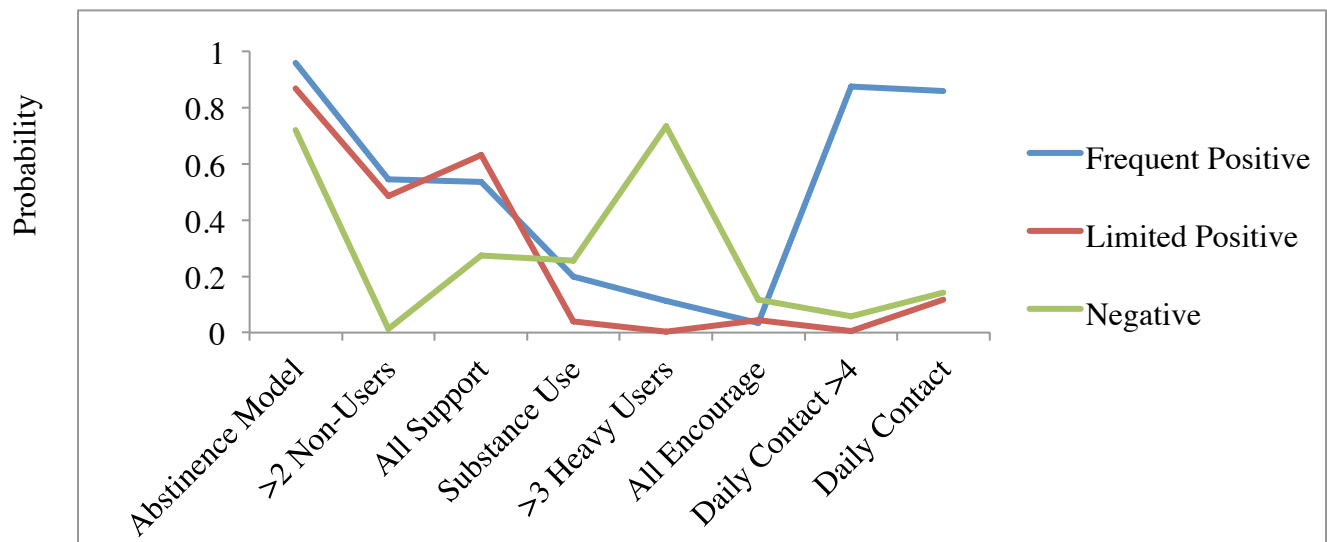


Figure 1. Men three class solution. The latent class analysis probability of a given male within the combined MATCH and ARC sample endorsing each of eight binary variables derived from the Important People and Activities instrument. Three unique (statistically independent) classes of social support endorsement probabilities were identified at baseline: two with support for abstinence that differed in the amount of contact the client had with his/her network members (frequent positive and limited positive support) and one with support for substance use (negative support).

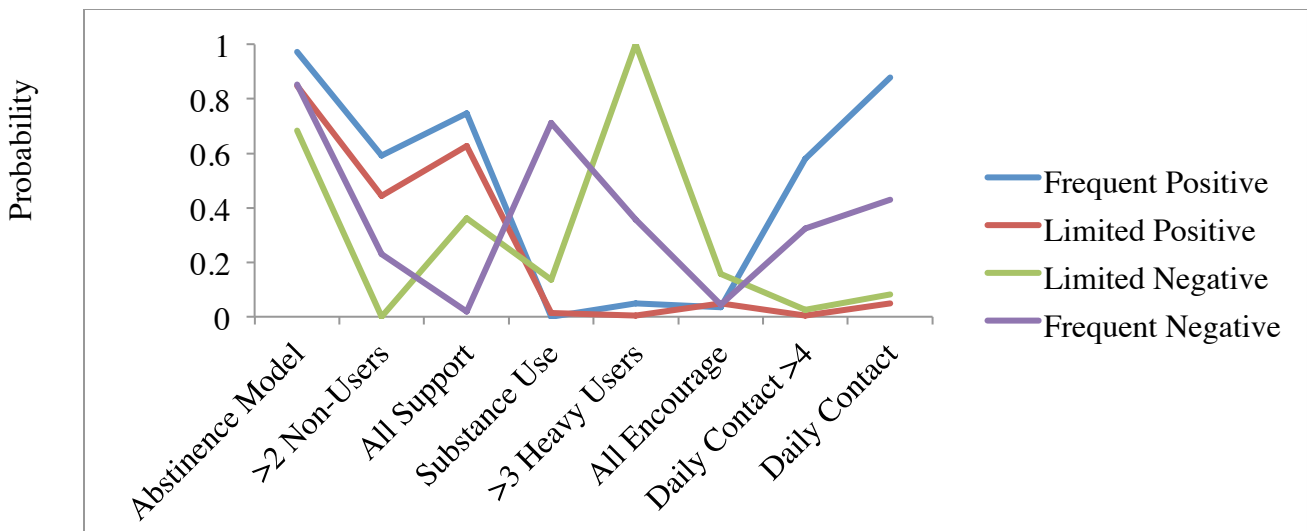


Figure 2a. Men four class solution. The latent class analysis probability of a given male within the combined MATCH and ARC sample endorsing each of eight binary variables derived from the Important People and Activities instrument. Four unique (statistically independent) classes of social support endorsement probabilities were identified: two with support for abstinence that differed in the amount of contact the client had with his/her network members (frequent positive and limited positive support) and two with support for substance use that differed in the amount of contact the client had with his/her network members (frequent negative and limited negative support).

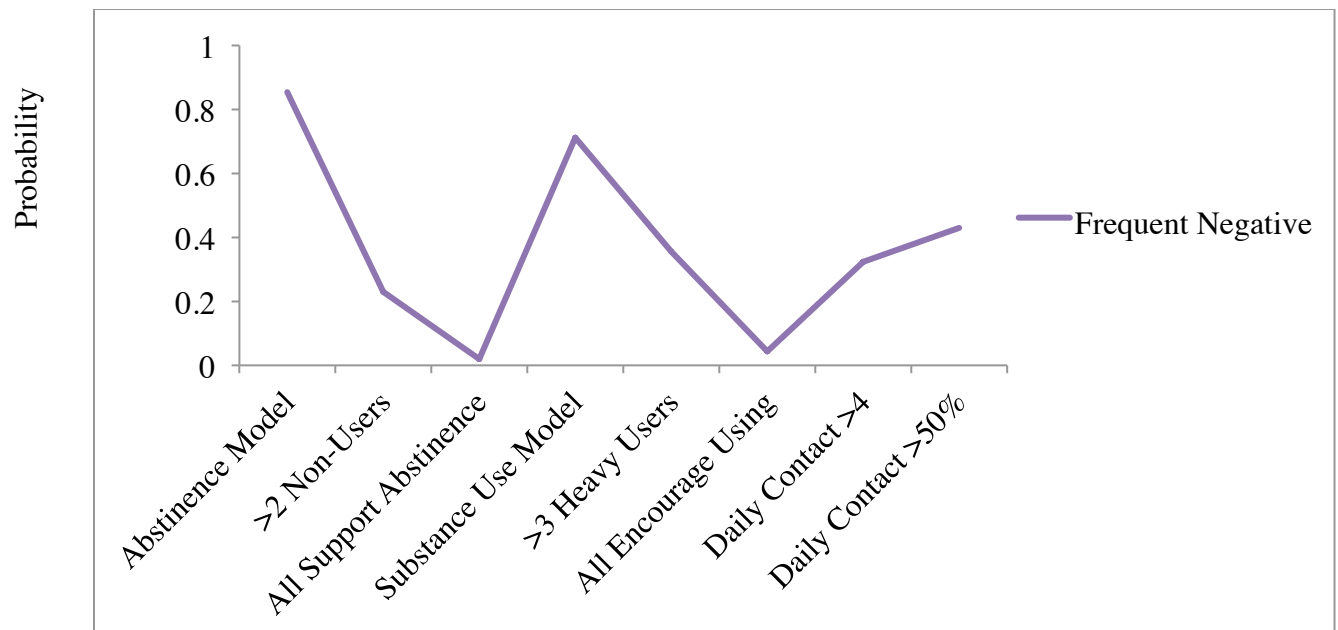


Figure 2b. Men fourth class. This class, termed Frequent Negative support, emerged when the data were divided among four classes. This class included clients who had a high probability of endorsing having a substance use model (71%), having more than three heavy users in their network (36%), and having daily contact with network members (43%).

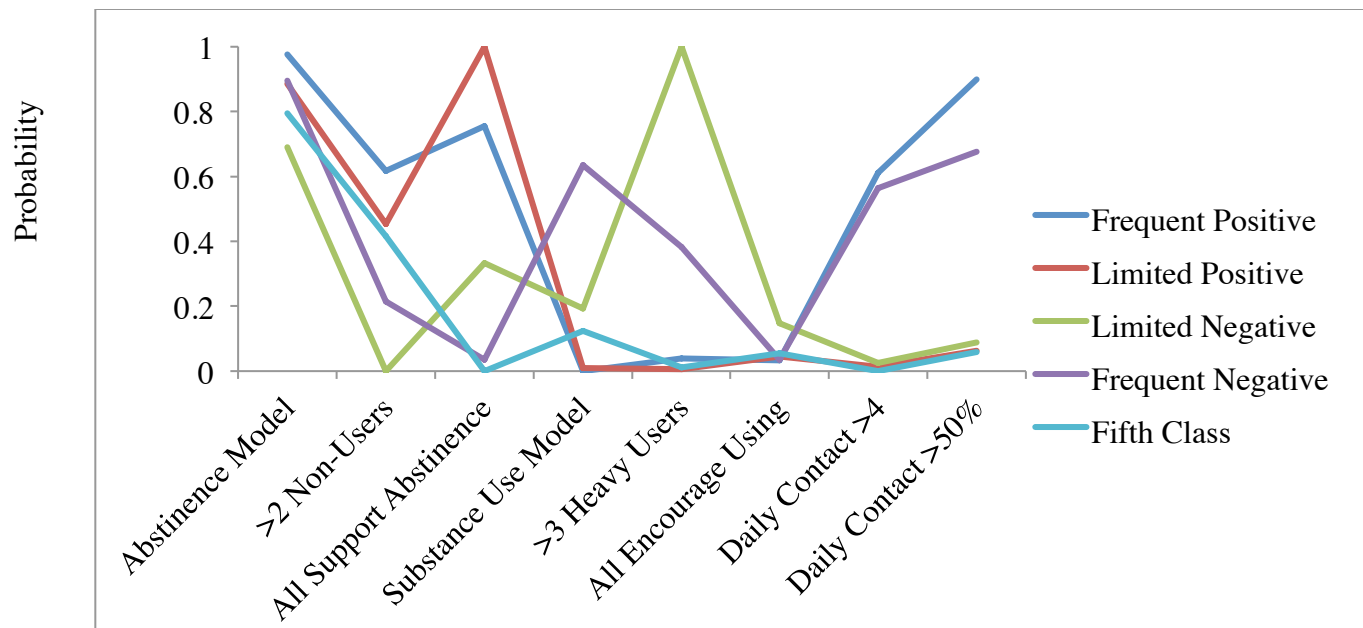


Figure 3a. Men five class solution. The latent class analysis probability of a given male within the combined MATCH and ARC sample endorsing each of eight binary variables derived from the Important People and Activities instrument. Five unique (statistically independent) classes of social support endorsement probabilities were identified: two with support for abstinence that differed in the amount of contact the client had with his/her network members (frequent positive and limited positive support); two with support for substance use that differed in the amount of contact the client had with his/her network members (frequent negative and limited negative support); and one described in Figure 3b.

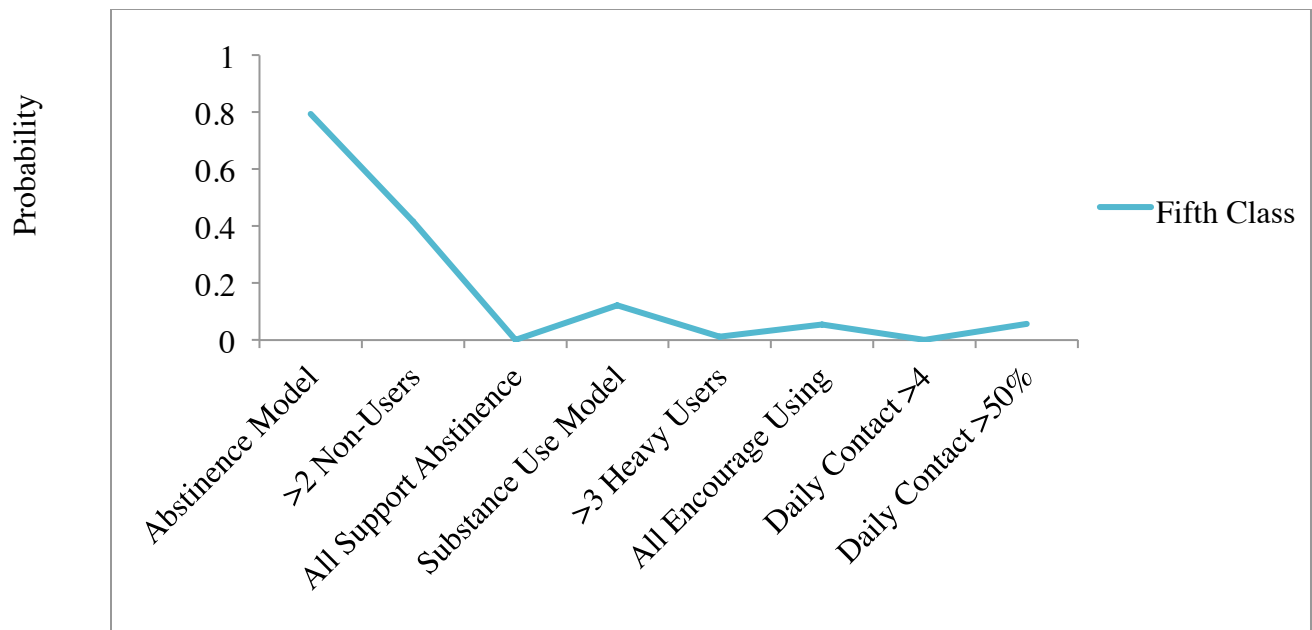


Figure 3b. Men fifth class. This class included clients who had a high probability of endorsing having an abstinence model (80%) and having greater than two non-users in their networks (42%). These individuals also had a low probability of endorsing having frequent contact with their network members (0%) and having network members who supported their abstinence (0%).

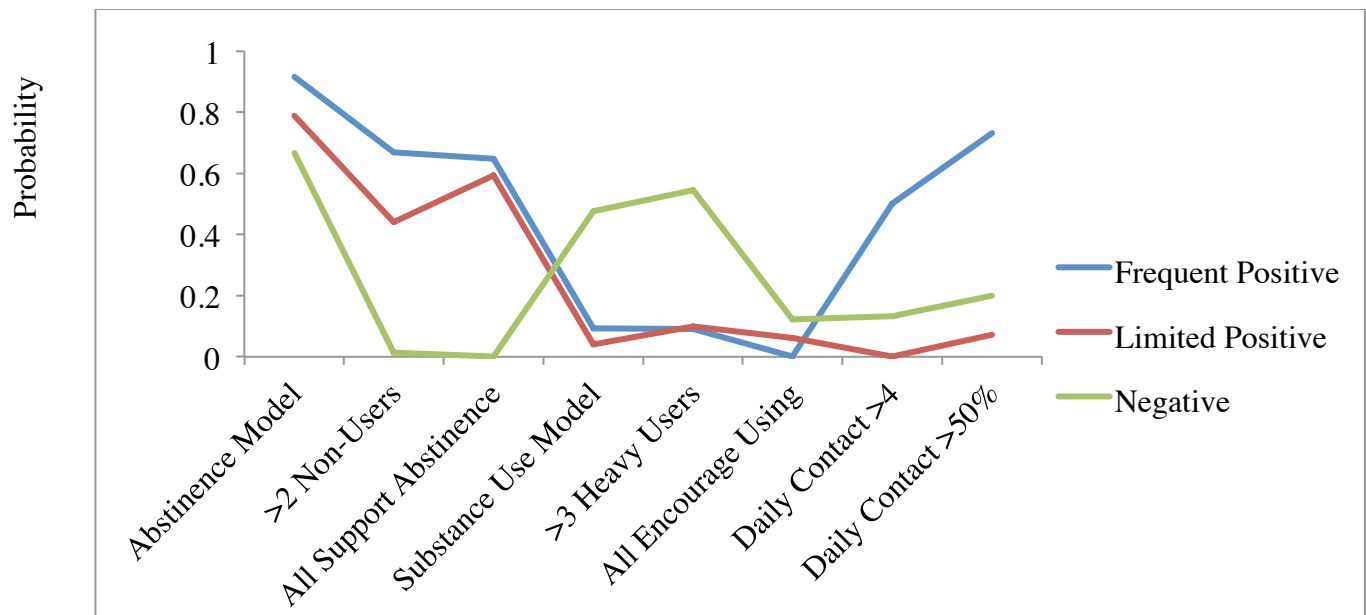


Figure 4. Women three class solution. The latent class analysis probability of a given female within the combined MATCH and ARC sample endorsing each of eight binary variables derived from the Important People and Activities instrument. Three unique (statistically independent) classes of social support endorsement probabilities were identified at baseline: two with support for abstinence that differed in the amount of contact the client had with his/her network members (frequent positive and limited positive support) and one with support for substance use (negative support).

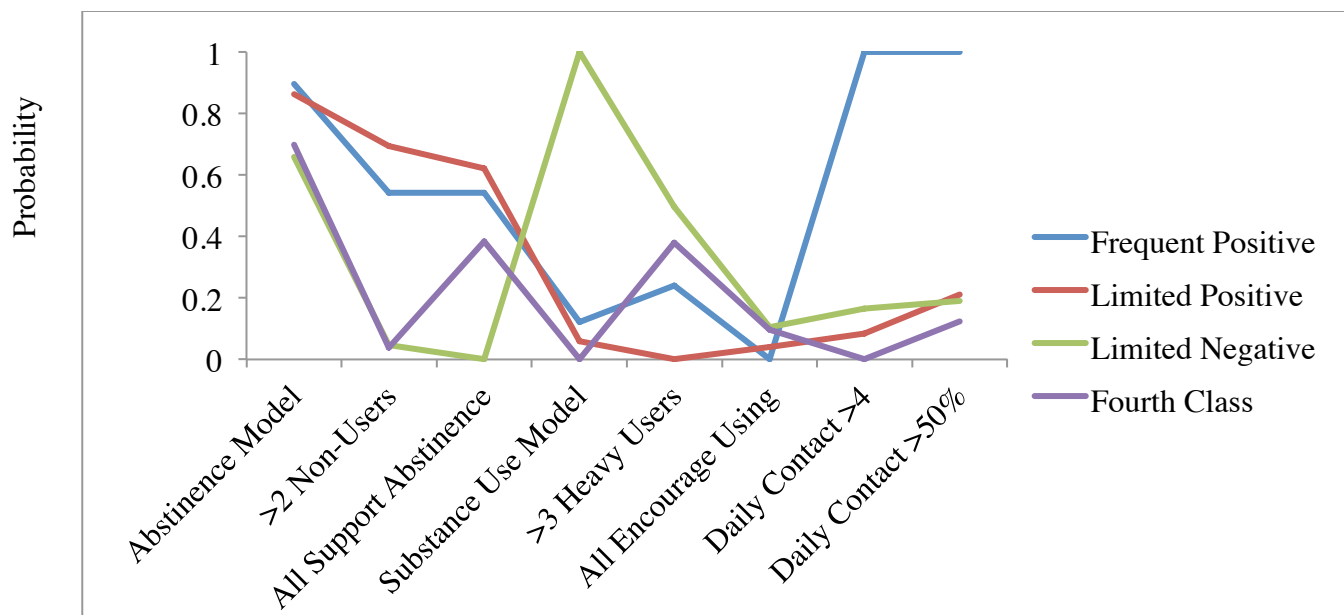


Figure 5a. Women four class solution. The latent class analysis probability of a given female within the combined MATCH and ARC sample endorsing each of eight binary variables derived from the Important People and Activities instrument. Four unique (statistically independent) classes of social support endorsement probabilities were identified: two with support for abstinence that differed in the amount of contact the individual had with his/her network members (frequent positive and limited positive support), one with support for substance use that had limited contact with their network members, and a fourth class described in Figure 5b.

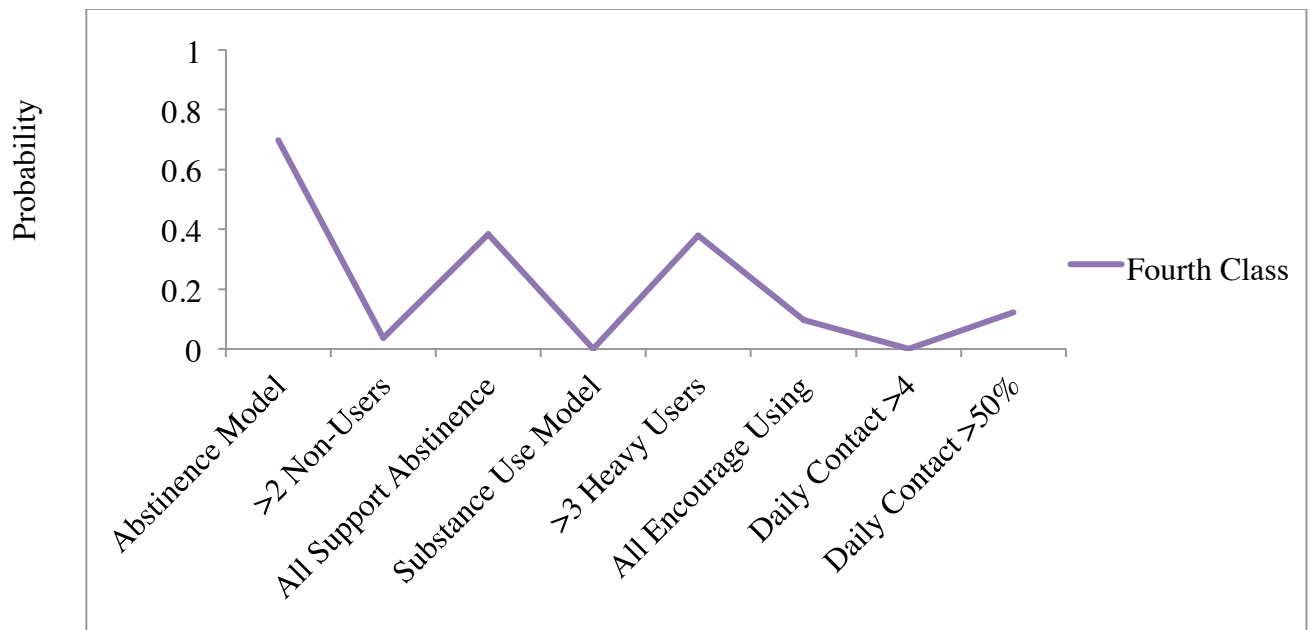


Figure 5b. Women fourth class. This class included clients who endorsed an equal probability of having >3 heavy users in their network (38%) and having network members who supported their abstinence (38%).

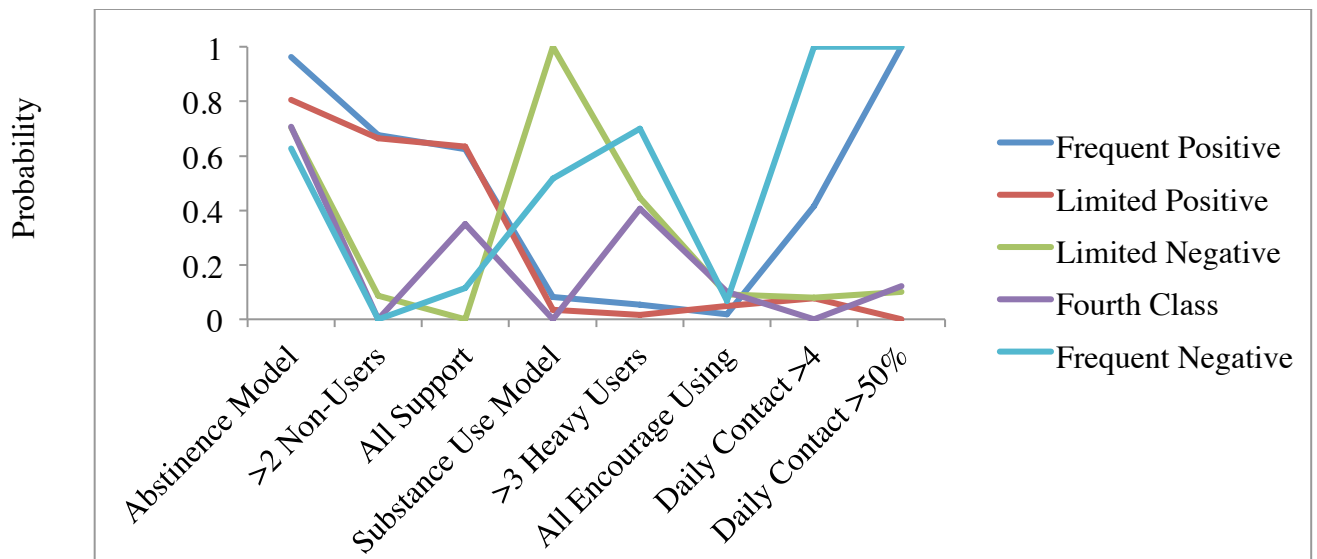


Figure 6a. Women five class solution. The latent class analysis probability of a given female within the combined MATCH and ARC sample endorsing each of eight binary variables derived from the Important People and Activities instrument. Five unique (statistically independent) classes of social support endorsement probabilities were identified: two with support for abstinence that differed in the amount of contact the individual had with his/her network members (frequent positive and limited positive support); two with support for substance use that differed in the amount of contact the individual had with his/her network members (frequent negative and limited negative support); and a fourth class with a high likelihood of endorsing having >3 heavy users in the network who also support the client's abstinence.

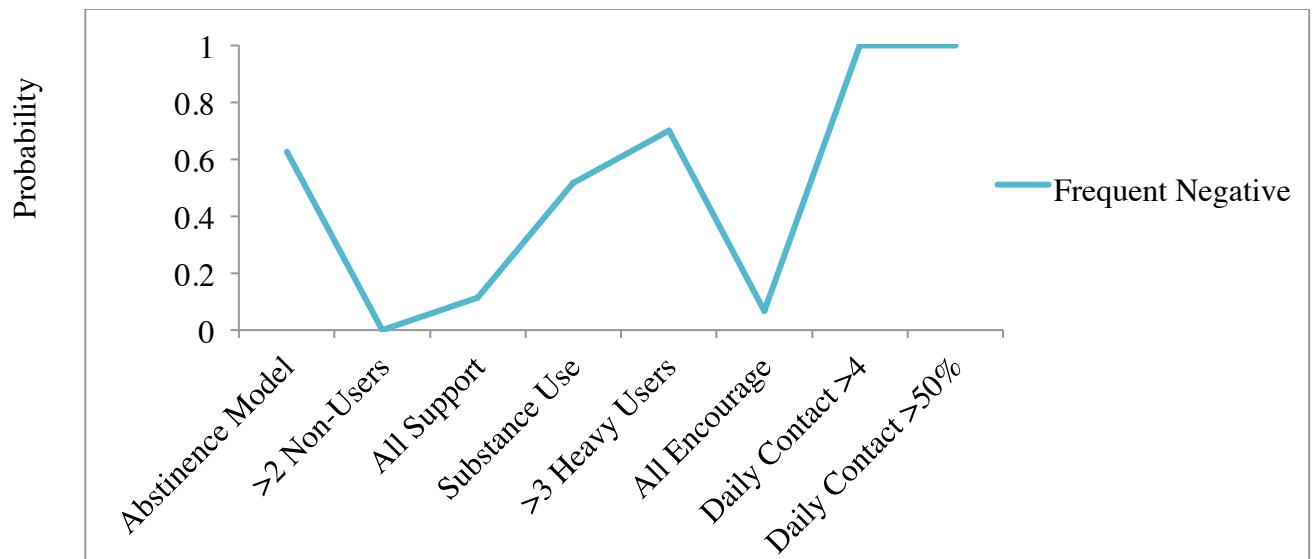


Figure 6b. Women fifth class. This class, termed Frequent Negative, included clients with a high likelihood of having a substance use model (52%), having greater than three heavy users in their network (70%), having no greater than two non-users in their network (0%), having few abstinence supporters (12%), and having high levels of contact with network members (100%).

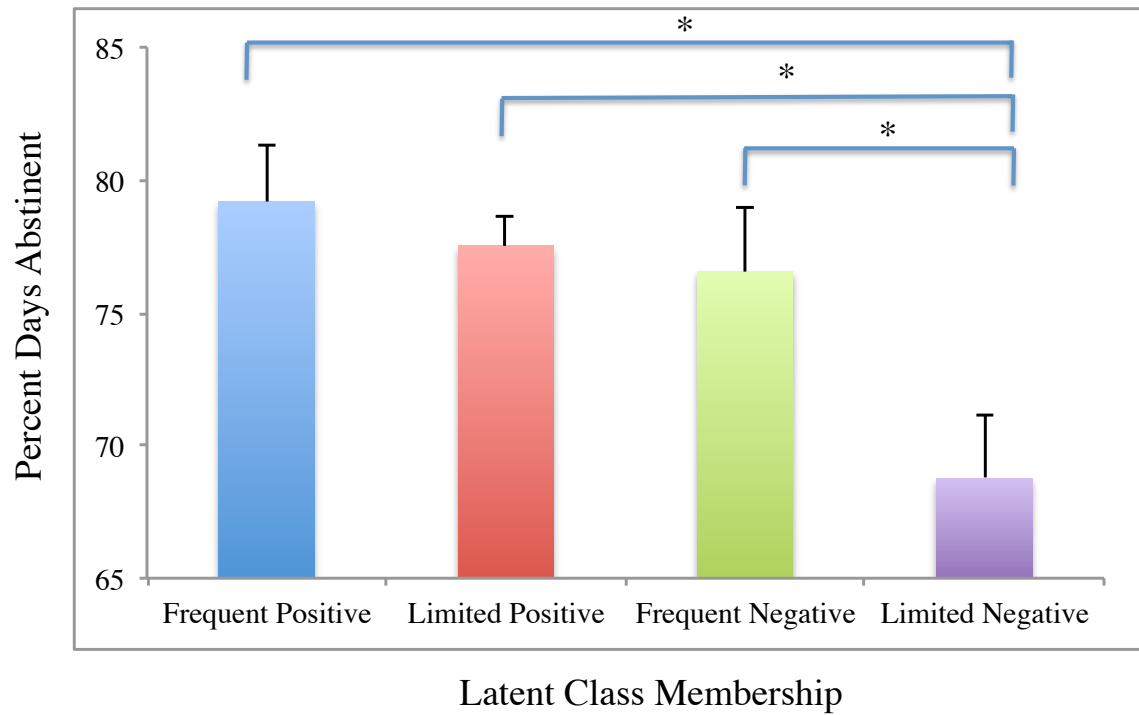


Figure 7. Percent days abstinent for men by latent class membership at 12-months follow-up. Individuals in the Limited Negative support group had a lower probability of maintaining abstinence at the 12-month follow-up as compared with individuals in the three other support classes.

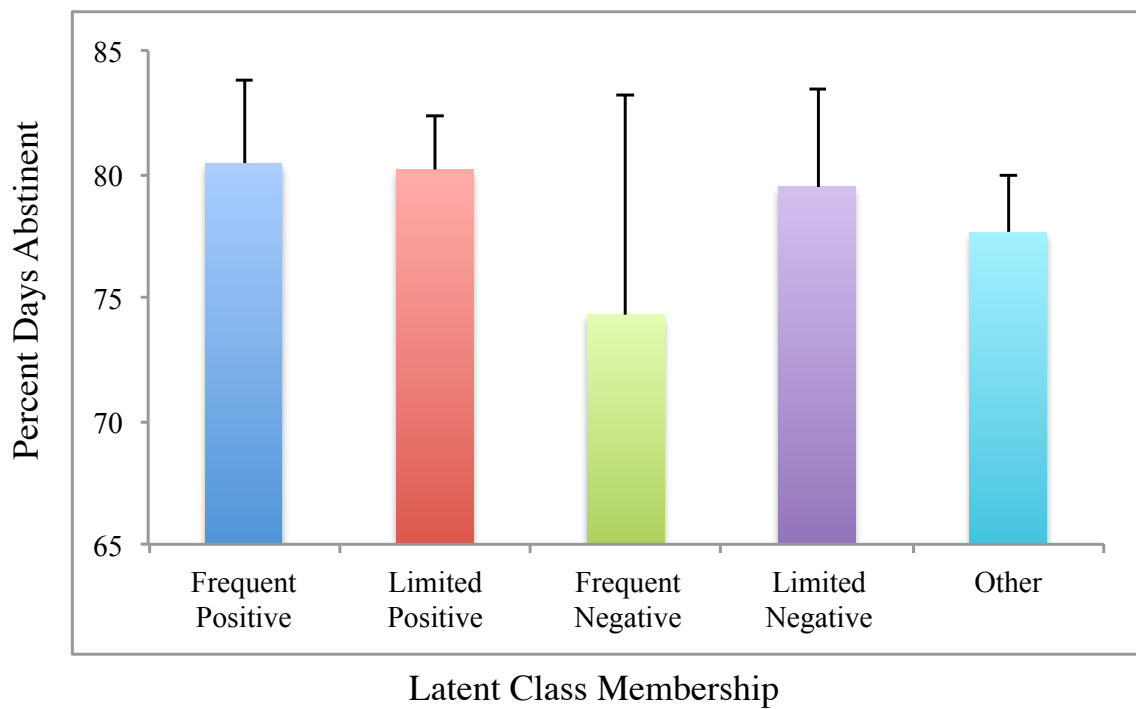


Figure 8. Percent days abstinent for women by latent class membership at 12-months follow-up. Non-significant differences were found between the five latent social support classes.

Appendix

Important People and Activities Inventory.

If subject answers "3" or less for Amount of Contact, do not collect rest of info.							
Name	Relationship	Sex	Years known	Amount of Contact	Drinking Status	Drug Use Status	How does this person feel about your getting alcohol treatment?
First and last initial only	1= spouse 2=children 3=parent 4=sibling 5=other/family 6=ex-intimate 7=boy/girlfriend 8=friend/work friend 9=AA/NA 10=other friend 11=co-worker 12=other	1=male 2=female		7=daily 6= 3-6 times a week 5=once or twice a week 4=every other week 3=about once a month 2=less than monthly 1=once in the past 6 months 0=not at all in the past 6 months	5=heavy drinker 4=moderate drinker 3=light drinker 2=abstainer 1=recovering alcoholic 7=don't know	5=heavy drug user 4=moderate drug user 3=light drug user 2=abstainer 1=recovering drug addict 7=don't know	5=Supported my getting treatment 4= Supported my getting treatment (though might prefer that I did it differently) 3=Neutral: Didn't say 2= Mixed: Sometimes supported, sometimes opposed 1=Opposed my getting treatment 7=Didn't know I got treatment
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							

Of those people you have listed, please name the five that you think have been the most important to you during the past 6 months. These would be people who have had an impact on your life, whether you liked them or not. Note: ALL QUESTIONS APPLY TO THE PAST 6 MONTHS.

Of those people you listed, who are the most important? Name (or initials)	How much have you liked this person? 7=Totally Liked 6=Very Much 5=Quite a Bit 4=Mixed Feelings 3=Disliked 2=Disliked a Lot 1=Totally Disliked	How important has this person been to you? 6=Extremely Important 5=Very Important 4=Important 3=Somewhat Important 2=Not Very Important 1=Not at all Important	How has this person reacted to your drinking/using drugs? 5= Encouraged 4=Accepted 3=Neutral 2=Didn't Accept 1=Left, or made you leave when you're drinking/using 9=Don't know	How has this person reacted to your not drinking/using drugs? 5= Encouraged 4=Accepted 3=Neutral 2=Didn't Accept 1=Left, or made you leave when you're drinking/using 9=Don't know
1.				
2.				
3.				
4.				