

**DRUG AND/OR ALCOHOL ABUSE OUTCOME IN MENTAL ILLNESS:
THE MEDIATING ROLE OF SOCIAL SUPPORT**

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ABSTRACT

Introduction: The present study examined whether social support served as a mediator (i.e., an apparent causal mechanism) for the relationship between mental illness (MI) and drug and/or alcohol abuse (SA).

Objective: This study's objective was to determine the role of social support as a potential mediator in the relationship between mental illness and drug and/or alcohol abuse.

Methods: We utilized data from a randomized controlled trial (RCT), conducted on individuals at risk for HIV in Philadelphia jails by following 600 study participants coming out of jails. Out of these 600 individuals, data was selected for individuals with mental illness and drug and/or alcohol abuse. In the parent study, these individuals were identified by asking questions about their mental illness, and drug and/or alcohol abuse problems. They also answered Norbeck Social Support Questionnaire about social support. They provided demographic data on their age, race, gender, religion, marital status and education level, which was collected as part of a face-to-face demographic interview conducted during the baseline assessment.

Results: Data was analyzed using negative binomial regression method to test for mediation effect. Results indicated that social support mediated the relationship between mental illness and drug abuse. We ran two generalized linear and one general linear regression models. In the first model, we looked at the total effect of mental illness on drug abuse (c); we found that the incidence rate for drug abuse (SA) would be expected

to increase by a factor of 1.387, (IRR,1.387; CI,1.270-1.515; P =0.000) for every one-unit increase in mental illness (M1), while holding all other variables in the model constant.

In the second model we adjusted our mediator, social support (SS) and looked at the direct effect of mental illness on drug abuse (c'). We interpreted that for every one-unit increase in mental illness, the incidence rate for drug abuse would be expected to increase by a factor of 2.717, (IRR,2.717; 95% CI,1.629 - 4.532; P = .000). For every one-unit increase in social support, the incidence rate for drug abuse is expected to decrease by a factor of .498, (IRR,.498; 95% CI,.443 - .560; P = .000). In the third model we found, for every one-unit increase in mental illness, there is an associated increase by 2.495 units in social support, P= .000. There was an **inconsistent mediation** in our model. Effect size for mediation by Percent mediation (P_m) method was found to be 0.64, it is the proportion of the effect that is mediated by our mediator social support. Sobel test showed the significance of mediation with a test statistic of 4.8282 at a significance level of 0.000.

Conclusion: Our data supported an alternative theory of inconsistent mediation. We found that social support mediates the relationship between mental illness and drug abuse, where positive social support has a stimulator effect on mental illness and a suppressor effect on drug abuse. Mental illness may have direct unfavorable effects on the drug abuse (outcome) and positive social network has beneficial effects on this outcome. We conclude that positive support allows betterment of mental health of patients and prevents involvement in drug abuse. Further, there is a need to consider both the positive and negative effects of social support while keeping in mind these associations may differ among sociodemographic groups.

DEDICATION

I dedicate my thesis to my parents: Abida Khan and the late I.H. Khan.

Thank you for fulfilling your obligation of loving me, while teaching me to achieve friendship from the rest of the world. Thank you for teaching me about the priorities in life. Thank you for raising me with the most superior examples of patience, compassion, diligence and integrity. Thank you for your support throughout my entire educational career: from pre-K to high school to medical school to masters. Thank you.

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CHAPTER 1

INTRODUCTION

A multitude of research demonstrates that mental illness is associated with involvement in drug and/or alcohol abuse; however, few studies have investigated the causal pathway for this association. In this study, we focused on the variable in the causal path that exacerbate or buffer risk for these co-occurring disorders. We looked at the mediating effect of social support (SS) in the relationship between our independent variable (mental illness, M1) and dependent variable (drug and/or alcohol abuse, SA).

Understanding the causal path, how mental illness leads to drug abuse, is crucial for the development of effective prevention and intervention strategies which will guide in alleviating these sequelae of mental illness. New interventions can be designed to change a mediating variable, such as social support, which is hypothesized to be causally related to the dependent variable (drug and/or alcohol abuse, SA) in this assessment. There remains a paucity of research examining mechanisms that underlie relations between mental illness and drug abuse. The present study addressed these gaps by exploring the mediation effects of social support.

Understanding how and why an independent variable (mental illness) influences a dependent variable (drug and/or alcohol abuse) is critical in both descriptive and intervention research. Variables that explain *how* or *why* are termed mediators (Krause et

al. 2010). Mediator variables are used to identify the essential processes that must occur for an independent variable to have an effect on a dependent variable (Shadish, Cook, & Campbell, 2002). In other words, a mediator (M) represents the generative mechanism through which the focal independent variable (IV) is able to influence the dependent variable (DV) of interest (Baron & Kenny, 1986, p. 1,173). In mediation, the IV, and the mediator are typically associated (correlated), and the IV and DV are correlated, and there is an implied causal path (“*because*”) that links the three variables. The IV causes the DV, because the IV causes the mediator, which in turn causes the DV. The mediator is adding to the overall variance accounted for in the model and trying to explain ‘why’ the IV and DV are related. With these thoughts in mind, in the present study we examined *how* and *why* social support (the mediating variable under assessment) influences the effect of an antecedent variable (mental illness) on a dependent variable (drug and/or alcohol abuse), thereby providing more detailed understanding of relations among these variable.

CHAPTER 2

BACKGROUND

People suffering from mental illness have high rates of comorbid substance use problems, i.e., “dual diagnosis” (Carrà G, Crocamo C, Borrelli P, Popa I, Ornaghi A, Montomoli C, Clerici M, 2015). Little is known about factors that contribute to drug use in people with mental illness. According to reports published by the *Journal of the American Medical Association*, roughly 50 percent of individuals with mental disorders are affected by substance abuse. The National Bureau of Economic Research (NBER) reports that mental health disorder patients are responsible for the consumption of roughly 38 percent of all alcohol, 44 percent of all cocaine, and 40 percent of all cigarettes. This may be due to the fact that drug use disorders and other mental illnesses are caused by overlapping factors such as underlying brain deficits, genetic vulnerabilities, and/or early exposure to stress or trauma. Research has shown that disadvantaged neighborhoods, unemployment, poverty, substance abuse, and stigma disproportionately, affect people with mental illness (Frank R & Glied S., 2006; Skeem, J. L., Manchak, S., & Peterson, J. K. , 2011; Davis, Fulginiti, Kriegel, & Brekke, 2012).

The social network theories describe mechanisms that influence offending behavior, including social structures that affect behavior, attitudes, and access to resources among network members (Davis, Fulginiti & Brekke, 2012). The social network is composed of family, friends, neighbors, treatment providers and community members that are available in times of need to give psychological, physical, and financial help (Lin, Ensel, Simeone, & Kuo, 1979). Theoretical models of social support specify

the following two important dimensions: (1) a structural dimension, which includes network size, depth of social network, frequency and duration of social interactions, compositional factors (network member characteristics, role and quality of relationships with members) and behavioral factors (injecting norms, patterns of drug use, severity of drug addiction) (De, Cox, Boivin, Platt, & Jolly, 2007) and (2) a functional dimension with emotional support (such as receiving love and empathy) and instrumental support such as gifts of money or supportive assistance (Charney, 2004). Most research has found that quality of relationships (functional dimension) is a better predictor of good health than the quantity of relationships (structural dimension), although both are important (Southwick, Vythilingam, & Charney, 2005).

Smaller social networks predicted heavier drug abuse and alcohol use over time which, in turn, predicted weakening of abstinence supporters and decreased multiplexity of relationships (Trumbetta, Mueser, Quimby, Bebout, & Teague, 1999). Small and densely interconnected networks which involve frequent contact with similar others have been linked to the spread of high-risk behaviors whereas large social networks results in increases in social capital (Christakis & Fowler, 2007). It has been discussed that rich social networks may reduce the rate at which individuals engage in risky behaviors, (Rozanski, Blumenthal, & Kaplan, 1999) prevent negative judgments, (Fontana, Kerns, Rosenberg, & Colonese, 1989) and increase treatment adherence in mentally ill people. Individuals with mental illness generally have small networks of similarly situated individuals affected by mental illness, addiction, joblessness, and homelessness (J. Skeem, Eno Loudon, Manchak, Vidal, & Haddad, 2009; Hawkins & Abrams, 2007).

Strong social support has been shown to be an important factor in decreasing functional impairment in patients with depression (Travis, Lyness, Shields, King, & Cox, 2004) and in increasing the likelihood of recovery (Sayal et al., 2002; Schön, Denhov, & Topor, 2009). Valdes et al. argued that clinical, social, financial, and care components in different accommodation settings (small or big) were not associated with risk behaviors in individuals suffering from severe and persistent mental disorders (Stauber J., & Reinhold K, 2015).

Network composition has important implications—specifically, whether the network tends toward prosocial activity or toward nonconformity, whether network members abuse substances, and lead to justice involvement (Hawkins & Abrams, 2007); and whether the network consists of treatment providers and others who provide support (J. Skeem, Eno Louden, Manchak, Vidal, & Haddad, 2009). Finally, among persons with mental illness, Skeem and colleagues (J. Skeem, Eno Louden, Manchak, Vidal, & Haddad, 2009) found that the perception of coercion and control was associated with increased probation violations and that substance abuse was related to poor relationships with treatment providers.

Individuals with mental illness die approximately 25 years earlier than the general be attributed to substance use disorders (Park et al., 2015; Colton & Manderscheid, 2006; Crump, Winkleby, Sundquist, & Sundquist, 2013). In addition to early mortality, the severity, and prognosis of the primary mental illness are worsened in the context of substance dependence (Brady, Killeen, & Jarrell, 1993; Drake & Wallach, 1989). Higher level of depression, reporting low social support, and larger reported injection networks

are all associated with greater levels of risky injection behaviors in drug abuse (Heimer, Barbour, Palacios, Nichols, & Grau, 2013).

The 2009-2011 National Survey on Drug Use found that adult smokers with mental illness are less likely to quit than adult smokers without mental illness (Report, 2013). This discrepancy highlights the public health disparity in the mentally ill, a uniquely vulnerable population. In addition to increased smoking among individuals with mental illness, alcohol, and other substance use disorders have increased prevalence in individuals with mental illness (J. Skeem, Eno Louden, Manchak, Vidal, & Haddad, 2009; Hawkins & Abrams, 2007; Park et al., 2015; Colton & Manderscheid, 2006; Crump, Winkleby, Sundquist, & Sundquist, 2013; Jiménez-Castro et al., 2010; Ronald C Kessler, Berglund, et al., 2005; Ronald C Kessler, Chiu, Demler, Merikangas, & Walters, 2005).

Several large epidemiological surveys have assessed comorbidity of affective and psychotic illness with tobacco, alcohol, and drug use disorders in the general population (Ronald C Kessler, Berglund, et al., 2005; Ronald C Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Lasser et al., 2000; Dickerson et al., 2013; R C Kessler et al., 1997; Regier et al., 1990; Moore, Mancuso, Slade, Galletly, & Castle, 2012; Merikangas, Akiskal, et al., 2007). Numerous epidemiological studies have reported that poor social support is associated with the onset and relapse of depression (Paykel, 1994), negative treatment response to dysthymia, (Oxman & Hull, 2001) and seasonality of mood disorder, (Michalak, Wilkinson, Hood, Dowrick, & Wilkinson, 2003).

A large body of literature has elucidated the mechanisms through which social support promotes physical and mental health and buffers psychological stresses (Greenblatt, Becerra, & Serafetinides, 1982; Taylor & Aspinwall, 1996; for a review, see Taylor, 1995). Moreover, social support has been linked to better quality of life both among substance users and individuals with a mental disorder (e.g., Brennan & Moos, 1990; Nelson, 1992). Alemi and colleagues demonstrated empirically the importance of the orientation of social support networks and noted “that people are likely to adopt roles supported by the individuals who they see most often and whose opinions are important to them” (Alemi, Stephens, Llorens, Schaefer, Nemes, & Arendt, 2003, p. 1294).

Social Support:

A social support network is made up of family members, friends, peers, and coworkers. A social support network is different from a support group, which is generally a structured meeting run by a mental health professional. Although both support groups and support networks can play an important role in times of stress, a social support network is something people develop when they are not under stress. It provides the comfort of knowing that their friends are there for them if they need them. This social network gives them access to information, advice, guidance and other types of assistance should they need them. It is comforting to know that they have people they can turn to in a time of need.

Positive and Negative Social Support:

A positive social support network can greatly increase the chances of an individual making a lasting recovery from addiction and mental illness. Such a network may be made up of friends, family, counselor or it could include membership with an addiction support group. These people will be able to offer emotional support, feedback, and advice. They might also be able to offer physical assistance such as helping the individual find a job. One study found that positive social support was an indicator for living a healthy lifestyle.

Those individuals who are addicted to drugs or alcohol may belong to a social network that promotes such abuse. This group may view intoxication as a desirable behavior and see abstinence as deviant. If one of the members of such a group decides to move away from substance abuse, it can be viewed as threatening to that person. Not only might these people not offer support to the individual attempting to escape addiction, but they could also do their best to disrupt such efforts. Research has also been conducted into the dangers of negative social support. The State University of New Jersey concluded in their study that those individuals who belonged to a social group that encouraged heavy drinking were less likely to find success in recovery.

In summary, strong social support seems to decrease expression of genetic and environmental vulnerabilities for mental illness, possibly by effects through other psychosocial factors, such as fostering effective coping strategies, and through effects on multiple neurobiological factors. Authors have tried to examine the generative mechanism, as to *how* and *why* social network leads to drug abuse in mentally ill people

and how positive social support through coping mechanism can prevent involvement in drug abuse. Given the paucity of research in this area, the aim of the cross sectional study presented here was:

Aim: To examine whether the current social network structures mediates the relationship between mental illness and drug and/or alcohol abuse.

To address this issue, we used a sample of people coming out of jails in Philadelphia and mingling with the community. These people were at risk for HIV. We assessed substance use in this large, multiethnic sample of individuals many of whom had depression, anxiety, schizophrenia, schizoaffective disorder, or bipolar disorder with psychotic features. Using this sample of incarcerated people, we were able to not only gain insight into substance use among individuals released from jails who had a mental illness but also determine the effect of social networks on drug and alcohol abuse in this population.

CHAPTER 3

OBJECTIVE, HYPOTHESIS, AND RESEARCH QUESTION

Objective: To determine the role of social support as a potential mediator in the relationship between mental illness and drug and/or alcohol abuse.

Many studies have documented the negative effects of mental illness on addiction to drug use; however, little is known about the mechanism underlying this relationship. Using the Baron and Kenny analytic framework of mediation, the authors assessed whether social networks mediated the relationship between mental illness and drug abuse. This model assumes a three-variable system such that there are two causal paths feeding into the outcome variable. In our study mental illness was the predictor and drug abuse was the outcome, this relationship is being mediated by social networks.

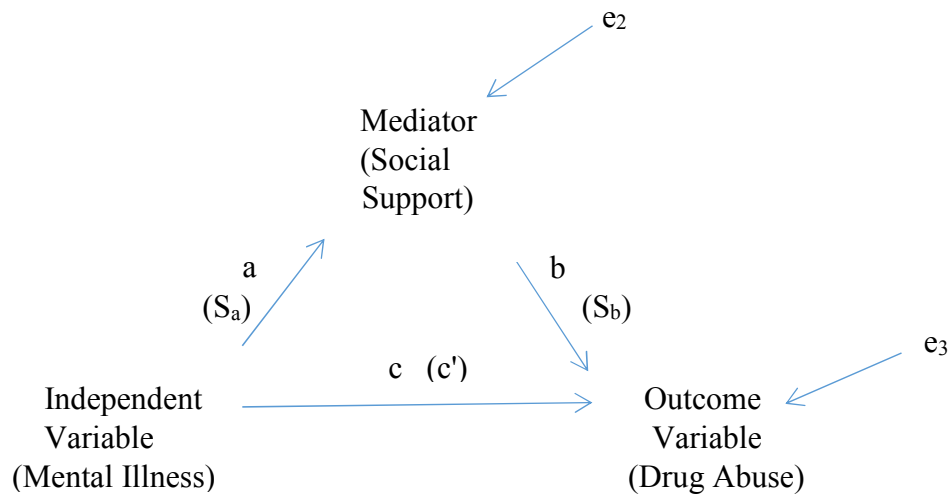


Figure 1. The single-mediator model depicting Causal Paths

Figure 1 illustrates causal paths by the single-mediator model. The relation between the independent variable X on the dependent variable Y is mediated through variable M; a represents the strength of the relation between X and M, b represents the strength of the relation between M and Y, c and c' represents the strength of the relation between X and Y, e_2 represents the unexplained part of M, and e_3 represents the unexplained part of Y. S_a and S_b are the standard errors of path a and b.

We assumed that our mediator met the following conditions: (1) variations in levels of the independent variable (mental illness) significantly accounted for variations in the presumed mediator, social support (i.e., Path a). (2) variations in the mediator (social support) significantly accounted for variations in the dependent variable (drug and/or alcohol abuse) (i.e., Path b). (3) variations in the independent variable (mental illness) significantly accounted for variations in the dependent variable (drug and/or alcohol abuse) (i.e., Paths (c) and (c') are total and direct impacts).

Mediation Model Pathways

Pathway 1—Effect of mental illness on drug and/or alcohol abuse.

Pathway 2— Effect of social networking on drug and/or alcohol abuse

Pathway 3— Effect of mental illness on social network

Hypothesis: We hypothesized that those people with mental illness, who get positive social support are less likely to get involved in drug and/or alcohol abuse.

Research Question: Is the relationship between mental illness and drug and/or alcohol abuse, mediated by social network characteristics?

CHAPTER 4

OPERATIONALIZATION

Independent Variable: Mental Illness (M1)

People were assessed about their mental illness status by completing the question, how many times in their life time were they hospitalized for psychiatric reasons? This question was a proxy for the diagnosis of mental illness.

Outcome Variable: Drug Abuse and/or Alcohol Abuse (SA)

Mentally ill people were assessed for drug and/or alcohol abuse by asking a question, how many times in their life time had they been in treatment for drug and/or alcohol abuse. For example, if they said, once for drug abuse and twice for alcohol abuse then Substance Abuse (SA) was counted as 3.

Mediator Variable: Social Support (SS)

Authors used the Norbeck Social Support Questionnaire to measure social support in the community. The Norbeck measures instrumental aid (supportive assistance), emotional support, and depth of social network as well as frequency of contact and duration of relationships. In the present study we focused on the structural dimension of social support. People were asked eight questions about the total number of support they received in the community after coming out of jail. We looked at the total number of support from spouse, family members, friends, work or school associates, neighbors, health care providers, priest and counselor/therapist.

CHAPTER 5

METHODS

Research Design of the Parent Study: Single blinded randomized controlled trial (RCT).

Study Participants: Study participants were chosen from the RCT conducted on HIV risk in Philadelphia jails, “Education, empowerment and community based structural reinforcement: An HIV prevention response to mass incarceration and removal.” (Draine J, McTighe L, Bourgois P, 2015). This study was conducted in Philadelphia by following 600 study participants coming out of jails. For this assessment, eligible people who were released from jail were asked different questions including how many times in their life time were they hospitalized for mental illness and how many times were they treated for drug and/or alcohol abuse. They also answered questions on social support. These questions were captured cross-sectionally in one survey.

Setting of the Parent Study: The Philadelphia Prison System (PPS), which is actually a jail system, houses a large population of individuals with HIV. The sampling population for this study was jail detainees (prisoners) incarcerated in the intake units of the Philadelphia Prisons System. The baseline sample consisted of 34,051 men (84.7%) and 6,163 women (15.3%) admitted to PPS in FY 2008. The sample was taken from the intake units to gain access to the significant portion of the population at risk for HIV that is released quickly (the modal jail stay in PPS is 2 days), thus reinforcing the generalizability of our sample to general jail populations.

Inclusion criteria: Prisoner on intake units at CFCF (largest men's jail and site for men's intake units) or Riverside (women's jail), eighteen years of age or older, Philadelphia resident.

Exclusion criteria: Excluded from the study were any whose incarceration based on being a state prisoner, Federal Marshall detainee, transfer between institutions or any other jurisdiction than that of a Philadelphia court judge, residence outside Philadelphia, less than 18 years of age.

Randomization: All individuals were randomized to either the experimental intervention (TITO) TEACH Inside TEACH Outside or the control condition intervention, (IPSI) infection prevention and safety intervention.

Overview of the present analysis: Initially there were 159 individuals with mental illness. Out of these 159 individuals, there was missing information for 15 (9.4%) individuals and therefore these individuals were excluded. We analyzed data on 144 (90.6%) individuals who had mental illness. Similarly, we had 159 individuals with drug and/or alcohol abuse and out of these 159 individuals, we did not have data on 15 (9.4%) individuals and were excluded. We analyzed data on 144 (90.6%) valid observations for drug abusers. Out of these mentally ill individuals, only 64 individuals received social support. We looked at the mediating effect of social support (SS) in the relationship between our independent variable (mental illness, M1) and dependent variable (drug and/or alcohol abuse, SA). Mediation analysis traditionally (Baron & Kenny, 1986) required one to report that, the IV predicts the mediator and the DV, that the mediator predicts the DV, and that the link between the IV and the DV decreases when the mediator is controlled.

- (1) We ran two generalized linear models (GLM) where the IV predicted the DV in Model 1, reporting the betas, 95% Wald Confidence Interval, associated significance level, and Incidence Rate Ratios (IRR). Then adding the mediator in Model 2, reporting the betas, 95% Wald Confidence Interval and associated significance level for the mediator, and the new beta for the IV along with Incidence Rate Ratios (IRR). We ran a general linear model (univariate) to look at the association of mental illness and social support.
- (2) We looked at the proportion of the mediating effect carried by our mediator by Percent mediation method.
- (3) Finally, we conducted Sobel test to report a significant mediation.

We performed Negative Binomial Analysis by keeping the following facts about “Mediation” in mind. If the IV drops from a significant beta to a nonsignificant beta, that is *full mediation*. If it drops from a significant beta to a smaller significant beta that is *partial mediation*. *Inconsistent mediation* models are those in which there is at least one mediating effect with a different sign in comparison to the direct effect. The relation of independent variable to dependent variable should be significant for interpretation of the outcome; however, there may be other cases in which the overall relation of independent variable to dependent variable is not significant. The direct effect is positive; while the indirect effect is negative; indicating *inconsistent mediation* meaning opposite signs between direct and indirect effects. MacKinnon et al. (2000) use the term suppressor variable to describe “a variable which increases the predictive validity of another variable by its inclusion in a regression equation.” Suppression occurs when an indirect effect has a sign that is opposite to that of the total effect, and thus omission of

the suppressor might lead the total effect to appear small or nonsignificant. Evidence of suppression is found when including an intervening variable produces a value of c' that is greater in magnitude than c . In such a case, the independent variable to dependent variable relationship is actually strengthened, not weakened, by including an intervening variable (i.e., a suppressor). According to Tzelgov & Henik (1991), suppressor variables are called suppressors because they suppress outcome-irrelevant variance in other predictors, causing the suppressed variables to obtain a substantial regression weight.

Thus, a situation in which the magnitude of the relationship between an independent variable and a dependent variable becomes larger when a third variable is included would indicate suppression. It is often possible that multiple indirect effects involving unmeasured variables explain a particular relationship. This observation is important because it provides another reason why there might be significant indirect effects in the absence of a total or direct effect.

Statistical analysis: The coefficients from our mediator model linking received social support (mediator), mental illness (IV) and drug abuse (DV) were decomposed into total, direct and indirect effects, in order to further understand the direction and extent of relationship between the three variables. In order to explicate the role played by the mediator, social support (SS), we present estimates for the individual associations, adjusted for covariates, between mental illness, social support and drug abuse. We observed an *inconsistent mediation* model (MacKinnon et al., 2000), whereby the effects of mental illness are mediated by social support, there is significant positive association between mental illness and social support. Social support also had a significant inverse

association with drug abuse (SA); negative social support was associated with higher involvement with drugs. All statistical tests used the 5% level of significance, and all P-values were two-tailed. Mean (SD) and percentages were used for descriptive statistics.

THE SINGLE-MEDIATOR MODEL

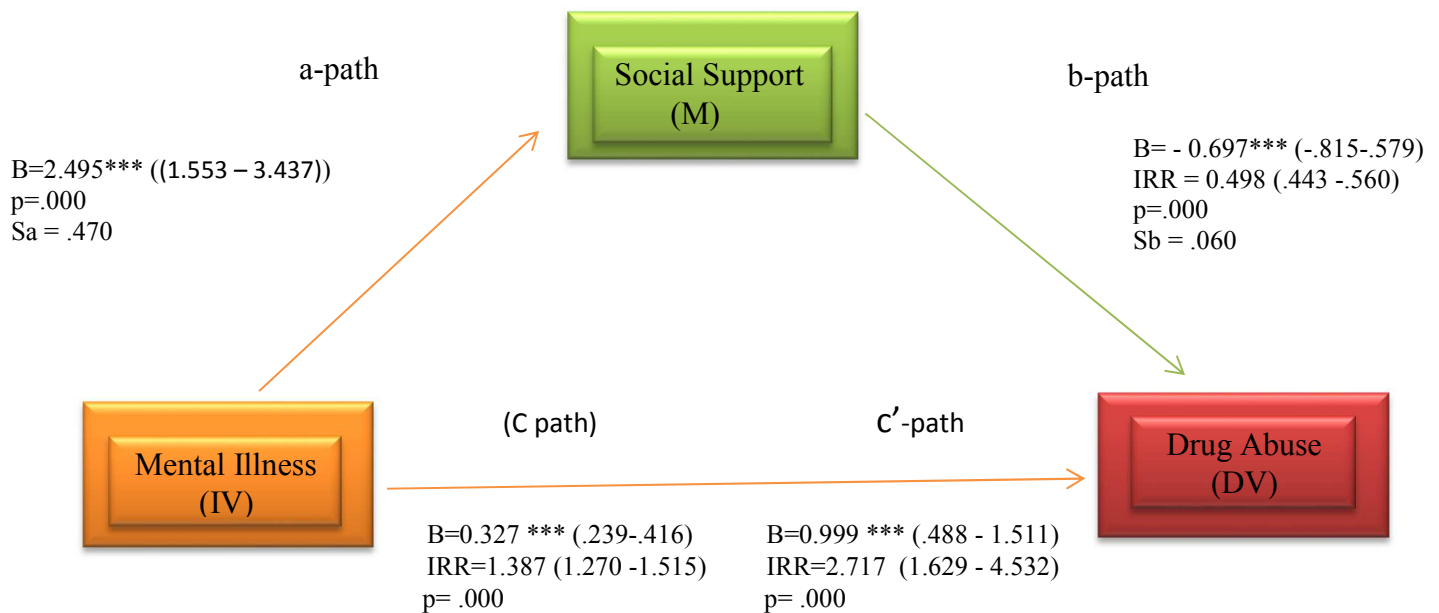


Figure 2. Indirect effect of Mental illness on Drug/Alcohol Abuse through Social Support

Note: * $p<.05$, ** $p<.01$, *** $p<.001$

The most common approach employed for the assessment and evaluation of the mediation model is the causal steps approach. The required data used in this approach is mainly obtained from the three regression equations, displayed below (MacKinnon & Dwyer, 1993):

$$(1) Y = i_1 + c X + e_1$$

$$(2) Y = i_2 + c' X + b M + e_2$$

$$(3) M = i_3 + a X + e_3$$

In the above equations, X represents the independent variable (mental illness, M1), Y is the dependent variable (drug abuse, SA), and M indicates the mediating variable (social support, SS). The coefficient, *c*, represents how strongly the independent variable (mental illness) predicts the dependent variable (drug abuse), and *c'* shows the coefficient connecting the dependent variable (drug abuse) to the independent variable (M1), adjusting them for the mediator (SS); *b* represents the coefficient linking the mediator indicator (social support, SS) to the dependent variable (SA); adjusted for the independent variable; *a* indicates the coefficient connecting the independent variable (mental illness) to the mediator variable (social support). B is the Beta and IRR indicates the Incidence Rate Ratio. The intercepts in each equation, representing the average score of each variable, are *i*₁ and *i*₂ and *i*₃, respectively; and *e*₁, *e*₂, and *e*₃ represent the error, or the part of the relation that cannot be predicted.

Step 1: Regress the dependent variable (SA) on the independent variable (M1). In other words, confirm that the independent variable is a significant predictor of the dependent variable.

Independent variable \longrightarrow Dependent variable

$$Y = i_1 + c X + e_1$$

c is significant, *p*=.000

$$E(\log(\text{SA})) = -29.999 + .327 * \text{M1}$$

Step 2: Regress the mediator (SS) on the independent variable (M1). In other words, confirm that the independent variable (M1) is a significant predictor of the mediator (SS). If the mediator is not associated with the independent variable, then it couldn't possibly mediate anything.

Independent variable \longrightarrow Mediator

$$M = i_3 + a X + e_3$$

a is significant, $p=.000$

$$E(\log(SS)) = -2.563 + 2.495 * M1$$

Step 3: Regress the dependent variable (SA) on both the mediator (SS) and independent variable (M1). In other words, confirm that the mediator is a significant predictor of the dependent variable, while controlling for the independent variable.

This step involves demonstrating that when the mediator and the independent variable are used simultaneously to predict the dependent variable, the previously significant path between the independent and dependent variable (Step #1) becomes larger and remains significant.

$$Y = i_2 + c' + b M + e_2$$

b is significant, $p=.000$

$$E(\log(SA)) = -24.320 + .999 * M1 - .697 * SS.$$

Indirect effect (a*b) = 2.495 x -.697 = - 1.739 (Please refer *figure 2* above)

Covariates Participants were asked to report their age, race, gender, religion, marital status and education level as part of a face-to-face demographic interview conducted during the baseline assessment. Please refer *Table 1* below.

Description of the data: We first did descriptive statistics, values shown in *Table 2* below. 144 cases were used for mental illness and drug abuse and 64 cases were used for social support in the analysis. We then saw information on the distribution of the categorical predictor variable, as well as information on the distribution of the dependent variable and the continuous predictor variable.

Continuous Variables Information: We had 159 individuals with mental illness, but there was missing information for 15 individuals (9.4%) and therefore these individuals were excluded from the analysis. We analyzed data on 144 (90.6%) individuals who had mental illness. Similarly, we had 159 individuals with drug and/or alcohol abuse but there was missing data on 15 (9.4%) individuals and were excluded. We analyzed data on 144 (90.6%) valid observations for drug abusers. Out of these individuals with mental illness, we only got 64 (40.3%) valid observations for social support indicating only 64 individuals received social support out of 159. There was missing information on social support for 95 (59.7%) individuals. The response variable of interest is involvement in drug and/or alcohol abuse. The variable social support is the mediator variable indicating the total number of social support each mentally ill individual received in their life time. Age was used as an off-set variable for our count variable, drug abuse. Participants had age range between 18-61 years, Mean age was 36 years.

Categorical Variable Information: Gender has been categorized as (1 = 'Male', 2 = 'Female'). Race has been recoded as 1 = 'Black' and 2 = 'Others'. Other races included 'White', 'Latino or Hispanic', 'Native American', 'Native Hawaiian or other Pacific Islander', and 'Asian or other'.

<i>Table 1. Data on Demographics</i>	
Variables	(N=159)
Age, mean (\pm SD)	36 (\pm 11)
Gender	
Male, n (%)	128 (80.5)
Female, n (%)	31 (19.5)
Race	
White, n (%)	18 (11.3)
Black, n (%)	95 (59.7)
Latino/Hispanic, n (%)	18 (11.3)
Pacific Islanders, n (%)	1(0.60)
Asian or other, n (%)	27 (17.1)
Race after Recoding	
Black, n (%)	95 (59.7)
Others, n (%)	64 (40.3)
Primary Language	
English, n (%)	148 (93.1)
Spanish, n (%)	8 (5.0)
Other, n (%)	3 (1.9)
Education	
No formal education, n (%)	0 (0)
Less than High School Diploma or GED, n (%)	61 (38.4)

Table 1. <i>Data on Demographics, Continued</i>	
High School Diploma or GED	
Received, n (%)	98 (61.6)
Do not know/Refused, n (%)	0 (0)
Marital status	
Separated, divorced, widowed, n (%)	2 (1.3%)
Single or Never Married, n (%)	39 (24.5%)
Married, n (%)	118 (74.2%)

Table 2. <i>Descriptive Statistics</i>							
Variables	Valid data N (%)	Missing values N (%)	Minimum	Maximum	Mean	Standard Deviation	Variance
Mental illness (M1)	144 (90.6%)	15 (9.4%)	0	23	.97	2.59	6.69
Social Support (SS)	64 (40.3%)	95 (59.7%)	1.00	71.00	4.64	10.47	109.73
Drug Abuse (SA)	144 (90.6%)	15 (9.4%)	0	18	1.75	3.03	9.18

The variances of Mental illness, Social Support and Drug Abuse are higher than the means. Therefore, Negative Binomial Regression is the preferred method of analysis in our count data. It has the same mean structure as Poisson regression and it has an extra parameter to model the over-dispersion.

Negative binomial regression analysis

We created and analyzed three regression models as shown in tables 3, 4 and 5 below:

(Please refer SPSS Tables in Appendix A).

Table 3 <i>Analysis of Model 1: Generalized Linear Model for MI (IV) with SA (DV)</i>			
	Beta (95% Wald CI)	p-value	Exp(B), Incidence Rate Ratio (IRR)
Mental illness	0.327(.239-.416)	.000	1.387 (1.270 -1.515)
Black	-12.118 (-13.265- -10.972)	.000	5.458E-6 (1.734E-6-1.718E-5)
Males	0.005 (-1.415-1.415)	.994	1.005 (.243-4.158)

Table 4 <i>Analysis of Model 2: Generalized Linear Model for MI (IV) and SS (M) with SA(DV)</i>			
	Beta (95% Wald CI)	p-value	Exp(B), Incidence Rate Ratio (IRR)
Mental illness	0.999 (.488 - 1.511)	.000	2.717 (1.629 - 4.532)
Social Support	-0.697 (-.815-.579)	.000	0.498. (.443 - .560)
Black	-5.860 (-7.821 - -3.898)	.000	0.003 (.000 - .020)
Males	-7.250 (-8.907- 5.594)	.000	0.001 (.000- .004)

Table 5 <i>Analysis of Model 3: General Linear Model, Univariate for MI (IV) with SS (DV)</i>			
	Beta	p-value	95% Confidence Interval
Mental illness	2.495	0.000	(1.553 – 3.437)
Black	2.659	0.248	(-1.907 – 7.224)
Males	2.544	0.431	(-3.880 – 8.967)
Type III sum of squares (df=3) for the corrected Model is 1994.391, p =.000. R squared = .355, Adjusted R Squared = .320.			

1) Analysis of Model 1: Generalized Linear Model for M1 (IV) with SA (DV),

Table 3.

We interpreted results as **Incidence Rate Ratios (IRR)**, by using the **(exponentiated)** option for Models 1 and 2.

M1 - Exp (B) column in table 3 above indicates estimated incidence rate ratio, for every unit increase in mental illness (M1), there is an expected increase in incidence rate for drug abuse by a factor of 1.387 (CI= 1.270-1.515), while holding all other variables in the model constant. It is statistically significant, $p = .000$.

2) Analysis of Model 2: Generalized Linear Model for M1 (IV) and SS (M) with SA (DV), Table 4.

M1 - This is the estimated incidence rate ratio for one-unit increase in mental illness, given the other variables are held constant in the model. If there is one-unit increase in mental illness, the incidence rate for drug abuse would be expected to increase by a factor of 2.717 (CI: 1.629 - 4.532), statistically significant at $p = .000$. If there is one-unit increase in social support the incidence rate of drug abuse is expected to decrease by a factor of .498 (CI: .443 - .560), which is statistically significant, $p = .000$.

3) Analysis of Model 3: General Linear Model, Univariate for M1 (IV) with SS (DV),

Table 5.

There is a significant relationship between mental illness and social support ($p = .000$). Tests of between-subjects effects was done with mental illness as independent variable and social support as dependent variable. Corrected Model has Type III sum of

squares was 1994.391, $df=3$, $R^2 = .355$, Adjusted $R^2 = .320$. F was 10.260 with a significance level of .000.

M1 - For every one-unit increase in mental illness, there is an associated increase by 2.495 units in social support. The $p = .000$.

Table 6				
<i>Total, Direct, and Indirect Effects in the Model</i>				
	B	SE	p	95% Confidence Interval
Total effect (c)	.327	.045	.000	.239 - .416
Direct effect (c')	.999	.261	.000	.488 - 1.511
a path	2.495	.470	.000	1.553 - 3.437
b path	-.697	-.060	.000	.815 - -.579

Significance of Indirect Effect: Sobel test was used to test the significance of $a*b$,

Mathematics has shown that: $(a\text{-path} * b\text{-path}) = c\text{-path} - c'\text{ path}$

Thus, if $a*b$ (the indirect effect) is statistically significant, mediation has occurred.

Effect Sizes for Mediation can be calculated by: Percent mediation (P_m)

Percent Mediation: The direct effect (c'-path) is larger than the total effect (c-path) as seen in our model of Inconsistent Mediation. In these cases, we have taken the absolute value before calculating effect size to avoid proportions greater than 1.0. There was a significant indirect effect of mental illness on drug abuse through social networks, $ab = -1.739, p = .000$.

Percent Mediation (Refer back to figure 2)

$$P_m = \frac{ab}{ab + c'} = \frac{ab}{c}$$

$ab = 2.495 * 0.697$
 $c' = 0.999$
 $P_m = 0.635$

Interpreted as the percent of the total effect (c) accounted for by the indirect effect (a*b).

Calculations

$$a*b = 1.739$$

Total effect = Direct effect + Indirect effect

$$c = c' + ab$$
$$= .999 + 1.739 = 2.738$$

Proportion of the effect that is mediated = Indirect effect / total effect

$$= ab/c = 1.739 / 2.738$$
$$= 0.64$$

$c - c'$ can be used to measure indirect effect like $a*b$.

$$c - c' = 2.738 - .999 = \mathbf{1.739} \text{ (} a * b = \mathbf{1.739}\text{)}$$

In our model of inconsistent mediation, 0.64 is the proportion of the effect that is mediated by our mediator, social support. The mediator could account for more than half of the total effect, $P_m = 0.64$.

Sobel Test Calculates the Significance of Mediation

Sobel test indicates whether a mediator variable (SS) significantly carries the influence of an independent variable (IV) to a dependent variable (DV); i.e., whether the indirect effect of the independent variable on the dependent variable through the mediator variable is significant.

An illustration of the mediation (Refer back to figure 1)

a, b, and c' are path coefficients. Values in parenthesis are standard errors of those path coefficients.

Description of the numbers needed

a= raw (unstandardized) regression coefficient for the association between IV and mediator.

S_a = standard error of a

b= raw (unstandardized) regression coefficient for the association between the mediator and DV (when IV is also a predictor of DV).

S_b = standard error of b.

To get numbers

1. We ran a regression analysis with the IV predicting the mediator. This gave a and S_a .
2. We ran a regression analysis with the IV and mediator predicting the DV. This gave b and S_b .
3. S_a and S_b should never be negative for Sobel test. Our S_a and S_b are positive.

Table 7				
<i>Results from Sobel Test, Aroian Test and Goodman Test</i>				
Input		Test Statistic	Std. Error	p- value
a = 2.495	Sobel test	- 4.82826379	0.36017398	0.00000138
b = - .697	Aroian test	- 4.81353241	0.36127626	0.00000148
$S_a = .470$	Goodman test	- 4.84313125	0.35906832	0.00000128
$S_b = .060$				

The reported p-values (rounded to 8 decimal places) are drawn from the unit normal distribution under the assumption of a two-tailed z-test of the hypothesis that the mediated effect equals zero in the population. +/- 1.96 are the critical values of the test ratio which contain the central 95% of the unit normal distribution. The test of the indirect effect is given by dividing ab by the square root of the above variance and treating the ratio as a Z test (i.e., larger than 1.96 in absolute value is significant at the .05 level).

Our test statistic is 4.83 at p value of < .05, hence mediation effect is significant.

Formulae for the tests provided here were drawn from MacKinnon & Dwyer (1994) and from MacKinnon, Warsi, & Dwyer (1995):

Sobel test equation

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2)$$

Aroian test equation

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2 + s_a^2*s_b^2)$$

Goodman test equation

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2 - s_a^2*s_b^2)$$

The Sobel test equation omits the third term of the variance estimate in the denominator. Aroian version of the Sobel test is suggested in Baron and Kenny (1986) because it does not make the unnecessary assumption that the product of S_a and S_b is vanishingly small. The Goodman version of the test subtracts the third term for an unbiased estimate of the variance of the mediated effect, but this can sometimes have the unfortunate effect of yielding a negative variance estimate.

CHAPTER 6

RESULTS

Data was analyzed using negative binomial regression method to test for mediation. Results indicated that social support mediated the relations between mental illness and drug abuse. We ran two generalized linear and one general linear regression models and found that the mental illness was a significant predictor of the drug abuse. In the first model, we looked at the total effect of mental illness on drug abuse (c), we found that for every one-unit increase in mental illness (M1), the incidence rate for drug abuse is expected to increase by a factor of 1.387 (IRR, 1.387; CI, 1.270-1.515; P= 0.000), while holding all other variables in the model constant. In the second model we controlled mediator (social support) and looked at the direct effect of mental illness on drug abuse (c'). We found that for every one-unit increase in mental illness, the incidence rate for drug abuse would be expected to increase by a factor of 2.717, (IRR, 2.717; 95% CI, 1.629 - 4.532; P = .000). If there is one-unit increase in social support the incidence rate of drug abuse is expected to decrease by a factor of .498, (IRR, .498; 95% CI; .443 - .560; P = .000). We then looked at the association of mental illness with mediator and found it to be a significant predictor of the mediator. For every one-unit increase in mental illness, there is an associated increase by 2.495 units in social support, P = .000

Looking at the Beta parameters we noticed, every one-unit increase in mental illness leads to 2.495 log expected count increase in social support (a). One-unit increase

in social support leads to .697 log expected count decrease in drug abuse (b). One unit increase in mental illness leads to .327 log expected count increase in drug abuse (Total effect without mediator, c). One-unit increase in mental illness leads to .999 log expected count increase in drug abuse, because of suppression effect of social support on drug abuse (Direct effect with mediator, c'). All these associations were statistically significant at $P = .000$.

Results indicated that the mediator, positive social support, was negatively associated with drug intake behavior, suggesting suppressor effect. In addition, results indicated that the direct effect of mental illness on drug abuse, controlling for positive social support, became bigger and remained significant, suggesting *inconsistent mediation*. This effect is in contrast to total or partial mediation where direct effect is decreased and become non-significant. Direct effect of mental illness on drug abuse was (c'): $B = 0.999$, (CI: .488 – 1.511), $P = .000$ compared to the total effect (c), $B = 0.327$, (CI: .239 - .416), $P = .000$. Direct effect is more than the total effect because of the suppressor effect of social support on drug abuse, supporting the theory of **inconsistent mediation** in our model.

We also calculated effect sizes for mediation by Percent mediation (P_m) method and found that 0.64 is the proportion of the effect that is mediated by our mediator social support. We then did Sobel test to calculate the significance of mediation. Sobel test showed test statistic of 4.8282 at a significance level of 0.000. Results of the mediation analysis confirmed the mediating role of social support in the relationship between mental illness and drug abuse problems.

CHAPTER 7

DISCUSSION

Using a sample of persons from jails in Philadelphia (N= 600), we observed that there were 144 mentally ill people. We found mental illness (IV) had a positive correlation with social support (M) and with drug abuse (DV). Positive social support has a suppressor effect on drug abuse. The present study supports the concept of inconsistent mediation. The study indicated that social network is the causal pathway from mental illness to drug abuse, thus supporting our hypothesis of social support as a mediator in this pathway. Our theoretical causal model is based on the longitudinal parent study and is, therefore, able to make more robust inferences about causality through temporal ordering.

The results from this study highlight the importance of understanding the role played by mediating variable such as social support in terms of and preventing the involvement of people in drug abuse. While previous studies have found a strong direct association between mental illness and drug abuse, few of those studies looked at the mediator effects. It remains important to unearth these complex associations between modifiable factors in order to promote better health outcomes. Since social network affects not only psychological health but physical health as well, it is an important concept to explore.

The results support our hypothesis of the social network as an inconsistent mediator or as a suppressor of the relationship between mental illness and drug abuse.

The suppression effect that we observed is attributable to the negative association of received social support with drug abuse. There was a consistency in our reported findings of the number of types of received social support. It is possible that the quality and quantity of support act as a coping mechanism for mental problems and thus prevent these people from becoming involved in drug abuse.

This study applied Social Support Theory to examine relationships among mental illness, social support, and involvement in drug abuse in a longitudinal context for people with mental illness. This suggested that received total social support from the spouse, family members, friends, work or school associates, neighbors, health care providers, priest, and counselor/therapist, influence the psychological health. Findings from this study support a general theoretical model in which mental illness is associated with decreased involvement in drug abuse through social support pathway. Results supported the temporal dimension of the theorized model and also suggested significant relationships among mental illness, social support and drug involvement. The present study was one of the few to test a social resources model of support in a mentally ill population, suggested that positive social support from others represents an important coping resource for mentally ill people. The results favor (Thoits, 1995); emotional support, information and tangible assistance from others may enable individuals with mental illness to overcome stressors that would otherwise be perceived as overwhelming.

The data support our hypothesis that social support mediates the relationship between mental illness and drug abuse. These findings relate to the previous research in this area. Future studies are needed to investigate potential mediators such as hope, self-esteem, and other self-appraisals.

CHAPTER 8

LIMITATIONS

The present study had several limitations. First, this assessment was cross-sectional, where data was analyzed at one specific point in time at the screening visit. As cross-sectional studies are descriptive studies and the exposure, outcome, and mediator assessed at the same point in time, more longitudinal and experimental studies should be done to thoroughly explore mediation. Second, there were numerous problems with relying on only self-reported data. Third, in issues where strong personal feelings may be involved, specific questions may be a source of bias. The diagnosis of mental illness and substance abuse was made based on proxy questions, leading to recall, response, and self-selection bias in the recruitment process. We do not have data available regarding individuals who chose not to participate in the study. There is a lot of missing data too. Missing people were not screened and did not get treatment for these devastating disorders. Additionally, the present study could have been upgraded by the inclusion of medical record information, biological verification of abstinence, or collateral reports indicating involvement with drug abuse.

Our findings warrant further investigation, in view of the limitations of this study. It is likely that the effects of the mental illness on drug abuse may be mediated by the quality and quantity of support given. However, certain aspects of functional and structural support were not accounted for in the analysis. There thus needs to be a further debate not only different numbers but on how different types of social support come

together to affect mental illness symptoms. While we considered a single mediating psychological variable, there is a possibility that more mediators may play a role in the mental illness and drug abuse association.

This study was conducted on a population of prisoners in Philadelphia, so there can be issues on generalizability. Further assessments in other populations and countries are needed. There can be ethical issues because these groups, HIV-positive, mentally ill and drug abusers were vulnerable populations.

Findings from the present study present a number of areas to address in future research. Our next step in research is to look at the moderator effect of social support (i.e., a variable that describes for whom or under what situation) for the relationship between mental illness (IV) and drug and/or alcohol abuse (DV). In moderation, the link between the IV and the DV is different for high vs. low levels of the moderator. If there's high moderator, then the IV does this with the DV, and if there's low moderator, the IV does this with the DV.

CHAPTER 9

CONCLUSION

Our data supported an alternative theory of inconsistent mediation. Firstly, it can be concluded that mental illness, social network, and drug abuse, are essentially different psychological constructs. Positive social support serves as a mediator in the causal path from mental illness to drug abuse. Modifiable factors such as mental illness may therefore, have detrimental effects on drug abuse and positive social support has beneficent effects on this outcome. Therefore, concurrent screening for substance use and change in social support should be conducted in all individuals with mental disorders. It is important to include the social network as a resource in assessment and in providing treatment to mentally ill individuals.

Further, there is a need to consider both the positive and negative effects of social support while keeping in mind these associations may differ among sociodemographic groups. Communities and social networks can provide support and all other positive sentiments that are associated with potential recovery, which itself arise from hope. Recovery can be enhanced through the help of many individuals, including those within families, peers, providers, faith groups and others. These people can help mentally ill patients to overcome all sorts of internal or external issues and challenges that they face. Social support allows the betterment of the mental health of patients and aids in the advancement of personal growth, wellness promotion and recovery. This is achievable

because the interaction with others gives them access to information and guidance. The fact that patients have the power to choose their interactions, allows them a sense of empowerment, which leads to a speedier recovery and higher resilience.

Self- determination and self-direction, paired with a support system that believes in them and offers hope, encouragement and resources expedites the recovery process. Those who have recovered or are undergoing recovery can further help others in similar situations to cope with mental illnesses or trauma.

CHAPTER 10

IMPLICATIONS

Mental disorders and drug abuse disorders are significant public health and social welfare problems. It is estimated that about 17.5 million Americans over the age of 18 had a serious mental health disorder in the year 2015. Of these individuals, about 4 million also struggled with a co-morbid drug or alcohol addiction (SAMHSA, 2016). According to recent estimates published in the journal *Lancet Psychiatry*, mental-health issues are currently costing the world one trillion dollars each year (Chisholm, D et al., 2016). In the United States alone, 30 percent of total disability costs are due to mental disorders. The costs of treatment for mental health and substance use disorders, which is a huge problem for the affected individuals, their families, and society, have led to increasing interest in prevention practices that can inhibit the onset or reduce the severity of the disorders.

Findings suggest that social support from family, friends, peers, and coworkers provides a mechanism of coping and recovery for mentally ill individuals. While the present results suggest that social support not only improves psychological functioning, they appear to be a viable option for individuals to remain abstinent from drug use.

Dealing with mental health problems was never easy, and it is even more challenging when the person is also struggling with substance abuse problems. When a mental health problem is deteriorated, the drug abuse problem usually gets worse as well. Recognition of social support, as a mediating variable, can be helpful in treatment and

prevention research, where efficient interventions can be designed to change this mediating variable, which is hypothesized to be causally related to a dependent variable, such as drug abuse problems. With proper support, coping and self-help strategies, people can overcome these co-morbid conditions and reclaim their lives.

From a treatment perspective, physicians may consider working to encourage healthy social networks and social support groups as aids to recovery. Severity, prognosis, treatment response and recovery of the primary mental illness depend on positive social support. Therefore, a key healthcare target of primary care management of common mental and substance use disorders should focus on support groups and social support network. Psychiatric, community and public health services should empower their users to engage local neighborhoods and live in partnership with communities. The National Institutes of Health (NIH) is exploring the process by which social networks connect individuals to health providers and how network members influence healthy and risky behaviors (NIH, 2001).

Mental illness and substance abuse go hand-in-hand for many individuals, yet as patients, they are treated by different teams of doctors getting different and sometimes contradictory treatments. Integrated dual diagnosis services for patients with these devastating comorbid disorders are emerging as evidence-based practice. Social support is an important component of these integrated services. Implementation of dual diagnosis programs should involve organizational and financing changes at the policy level. This is especially pertinent for policymakers to focus on this important public health problem of “Co-morbid disorders.” Policymakers should focus on areas including treatment-seeking

patterns, provision of care in public health and social service systems, evidence-based practices, and the issues of reimbursement. The costs, coverage, and availability of mental health services are some important issues for policy discussions. The Substance Abuse and Mental Health Services Administration (SAMHSA) has sought to promote an approach to address the needs of persons with mental health and substance use problems. In the US, the Mental Health Parity and Addiction Equity Act of 2008 (MHPAEA) made insurers offer equal benefits to an individual for mental health treatment and physical health treatment. As federal agencies attempt to develop effective policies to help health care providers to meet the composite needs of persons with co-occurrence disorder, their choices are informed by public choices and research on effective practices. Research shows special attention should be paid to a sociocultural model of treatment, emphasizing deficits in socialization process that can be amended by changing the physical and social environment.

The present study has shown that positive social networks are directly and positively related to mental and physical health and buffers psychological stresses, alleviating the sequelae of mental illness. However, a better understanding of the relationship between treatment status and structural and functional dimensions of the perceived social support is still needed.

CHAPTER 11

FUTURE DIRECTIONS

Mediation analysis continues to be an important area of methodological research. Longitudinal mediation models should be developed for investigation of temporal precedence in mediation relations. Similarly, good experimental designs of research to more thoroughly explore mediation should be designed. More research is needed on the determinants of social support. It will give a better understanding of the relationship of treatment status with structural and functional dimensions of the perceived social support. Further, there is a need to consider both the positive and negative effects of social support while keeping in mind these associations may differ among sociodemographic groups. Future studies are needed to investigate potential mediators such as hope, self-esteem, and other self-appraisals. Future research in mediation analysis will help obtain more accurate answers of *how* and *why* two variables are related to each other.

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APPENDIX A

TABLES FOR MODELS 1, 2, AND 3

MODEL 1

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	-29.969	.6218	-31.188	-28.750	2322.611	1	.000	9.655E-14	2.854E-14	3.266E-13
[black=1]	-12.118	.5851	-13.265	-10.972	428.991	1	.000	5.458E-6	1.734E-6	1.718E-5
[black=2]	0 ^a	.	.	.	.	.	.	1	.	.
[D3=1]	.005	.7244	-1.415	1.425	.000	1	.994	1.005	.243	4.158
[D3=2]	0 ^a	.	.	.	.	.	.	1	.	.
PM1	327.1 ^b	.0449	.239	416	53.097	1	.000	1.387	1.270	1.515
(Scale)										
(Negative binomial)	1 ^b									

Dependent Variable: SA1. How many times in your life have you been in treatment for drug and/or alcohol abuse?

Model: (Intercept), black, D3, PM1, offset = age

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

MODEL 2

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	-24.320	.8322	-25.951	-22.689	854.057	1	.000	2.741E-11	5.366E-12	1.401E-10
[black=1]	-5.860	1.0007	-7.821	-3.898	34.290	1	.000	.003	.000	.020
[black=2]	0 ^a	.	.	.	.	.	.	1	.	.
[D3=1]	-7.250	.8454	-8.907	-5.594	73.561	1	.000	.001	.000	.004
[D3=2]	0 ^a	.	.	.	.	.	.	1	.	.
PM1	.999	.2611	.488	1.511	14.655	1	.000	2.717	1.629	4.532
TotalNumberOfSupport	-.697	.0600	.515	-.579	134.843	1	.000	.498	.443	.560
(Scale)										
(Negative binomial)	1 ^b									

Dependent Variable: SA1. How many times in your life have you been in treatment for drug and/or alcohol abuse?

Model: (Intercept), black, D3, PM1, TotalNumberOfSupport, offset = age

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

MODEL 3

Tests of Between-Subjects Effects

Dependent Variable: TotalNumberOfSupport

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1994.391 ^a	3	664.797	10.260	.000	.355
Intercept	.034	1	.034	.001	.982	.000
PM1	1824.715	1	1824.715	28.161	.000	.335
black	88.163	1	88.163	1.361	.248	.024
D3	40.783	1	40.783	.629	.431	.011
Error	3628.593	56	64.796			
Total	6673.000	60				
Corrected Total	5622.983	59				

a. R Squared = .355 (Adjusted R Squared = .320)

Parameter Estimates

Dependent Variable: TotalNumberOfSupport

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	-2.563	2.866	-.894	.375	-8.304	3.178	.014
PM1	2.495	.470	5.307	.000	1.553	3.437	.335
[black=1]	2.659	2.279	1.166	.248	-1.907	7.224	.024
[black=2]	0 ^a	.	.	.	.	.	.
[D3=1]	2.544	3.207	.793	.431	-3.880	8.967	.011
[D3=2]	0 ^a	.	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.665 ^a	.443	.413	1.810

a. Predictors: (Constant), Moderator, PM1. How many times in your life have you been hospitalized for psychiatric reasons?, TotalNumberOfSupport

b. Dependent Variable: SA1. How many times in your life have you been in treatment for drug and/or alcohol abuse?

APPENDIX B

SOBEL TEST

Calculation for the Sobel test: An interactive calculation tool for mediation tests

Kristopher J. Preacher (*Vanderbilt University*), Geoffrey J. Leonardelli (*University of Toronto*).

To conduct the Sobel test: Details were taken from Baron and Kenny (1986), Sobel (1982), Goodman (1960), and MacKinnon, Warsi, and Dwyer (1995). We inserted the a , b , s_a and s_b into the cells below and this program calculated the critical ratio as a test of whether the indirect effect of the IV on the DV via the mediator is significantly different from zero.

Input:		Test statistic:	Std. Error:	p -value:
a	2.495	Sobel test: -4.82826379	0.36017398	0.00000138
b	-.697	Aroian test: -4.81353241	0.36127626	0.00000148
s_a	.470	Goodman test: -4.84313125	0.35906832	0.00000128
s_b	.060	Reset all	Calculate	

The test of the indirect effect is given by dividing ab by the square root of the above variance and treating the ratio as a Z test (i.e., larger than 1.96 in absolute value is significant at the .05 level).

There are three principal versions of the "Sobel test" - one that adds the third denominator term (Aroian, 1944/1947 - this is the version popularized by Baron & Kenny as the Sobel test), one that subtracts it (Goodman, 1960), and one that does not include it at all.

Formulae for the tests provided here were drawn from MacKinnon & Dwyer (1994) and from MacKinnon, Warsi, & Dwyer (1995):

Sobel test equation

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2)$$

Aroian test equation

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2 + s_a^2*s_b^2)$$

Goodman test equation

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2 - s_a^2*s_b^2)$$

APPENDIX C

CITI TRAINING CERTIFICATES

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM) COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Farah Sultan (ID: 2110945)
- **Email:** farah.sultan@temple.edu
- **Institution Affiliation:** Temple University (ID: 926)
- **Institution Unit:** Public Health
- **Phone:** 610-592-7081

- **Curriculum Group:** CITI Good Clinical Practice
- **Course Learner Group:** Same as Curriculum Group
- **Stage:** Stage 1 - Basic Course
- **Description:** This ICH E6 GCP Investigator Site Training meets the Minimum Criteria for ICH GCP Investigator Site Personnel Training identified by TransCelerate BioPharma as necessary to enable mutual recognition of GCP training among trial sponsors.

- **Report ID:** 18241372
- **Completion Date:** 05/30/2016
- **Expiration Date:** 05/30/2018
- **Minimum Passing:** 75
- **Reported Score*:** 93

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
The CITI Good Clinical Practice Course for Clinical Trials Involving Drugs and Devices (ID: 1350)	05/30/16	3/3 (100%)
Overview of New Drug Development (ID: 1351)	05/30/16	5/5 (100%)
Overview of ICH GCP (ID: 1352)	05/30/16	4/4 (100%)
ICH - Comparison Between ICH GCP E6 and U.S. FDA Regulations (ID: 1354)	05/30/16	4/4 (100%)
Conducting Investigator-Initiated Studies According to FDA Regulations and GCP (ID: 1355)	05/30/16	3/3 (100%)
Investigator Obligations in FDA-Regulated Research (ID: 1356)	05/30/16	5/5 (100%)
Managing Investigational Agents According to GCP Requirements (ID: 1357)	05/30/16	4/5 (80%)
Overview of U.S. FDA Regulations for Medical Devices (ID: 1358)	05/30/16	3/3 (100%)
Informed Consent in Clinical Trials of Drugs, Biologics, and Devices (ID: 1359)	05/30/16	3/4 (75%)
Detecting and Evaluating Adverse Events (ID: 1360)	05/30/16	4/4 (100%)
Reporting Serious Adverse Events (ID: 1361)	05/30/16	3/4 (75%)
Audits and Inspections of Clinical Trials (ID: 1363)	05/30/16	5/5 (100%)
Monitoring of Clinical Trials by Industry Sponsors (ID: 1362)	05/30/16	4/5 (80%)
Completing the CITI GCP Course (ID: 1364)	05/30/16	No Quiz
Temple University (ID: 1758)	01/26/15	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

CITI Program
 Email: citisupport@miami.edu
 Phone: 305-243-7970
 Web: <https://www.citiprogram.org>

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Farah Sultan (ID: 2110945)
- **Email:** farah.sultan@temple.edu
- **Institution Affiliation:** Temple University (ID: 926)
- **Institution Unit:** Public Health
- **Phone:** 610-592-7081

- **Curriculum Group:** CITI Good Clinical Practice
- **Course Learner Group:** Same as Curriculum Group
- **Stage:** Stage 1 - Basic Course
- **Description:** This ICH E6 GCP Investigator Site Training meets the Minimum Criteria for ICH GCP Investigator Site Personnel Training identified by TransCelerate BioPharma as necessary to enable mutual recognition of GCP training among trial sponsors.

- **Report ID:** 18241372
- **Report Date:** 05/30/2016
- **Current Score**:** 93

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
The CITI Good Clinical Practice Course for Clinical Trials Involving Drugs and Devices (ID: 1350)	05/30/16	3/3 (100%)
Overview of New Drug Development (ID: 1351)	05/30/16	5/5 (100%)
Temple University (ID: 1758)	01/26/15	No Quiz
Overview of ICH GCP (ID: 1352)	05/30/16	4/4 (100%)
ICH - Comparison Between ICH GCP E6 and U.S. FDA Regulations (ID: 1354)	05/30/16	4/4 (100%)
Conducting Investigator-Initiated Studies According to FDA Regulations and GCP (ID: 1355)	05/30/16	3/3 (100%)
Investigator Obligations in FDA-Regulated Research (ID: 1356)	05/30/16	5/5 (100%)
Managing Investigational Agents According to GCP Requirements (ID: 1357)	05/30/16	4/5 (80%)
Overview of U.S. FDA Regulations for Medical Devices (ID: 1358)	05/30/16	3/3 (100%)
Informed Consent in Clinical Trials of Drugs, Biologics, and Devices (ID: 1359)	05/30/16	3/4 (75%)
Detecting and Evaluating Adverse Events (ID: 1360)	05/30/16	4/4 (100%)
Reporting Serious Adverse Events (ID: 1361)	05/30/16	3/4 (75%)
Audits and Inspections of Clinical Trials (ID: 1363)	05/30/16	5/5 (100%)
Monitoring of Clinical Trials by Industry Sponsors (ID: 1362)	05/30/16	4/5 (80%)
Completing the CITI GCP Course (ID: 1364)	05/30/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

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APPENDIX D

NORBECK SOCIAL SUPPORT QUESTIONNAIRE

Now I am going to ask about significant people in your life. Consider the persons who provide personal support for you or who are important to you. I will ask you all eight questions for a person, before moving to the next person. Please refer to cards 13-15.

Use the following list to help you think of the people important to you, and list as many people as apply in your case.

- Spouse or partner
- Family members or relatives
- Friends
- Work or school associates
- Health care providers
- Counselor or therapist
- Minister/priest/rabbi
- Other

Psychiatric and Medical Status

	NANS	NASK
M1. How many times in your life have you been hospitalized for psychiatric reasons? _____	<input type="checkbox"/> -8	<input type="checkbox"/> -9

Substance Abuse Treatment Status

	NANS	NASK
SA. How many times in your life have you been in treatment for drug and/ or alcohol abuse? _____	<input type="checkbox"/> -8	<input type="checkbox"/> -9