#### CO-OCCURRING SUBSTANCE USE AND PSYCHIATRIC DISORDERS AMONG A SUBSTANCE ABUSE TREATMENT POPULATION

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#### Abstract

Research has shown that persons with co-occurring disorders are more likely to use multiple drugs and to have more social and economic problems than substance abuse treatment populations without a co-occurring mental health disorder. This article focuses on the incidence and characteristics of persons with co-occurring disorders among a substance abuse treatment population in Detroit, MI. Data were extrapolated from a larger needs assessment that covered the three-year period 2004-2006.

It is estimated that over 5 million adults in the United States suffer from co-occurring mental health and substance abuse disorders (SAMHSA, 2006). Individuals with co-occurring disorders account for a significant proportion of the substance abuse treatment population. In 2001, the number of substance abuse treatment admissions with co-occurring disorders made up 16 percent of all admissions (The DASIS Report, 2004). Clinical samples show that as many as 60 to 80 percent of persons with substance abuse histories have a co-occurring mental illness diagnosis (Mueser, Drake, Turner & McGovern, 2006).

Among mental health populations in 2003, 21.3% were found to be substance dependent (SAMHSA, 2006). Moreover, the literature suggests that certain mental health challenges places individuals at increased risk for substance abuse behaviors. For example, persons with antisocial personality disorders are at a 15,5 percent increased risk for substance abuse behavior. The psychiatric problems

commonly identified as co-occurring with substance abuse behaviors are depression and bi-polar disorders. generalized anxiety disorders, panic disorders, obsessive-compulsive disorders, phobias, schizophrenia and personality disorders (Mental Health America, 2008).

The social and economic costs of co-occurring mental health and substance use disorders has been well documented in the literature on both substance abuse and mental health (SAMHSA, 2008). Research has shown that persons with co-occurring disorders (PWare more likely to use multiple drugs and to have more social and economic problems than substance abuse treatment populations without a co-occurring mental health disorder. Those with co-occurring disorders more likely to be chronically homeless, have serious medical problems like HIV, have functional impairment, and behavioral problems than persons with either mental health challenges or substance use issues alone. Also, persons with co-occurring disorders tend to have high utilization rates for other public services - such as police, jail and court services - and medical services - such as hospital emergency rooms and emergency medical transportation services (Mowbray, Ribisi, Solomon, Luke & Kewson, 1997; Compton, Weiss, West & Kaslow, N., 2005). This article focuses on the incidence and characteristics of persons with co-occurring disorders among a substance abuse treatment population in a large urban area.

#### METHODS

The data reviewed here were collected as part of a larger needs assessment study completed in 2007 for the City of Detroit Department of Health and Wellness Promotion, Bureau of Substance Abuse Prevention, Treatment and Recovery (BSAPTR) in the City of Detroit Department of Health and Wellness Promotion. BSAPTR is one of 16 state designated Substance Abuse Coordinating Agencies in Michigan. Its coverage area is the City of Detroit.

Detroit is Michigan's largest city; once ranked as the fifth largest city in the U.S. (1960 population of 1,670,144). Today, with just under one million residents, Detroit is one of the poorest cities in the United States. African-Americans make up about 81 percent of the population and almost half (49 percent) of Detroit's residents have incomes below 200% of the federal poverty level (American Community Survey, 2005). The city is plagued by population loss, poverty, decaying neighborhoods, unemployment, violence, and substance abuse (United Way for Southeastern Michigan, 2006).

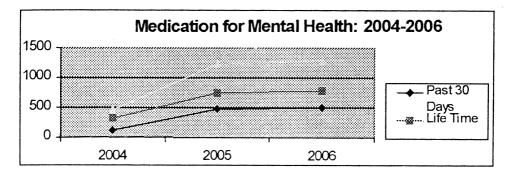
BSAPTR administers federal Substance Abuse Block Grant funds and federal and state Medicaid funded treatment services to Medicaid eligible persons residing in Detroit. In addition to contracting for substance abuse treatment, recovery and prevention services, it oversees the operations of a centralized entry point into substance abuse treatment: Access Assessment and Referral Services (AAR).

The needs assessment study used a number of administrative data sets and a variety of methods (focus groups, key informant interviews, public opinion telephone poll, mailed stakeholder group surveys) to engage the general public and BSAPTR's stakeholder communities in the needs and asset assessment process. The data reported here were derived from an administrative data set called CareNet®. CareNet® is an electronic case file system that aggregates information inputted by BSAPTR CareNet® data were providers. provided as individual Excel files for three years: 2004, 2005 and 2006. Each file contained the fields from the CareNet® database with client ID as a linking variable. The files were cleaned and exported to SPSS for analysis.

#### INCIDENCE OF CO-OCCURRING DISORDERS

BSAPTR gathers information on serious mental health issues via self-report at the point of admission. In addition to gathering information on specific serious issues such as depression and anxiety, information on the use of medication for mental health issues is recorded in a non-duplicative manner, based on most recent use. For the purposes of this analysis, the receipt of medication for mental health issues was used to indicate a diagnosed co-occurring disorder. Over a three year window from 2004 ring cases is viewed by year increases are noted.

As noted earlier, the city of Detroit is a largely African-American urban area. Consequently, it is no surprise that the majority of persons seeking treatment for substance abuse in Detroit (90.9%, n=12634) and a majority of the co-occurring population 87.2% (n=2,597) are African-American. Caucasians make up only 6.1% (n=850) of the larger substance abuse population seeking treatment in Detroit and about 10% (n=297) of the co-occurring population.Hispanic/Latinos (1.3%, n=34), Native Americans (.3%,



to 2006, close to 12% (n = 1,872) of all intakes noted prescribed medication for mental health symptoms 'at some point in their lives' and another 6.9% (n = 1,106) of the intakes within that same three year window noted medication for mental health symptoms 'within the last 30 days.' Together, these two categories represent 18.5% (n = 2,978) of all substance abuse treatment admissions in the city of Detroit for the years 2004 through 2006. When the number of co-occurn=8), Asian Americans (.3%, n=8) and Arab Americans (.1%, n=3) are alsorepresented among the co-occurring population, albeit in fairly low numbers.

These data show that the substance abuse treatment population in Detroit is predominantly male. Males outnumber females by almost 2 to 1 (65.1%, n=9068 males v 34.9%, n=4860 females). However, gender breakdowns for persons with both a substance abuse and mental health disorder tell

a different story. These data show a fairly equal distribution of women (48.4%, *n* = 1,264) and men (51.6%, n=1,536). Moreover, persons with cooccurring disorders are more likely to be female when compared to persons admitted to treatment for substance abuse disorders only (48.4%, n=1264 women with co-occurring disorders v 31.8%, n=3596 women with only substance abuse disorders). The individuals who sought substance abuse treatment in Detroit between 2004 and 2006 were primarily single 90.9% (n=12646). Only 7.8% (n=1257) were married at the time of admission into treatment. Table 1 shows a comparison of marital status at the time of admission for co-occurring v substance abuse only groups.

Among the persons seeking substance abuse treatment in the city of Detroit between 2004 and 2006, about 3% (n=89) were court referred to treatment. These individuals had an average of 12.7 arrests with drugs noted in 11.7% (n=347) of the cases. Sixteen percent (n=476) were on probation and 2.5% (n=73) had open protective services cases at the time of admission.

There was a higher incidence of homelessness among the co-occurring group when compared to the substance abuse only group (20.2%, n=527 v 15.3%, n=1730). Persons with co-occurring disorders were less likely than those with substance abuse only to be in the competitive labor force (21.6%, n=563 for co-occurring v 15.4%, n=1744 for substance abuse only); more likely to be on public assistance (42.2%, n=1112 v 27.3%, n=3188); and more likely to have Medicaid as their funding source for substance abuse treatment (42.0%,n= 1102 v 24.4%, n=2829).Table 2 compares select characteristics of the co-occurring group v the substance abuse only group. About 36% (n=1,068) of the co-occurring group have a family history of substance abuse and 96.7% (n=2879) report a history of drug overdose. The top

	Co-Occurring Disorder No. (%)	Substance AbuseOnly No. (%)	
All	2,978 (100.0)	13,077 (100.0)	
Marital Status			
Divorced	313 (12.0)	1,120 (9.9)	
Married/Cohabiting	200 (7.7)	1,057 (9.4)	
Never Married	1,750 (67.2)	8,197 (72.5)	
Separated	242 (9.3)	643 (5.7)	
Widowed	98 (3.8)	283 (2.5)	

Table 1: Co-Occurring v Substance Abuse Only by Marital Status

Characteristics of the Co-occurring Group Compared to Substance Use Only Group

# Table 2: Characteristics of Co-Occurring v Substance Abuse Only

Table 2: Characteristics of Co	Co-Citauring Disorder	Substance Abuse Only		
	Nb (%)	No (%)		
Al	2978(1000)	13,077 (100.0)		
Dependent Homeless Independent	1,978 (41.4) 527 (20.2) 938 (38.3)	4,467 (39,5) 1,730 (153) 513 (452)		
Military Service				
Yés No	81 (3.1) 2,522 (969)	274 (24) 11,026 (997.6)		
Employment Status				
Employed Full Time Employed Pat Time Not Applicable Not in Competitive Labor Force Retired from Work Utemployed	24 (9) 41 (1.6) 59 (23) 563 (21.6) 19 (.7) 1,897 (729	338 (34) 396 (35) 131 (12) 1,744 (154) 77 (7) 8,564 (758)		
Education				
LesstranH6 H6Qad MoretranH6	1,155 (444) 1,985 (41.7) 380 (138)	4,489 (398) 5,531 (490) 1,264 (11.1)		
Ruldic Assistance				
Yés No	1,112 (42.2) 1,523 (57.8)	3,188 (27.3) 8,481 (727)		
FundingSaurce				
Adult Benefit Waiver Book Gent Medicaid SDA Women's Specialty Other Third Party Detroit OtyFunds Medicare Blue Care Network Count Other	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9 (7.8) \\ 6 (270) \\ (53.9) \\ 2 (282) \\ (24.4) \\ 1,301 \\ (11.2) \\ 210 \\ (1.8) \\ 19 \\ (2) \\ 60 \\ (.5) \\ 7 \\ (.1) \\ 5 \\ (0) \\ 3 \\ (0) \\ 3 \\ (0) \end{array}$		

three primary substances reported for persons with co-occurring disorders were crack cocaine (38.9%; n =1,018), heroin (28.3%; n = 740), and alcohol (21.6%; n = 565). Secondary substances included alcohol (41%; n =647) and crack cocaine (26.9%; n =425). Comparative data show that persons with co-occurring disorders are more likely to use crack cocaine as their primary drug of choice (38.9%,  $n=1018 \vee 29.4\%$ , n=3343) and less likely to use marijuana/hashish (7.8%,  $n=204 \vee 14.8\%$ , n=1683) than persons with substance abuse only issues.

Almost all in the co-occurring group experienced serious mental health symptoms prior to admission. Twothirds of this group reported experiencing serious depression at some point during their lives (and one-third within the past 30 days). Nearly half reported serious anxiety and tension (46.2%, n=1376), with slightly over one-quarter experiencing these symptoms in the past 30 days. Close to 29% (n=858) had trouble understanding/ concentrating/remembering, and 29.2% (n=870) reported adjustment difficulties.

Nearly one-fifth experienced hallucinations (19.3%, 575), and one-third had attempted suicide (32.1%, 956) at least once. Table 3 identifies the substances used and the mental health symptoms experienced within the 30 days prior to admission for substance abuse treatment for the co-occurring group compared to the substance abuse only group.

## Differences among the Co-Occurring Population

Though males significantly outnumber females among the general substance abuse treatment population, males and females are fairly equal among the co-occurring population. Comparative data by gender among the co-occurring population show very few differences. However, several characteristics where females and males differ are noteworthy. For example, among the co-occurring population, whites are slightly more likely to be female than male. (54.4%, n=143 v 45.6%, n=120).

Females are more likely to have been married and divorced, separated or widowed than males (34.5%, n=461 for females v 29.1%, n=392 for males). It is also interesting to note that more females reported living in dependent situations at the time of admission than males (45.1%, n=569 females v 38.0%, n=509 males) and more males reported being homeless than females (24.2%, n=325 males v 16.0%, n=202 females). Table 4 distributes characteristics of the cooccurring group by gender.

Choice of primary substance also differs by gender. Though of choice (25.5%, n=342) and more females identify heroin as a primary drug of choice (31.7%, n=399). When viewing mental health symptoms experienced thirty days

Table 3: Substances and Symptoms Co-Occurring v Substance Abuse On	niv
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Primery Substance Used	Co-Cocuring Disorder No. (%)		Substance No	Abuæ Only (%)
Alcohol	565	(21.6)	2474	(21.7)
Harain	740	(28.3)	3,534	(31.1)
Methedone (illiait)	8	(.3)	21	(.2)
Other Opiates or synthetics	28	(1.1)	91	(8.)
Other Sectatives or Hyprotics	0	(0)	1	(0)
Barbiturates	1	(0)	0	(0)
Cozaine	48	(1.8)	216	(1.9)
Crack Coccaine	1,081	(38.9)	3,343	(29.4)
Other Amphetamines	0	(0)	1	(0)
Methcathinone	1	(0)	1	(0)
Marijuana / Hashish	204	(7.8)	1,683	(14.8)
Ecstacy (MDNA, MDA)	1	(0)	9	(.1)
Intelents	0	(0)	2	(0)
Mental Health Symptoms in Past 30 Days				
Serious Depression	911	(30.6)	1,304	(100)
Serious Anxiety and Tension	744	(260)	1,011	(7.7)
Hallucinations	234	(7.9)	140	(1.1)
Trouble Understanding/Concentrating/Remembering	641	(21.5)	632	(48)
Cartralling Molert Betaviar	183	(61)	246	(1.9)
Serious Thoughts of Suicide	226	(7.6)	163	(1.2)
Attempted Suicide	90	(30)	73	(.6)
Adjustment Difficulties	493	(166)	1,150	(88)
Paric Attacks	271	(9.1)	204	(1.6)

	Female No. (%)	Male No. (%)
Gender	1,264 (48.4)	1,346 (51.6)
Race/Ethnicity		
African American/Black	1,086 (86.1)	1,185 (88.4)
Arab American	1 (.1)	2 (.1)
Asian or Pacific Islander	4 (.3)	3 (.2)
Hispanic	16 (1.3)	18 (1.3)
Multi-racial	2 (.2)	1 (.1)
Native American	5 (.4)	3 (.2)
Refused to provide	0 (0)	1 (.1)
Unknown	5 (.4)	8 (.6)
White	143 (11.3)	120 (8.9)
Marital Status		
Divorced	167 (13.2)	146 (10.9)
Married/Cohabiting	84 (6.7)	116 (8.7)
Never Married	801 (63.5)	949 (70.8)
Separated	140 (11.1)	102 (7.6)
Widowed	70 (5.5)	28 (2.1)
Living Arrangement		
Dependent	569 (45.1)	509 (38.0)
Homeless	202 (16.0)	325 (24.4)
Independent	491 (38.9)	507 (37.8)
Military Service		
Yes	16 (1.3)	65 (4.8)
No	1,246 98.7)	1,276 (95.2)

#### Table 4 - Characteristics of Females v Males with Co-occurring Disorders

Table 4 cont.. - Characteristics of Females v Males with Co-occurring Disorders

Employment Status		
Employed Full Time	8 (.6)	16 (1.2)
Employed Part Time	14 (1.1)	27 (2.0)
not applicable	32 (2.5)	27 (2.0)
Not in competitive Labor force	277 (21.0)	286 (21.3)
Retired from Work	9 (.7)	10 (.7)
Unemployed	922 (72.9)	975 (72.7)
Education		
Less than High School	603 (47.7)	553 (41.4)
High School Grad	466 (36.9)	619 (46.0)
More than High School	195 (15.4)	174 (12.9)
Public Assistance		
Yes	580 (46.7)	492 (37.2)
No	662 (53.3)	831 (62.8)
Funding Source		
Adult Benefit Waiver	79 (6.4)	119 (9.0)
Block Grant	402 (32.4)	563 (42.7)
Medicaid	600 (48.3)	455 (34.5)
SDA	61 (4.9)	172 (13.0)
Women's Specialty	98 (7.9)	5 (.4)
Other Third Party	0 (0)	1 (.1)
Detroit City Funds	0 (0)	4 (.3)
Medicare	1 (0)	0 (0)

Primary Substance Lised	Female No. (%)		l Na	V <b>aic</b> (%)
Alcohol	223	(17.7)	342	(255)
Herain	399	(31.7)	332	(24.8)
Methechne (Illicit)	4	(.3)	4	(.3)
Other Opiates or synthetics	19	(1.5)	9	(7)
Babiluales	1	(.1)	0	(0)
Cozire	24	(1.9)	24	(1.8)
Orack Coccaine	505	(401)	505	(37.7)
Metrcatrinone	1	(.1)	0	(0)
Marijuana / Hashish	81	(64)	122	(91)
Ecstacy (MDNA, MDA)	0	(0)	1	(.1)
Ketamine	1	(.1)	0	(0)
Mintal Health Symptoms in Past 30 Days				
nieseqeadavoies	396	(31.3)	401	(298)
Sericus Anxiety and Tension	333	(263)	337	(7250)
Haliucinations	86	(68)	122	(91)
Trouble Understanding/Concentrating/Remembering	283	(224)	265	(197)
Cartrolling Vident Behavior	78	(62)	82	(61)
Satice Tradits of Slicide	106	(84)	95	(7.12)
Attempted Suicide	42	(33)	33	(25)
Adjustment Officilities	394	(312)	219	(163)
ParicAttades	132	(104)	96	(7.1)

Table 5: Substances and Symptoms Females v Males with Co-occurring Disorders

# Table 6 – Characteristics of Homeless, Dependent and Independent Persons among the Co-occurring Group

	HOMELESS No. (%)		DEPENDENT No [%]		IN DEPENDENT No (%)	
Living Arrangement	527	(100.0)	1,078	(100.0)	998	(100.0)
Gender						
Female Male	202 325	(38.3) (61.7)	569 509	(52.8) (47.2)	491 507	(49.2) (50.8)
Race/Ethnicity						
A frican American/Black Arab American Asian or Pacific Islander Hispanic Multi-racial Native American Refused to provide Unknown White	4 4 6 1 0 3 0 3 0 4 7 0	(8 4.6) (.2) (0) (.6) (0) (.6) (0) (.8) (1 3.3)	986 1 0 16 2 0 0 0 7 3	(91.5) (.1) (0) (1.5) (.2) (0) (0) (0) (6.8)	839 1 7 15 1 5 1 9 120	(84.1) (.1) (.7) (1.5) (.1) (.5) (.1) (.9) (12.0)
Marital Status						
Divorced Married/Cohabiling Never Married Separated Widowed	82 18 350 64 13	(15.6) (3.4) (66.4) (12.1) (2.5)	107 90 736 102 43	(9.9) (8.3) (68.3) (9.5) (4.0)	124 92 664 76 42	(12.4) (9.2) (66.5) (7.6) (4.2)
Military Service						
Ye s N o	13 514	(2.5) (97.5)	39. 1,039	(3.6) (96.4)	29 969	(2.9) (97.1)
Employment Status						
Employed Full Time Employed Part Time not applicable Not in competitive Labor force Retired from Work Unem ployed	2 5 17 113 4 386	(.4) (.9) (3.2) (21.4) (.8) (73.2)	5 18 19 271 6 759	(.5) (1.7) (1.8) (25.1) (6) (70.4)	17 18 23 179 9 752	(1.7) (1.8) (2.3) (17.9) (9) (75.4)
Education						
Less than High School High School Grad More than High School	249 205 73	(7.2) (38.9) (13.8)	547 400 130	(50.8) (37.1) (12.1)	360 480 157	(36.1) (48.1) (15.7)
Public Assistance						
Yes No	139 381	(267) (733)	571 486	(54.0) (46.0)	369 624	(36.5) (63.5)
Funding Source						
A dult Benefit Waiver Block Grant Medicaid SDA Women's Specialty Other Third Party Detroit City Funds Medicare	39 198 153 96 29 0 2	(7.5) (38.3) (29.6) (18.6) (5.6) (0) (4) (0)	42 326 604 43 40 0 1	(4 0) (3 0.8) (5 7.1) (4 1) (3 8) (0) (.1) (.1)	117 439 295 94 34 1 0	(11.9) (44.8) (30.1) (9.6) (3.5) (.1) (.1) (.1) (0)

Rinary Substance Liad	Honetess No (%)		Dep No	Dependent No (%)		Independent No (%)	
Acto	127	(243)	219	(204)	218	(220)	
Heroin	80	(1537)	330	(297)	331	(334)	
Nethedre(ilicit)	0	(0)	2	(2)	6	(.6)	
Cher Opiates or synthetics	6	(1.1)	12	(1.1)	10	(1.0)	
Babiluates	0	0)	20	(1.9)	1	(.1)	
Cocaine	10	(1.9)	388	(361)	18	(1.8)	
(Cadk Coxaine	272	(520)	1	(.1)	345	(348)	
Mahcatrinone	0	(0)	114	(106)	0	<b>(0</b> )	
Manjuana/Hashish	28	(54)	0	<b>(0</b> )	61	(61)	
Ecstacy (MDNA, MDA)	0	(0)	0	(0)	1	(.1)	
Ketanine	0	0)	0	0)	1	(.1)	
Mintel HallhSynphons in Past 30 Days							
Serice Depression	176	(334)	283	(26 <b>3</b> 5)	337	(338)	
Serious Anxiety and Tension	<b>14</b> 6	(27.7)	236	(228)	276	(27.7)	
Hallwinations	55	(104)	67	(62)	86	(86)	
Table <u>Urbszadrg Covertairg Renenteirg</u>	118	(224)	204	(189)	225	(225)	
Controlling Vident Behavior	36	(68)	65	(60)	59	(59)	
Series Trachts of Sicile	55	(104)	72	(67)	73	(73)	
Attempted Suicide	18	(34)	23	(21)	34	(34)	
Adustment Difficulties	112	(21.3)	156	(145)	158	(158)	
ParicAttades	60	(11.4)	74	(69)	94	(94)	

Table 7: Substances and Symptoms by Living Arrangement

prior to admission, adjustment disorders appear more pronounced among females than males (31.2%, n=394)females v 16.3%, (n=219 males). Table 5 distributes primary substances and mental health symptoms by gender.

# Homeless, Dependent and Independent Persons among the Cooccurring Population

Among the co-occurring population males are significantly more likely to be homeless at the point of admission than females (61.7%,n=325 males v 38.3%, n=202 for females). Otherwise, the characteristics of persons with co-occurring disorders do not appear to be related to living arrangement at admission (see table 6).

The data on primary substance of choice, as distributed in table 7, shows that persons who were homeless at the point of admission were significantly more likely to identify crack cocaine as their drug of choice than persons in other living arrangements (52%, n=272 for the homeless, compared to 34.8%, n=345 for persons living independently and only one person in a dependent living arrangement (defined as living with family and/or Mental Health symptoms friends). experienced show little variation based on living arrangement. (See table 7.)

#### Discussion

Data from <u>CareNet®</u> identify a high incidence of co-occurring disorders among the substance abuse treat-

ment population in the city of Detroit. Between 2004 and 2006 the persons with co-occurring disorders made up 18.5% of all substance abuse treatment cases. This percentage is slightly higher than national estimates of 16%. Among this group of persons with both a substance abuse and mental health disorders, men and women are almost equally represented, even though the substance abuse treatment population in Detroit is largely male. The high number of substance addicted women who also have mental health issues suggests the need for specialized integrated treatment programs that are able to address female specific treatment issues.

Housing and financial assistance are important considerations in the development of comprehensive programming for the co-occurring population. The co-occurring group had a higher percentage of living arrangements recorded as homeless at admission when compared to the substance abuse only group. Almost two thirds of the co-occurring group was either homeless or living in a 'dependent' arrangement. Only 38.3% were living independently at intake into the treatment program. And only 2.5% were employed at the time of admission. The lack of stable housing and the lack of employment are conditions that have been associated with relapse (Xie, McHugo, Fox and Drake, 2005). These data show that persons who suffer from co-occurring disorders in Detroit have a complex web of issues and concerns. Many of the cases included in this study were involved with the criminal justice system for various offenses such as shoplifting, vandalism, driving while intoxicated and public intoxication. Most had low levels of educational attainment and came from families with a history of substance abuse. Moreover, the combination of mental health disorders and substance abuse complicates treatment access and service delivery.

# Conclusion

Individuals with co-occurring disorders are often required to negotiate two different systems - the mental health system and the substance abuse treatment system. The existence of two different service systems often results in consumers bouncing back and forth between substance abuse and mental health systems, receiving treatment for only one disorder at a time with poor outcomes (SAMHSA, 2002). In recent years, the US Department of Health and Human Services Substance Abuse and Mental Health Services Administration has devoted significant resources to gather evidence on the effectiveness of integrated services (SAMHSA, 2008). As evidence mounts, many substance abuse coordinating agencies, including BSAPTR, have started thinking about and working on more fully integrating mental health and substance abuse services to better address the needs of individuals with co-occurring disorders.

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