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Substance Use, Depression and Sociodemographic Determinants of HIV Sexual Risk Behavior in Outpatient Substance Abuse Treatment Patients

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In the U.S., sexual risk behavior is the primary route of HIV transmission [CDC, 2009]. Individuals with substance abuse, even if in substance abuse treatment, may be especially vulnerable to sexual transmission. Research, among inner city New York substance users in [Des Jarlais, Semaan, 2011] and out of [Des Jarlais, et al., 2007; Hagan, Perlman and Des Jarlais, 2011] treatment, has obtained nearly identical HIV seroprevalence rates among non-injecting and injecting drug users. This vulnerability is due both to the links between substance use and sexual behavior [Mathers et al., 2008], and between substance use and exchange of sex for drugs or money [Dehovitz et al., 1992]. Research has highlighted stimulants, especially cocaine [Edlin et al, 1994; Mathers et al., 2008] and methamphetamine [Colfax, 2004; Shoptaw & Reback, 2006], as a driver of sexual risk behavior. There is increasing evidence that alcohol, through disinhibition, may exert a similar effect on sexual risk [Castilla, Barrio, Belza and de la Fuente, 1999; Aicken, Nardone and Mercer, 2011; Van Tieu and Koblin, 2009]. In contrast, opiates, as potential inhibitors of libido and sexual function [Lejuez et al, 2005], have not been found to be consistent predictors of sexual risk behavior.

Research has also examined the role of comorbid psychiatric symptoms in sexual risk behavior [Meade, 2006]. Susceptibility to sexual risk behavior among individuals with severe mental illness, mediated by impulsivity, substance use, and/or paid sex, has been widely observed. For depression, commonly found in between one-third and one-half of

substance users in outpatient substance abuse treatment [Nunes, Sullivan and Levin, 2004], findings related to sexual risk are mixed. Some research has emphasized the constricting effects of depression on sexual drive and behavior (Pilowsky, Wu, Burchett, Blazer, & Ling, 2011). Other research has observed that depressive passivity, resignation and pessimism may drive the individual to careless risk behavior [Khan et al., 2009]

Research investigating sexual risk behaviors has been concentrated in out-of-treatment [Mathers et al, 2008; Des Jarlais, Arasteh, McKnight, Hagan, Perlman & Semaan, 2011; Hagan, 2011] or methadone treatment programs [Mark et al., 2006]. Few studies have examined the sexual behavior of individuals in both narcotic replacement and psychosocial outpatient programs. A NIDA Clinical Trials Network 12-site trial of rapid, on-site HIV testing, with or without pre-test risk reduction counseling, provided a platform for the study of associations between sexual risk behavior, substance use and depression – in a large (N=1281), geographically and ethnically diverse sample of substance users in treatment.

METHODS

Participants

Recruitment occurred between January and December 2009. Sites included 12 outpatient psychosocial, intensive outpatient, outpatient methadone/other narcotic replacement, and residential programs that had not offered on-site HIV testing in the previous 6 months. Three sites were in the East (Plainville, New Britain and Danbury, CT; Baltimore, MD); three in the West (Portland, OR; Tucson, AZ; and Santa Fe, NM); five in the South (Cape Girardeau, MO; Chesterfield, VA; Salisbury and Concord, NC; and Columbia, SC), and one in the Midwest (Pittsburgh, PA). Eligible participants were: 1) 18 years old, (2) HIV-negative or unknown HIV status, (3) able to provide informed consent, (5) fluent in English, (6) and willing to provide locator information and access to their HIV testing records.

Description of methods and primary outcome results have been previously published (Metsch et al., 2012). The study was approved by the Western Institutional Review Board, and IRB of four sites. All participants gave written informed consent at study entry.

Data Collection

An Audio Computer Assisted Self-Interview (ACASI) was used to collect information on sociodemographic characteristics, drug use, sexual risk behaviors, self-efficacy and attitudes toward condom use, and depression.

Demographic characteristics included age, gender, education, marital status, income, and race/ethnicity.

Drug Use characteristics included use and injection of any of the following substances in the past 6 months: alcohol, hallucinogens, barbiturates and sedative/hypnotics, marijuana, opioids, amphetamines, cocaine (Powder, Crack and IDU), and club drugs (GHB, ketamine, ecstasy). IDU lifetime history was also assessed. For analyses, answers were coded as zero (i.e. substance not used in prior 6 months) or one (i.e. substance used). Severity of drug use

was assessed using the Drug Abuse Screening Test – 10 (DAST-10; Skinner, 1982; Grekin et al., 2010; Yudko, Lozhkina, & Fouts, 2007).

Sexual risk behavior was assessed by an instrument based on Project Mix (Mansergh, et al., 2010; Koblin et al., 2011) and Project Explore (Koblin et al., 2003; Colfax et al., 2004). For the prior six month period, individuals were asked for number of (anal or vaginal) sex partners, number of each type of sex act, and number of such occasions when a condom was properly used (i.e. from start to finish). Sexual risk was operationalized as number of anal or vaginal sex occasions in which a condom was not used. Participants reported this information for primary and non-primary partners. Because number of HIV positive partners was so small, sexual risk behavior was not distinguished by HIV partner status in analyses. With this information we created the following variables: 1) count of unprotected sex occasions (USO) within 2 hours of substance use, 2) count of USO with a primary partner, and 3) count of USO with non-primary partners.

Depression was assessed with the 16-item, self-reported, Quick Inventory of Depressive Symptomatology (QIDS), yielding continuous symptom scores. This scale has good internal consistency and predictive validity (Rush, et al., 2003). Cronbach's alpha for the current sample was 0.85, which closely matched that of the validation study.

Statistical Analysis

Models were estimated for each of the three measures of sexual risk—USO When High or Drunk, USO with a Primary Partner, and USO with Non-Primary Partners. All models were estimated using SAS 9.1.3 Proc Countreg with the zero-inflated negative binomial specification. This model fit the data better than a simple negative binomial, Poisson or zero-inflated Poisson model. Zero-inflated models were used when there were more data with a zero value on the dependent measure than would be expected with a simple negative binomial (or Poisson) model. There are two components that are estimated, both of which may include zero values. One component is a negative binomial count model which includes a certain number of zeros in the distribution. The second component is a binary model to predict the extra zero values which are not explained by the negative binomial component. Predictor variables can be added to both components of the model, and the coefficients for any particular predictor that is in both components will differ. The same set of predictors were entered into both components of the statistical model. Predictors included demographics, measures of drug use and depressive symptoms. Fixed site effects were controlled for in the models. The coefficients of the binary piece are interpreted similarly to a logistic regression. The exponentiated coefficient is interpreted as an odds ratio (OR). In general, zero inflated models predict the probability of being an excess-zero. We have transformed our results to express the probability of not being an excess zero (to be parallel with the negative binomial results, described below), so that the reported OR is for the likelihood of not being an excess zero and therefore engaging in a given sexual risk behavior. An OR less than 1 means that the characteristic is associated with a lower likelihood of engaging in a given sexual risk behavior. An OR greater than 1 means that the characteristic is associated with a higher likelihood of engaging in the given sexual risk. The coefficients of the negative binomial piece are interpreted similarly to a simple negative

binomial model. The exponentiated coefficient is interpreted as an incidence rate ratio (IRR) of the level of sexual risk. An IRR greater than one means that the characteristic is associated with a higher rate of sexual risk behavior. The continuous model variables, age, QIDS depressive symptom score and DAST 10 score were transformed so that a 1 unit change corresponded to 1 standard deviation of the underlying scale.

Results

Participant Characteristics

Of the 1281 randomized participants, 1258 were included in analyses. Ten, only having had sex with a same-gender partner, and thirteen, missing at least one predictor variable, were excluded. The sociodemographic, substance use and sexual risk characteristics of the sample are presented in Table 1. The majority were high school educated (63.4%), White (59.2%), and male (60.8%). The average age was 40.1 years ($SD = 11.3$) and 42.8% reported being single. Nearly 72% reported problematic drinking. More than a third but less than half used marijuana, opioids, or cocaine. The majority (51.2%) reported having never injected any drug, while about a fifth (20.8%) were current injection drug users (IDU). Sexual risk behavior was common. Rates varied for the 3 types of sexual risk behavior. Half of the sample engaged in USO with a primary partner (mean = 3.85 occasions) in the past 6 months. Forty-one percent engaged in USO while high or drunk (mean = 3.28 occasions). Twenty-three percent engaged in USO with non-primary partners (i.e. mean = 2.12 occasions).

Predictors of HIV/STD Sexual Risk Behavior

In Table 2, 3 vertical panels present results for the three outcome variables: Number of Unprotected Sex Occasions (USO) When High or Drunk, With Primary Partner, and With Non-Primary Partner. Each outcome variable panel has two parts corresponding to the two components of the zero-inflated negative binomial model: The first part containing OR with 95% confidence intervals (95%CI) refers to the logistic model of having or not having any unprotected sex. The second part containing IRR with 95% confidence intervals refers to negative binomial model for the count of unprotected sexual behaviors.

Overall, similar factors were significantly associated with each type of risky sex. To avoid undue repetition, these associations will be more fully explained for USO when drunk or high. For the other two types of sexual risk behavior, USO with primary and non-primary partners, similarities and differences in associations with predictors will be described.

HIV/STD Sexual Risk Behavior When High or Drunk

Unprotected sex (USO) when high or drunk was associated with a few demographic characteristics. Older age was associated with lower odds of engaging in USO when drunk or high; odds decreased by 40% with a one standard deviation (i.e. 11 year) increase in age. As compared to single individuals, those in other relationship status categories (i.e. married, cohabitating, divorced/separated) had approximately two – three times greater odds of engaging in USO when drunk or high. African Americans had odds that were half those of Whites. USO when high or drunk was associated with several substance use characteristics.

Problem drinkers had more than three and a half times greater odds than non-problem drinkers. Cocaine users had twice the odds of non-users. Drug and alcohol severity (i.e. DAST-10) was associated with higher odds; odds increased by 68% with a one standard deviation (i.e. 3.7 point) increase in DAST-10 score. With each standard deviation increase in DAST-10 score, number of USO while drunk or high increased by 23%. In current injection drug users, number of USO while high or drunk exceeded that in non-injectors by 78%.

HIV/STD Sexual Risk Behavior with a Primary Partner

A nearly identical set of predictors was significantly associated with having USO with a primary partner. That is, USO with a primary partner was associated with the following demographic factors: Older age was associated with lower odds and fewer numbers of USO. Being married, cohabitating or being divorced or separated were associated with higher odds. However, married individuals had fewer USO than single individuals. Odds of having USO with a primary partner were associated with the following substance use characteristics: problem drinking and higher DAST-10 drug and alcohol severity were associated with higher odds. Being a current drug injector was associated with a higher number of USO.

A few factors were significantly associated with having USO with a primary partner that were not associated with unprotected sex when high or drunk. Odds for women were more than 1½ times greater than for men. One additional substance use characteristic was associated with USO with a primary partner. Depression was also found to be associated with lower odds of having USO with a primary partner. Odds decreased by 29% with a one standard deviation (5.8-point) increase in QIDS depressive symptom score.

HIV/STD Sexual Risk Behavior with Non-Primary Partners

A subset of the same predictors were similarly associated with having USO with non-primary partners, as were associated with one or both of the other (above) types of unprotected sex. Older age was associated with lower odds. Higher odds of having unprotected sex with a non-primary partner were associated with the following substance use characteristics: cocaine use, DAST-10 drug and alcohol severity and problem drinking. However, problem drinking was associated with fewer numbers of USO. Injection history was associated with USO with non-primary partners. Both former and current injection drug users had more than twice the rates of USO with non-primary partners than non-injectors. The association between relationship status and USO with non-primary partners was opposite that observed for both of the (above) types of unprotected sex. That is: being married was associated with lower odds. Being widowed was associated with lower rates.

Discussion

Using the platform of a NIDA Clinical Trials Network 12-site trial, this study obtained a snapshot of HIV sexual risk behavior in a large (N=1281), representative sample of substance users in methadone or psychosocial outpatient treatment programs across the U.S. Understandably, substance users in treatment have been less frequently studied than out-of-

treatment substance users, who, without the benefit of treatment, have been assumed to be at more active risk. The first noteworthy finding of this study is: Among substance users in treatment, risk behavior was common. Half had engaged in unprotected sex (USO) with primary partners in the past 6 months. A substantial percentage (42%) had engaged in USO while high or drunk during the past 6 months. A considerable percentage (23%) had engaged in USO with non-primary partners during the past 6 months. While mean 6-month frequencies for each type of sexual risk behavior are low, it should be qualified that our use of means, for highly skewed distributions, overly muted these frequencies. These frequencies can be appreciated by examining the ranges, between the 25th and 75th percentiles, for each type of risk behavior. This range for USO with primary partners is 0 – 25. This range for USO while high or drunk is 0 – 9. For USO with non-primary partners, the value for this entire percentile range is 0. As discussed below, this is due to the lower percentage of individuals engaged in this behavior.

The second noteworthy finding of this study is: Among substance users in treatment, there is marked variability in their behavior on different sexual risk behaviors. Whereas half had engaged in USO with primary partners during the past six months, a far lower, but considerable, percentage (23%) had had unprotected sex with other partners. It should be emphasized that, in the U.S. HIV epidemic, both types of relationships have been shown to play a role in HIV transmission. Unprotected sex with multiple partners has long been appreciated as a means of acquiring HIV (CDC, 2002), particularly among substance users (Windle, 1989, Leigh and Stall, 1993; Leigh, Temple and Trocki, 1994). Unprotected sex with primary partners, who may carry hidden risks, has emerged as one of the important vectors for HIV infection in African American women (Millet, Malebranche, Mason, & Spikes, 2008). This risk is especially salient among substance users – whose substance using and seeking lifestyles may throw them into risk behavior with higher risk partners, under several circumstances. These could include unprotected sex while high or drunk (Raj, Saitz, & Cheng, 2007; Rosengard, Anderson, & Stein, 2006), while trading sex for drugs (Windle, 1997; Astemborski, Vlahov, Solomon, and Nelson., 1994), or while engaged in subsistence sex to meet basic needs. These could also include unprotected sex during incarceration (CDC, 2006) or coerced sex under threat of violence, in circumstances of intimate partner violence or rape by strangers (El Bassel, Gilbert, Witte, Wu, & Chang, 2011; Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997). Further, primary relationships pose particular challenges to practicing safer sex. Where emotional intimacy and trust is a defining feature of the relationship, initiation of, or even discussion of, safer sex can elicit suspicion of infidelity, hostility and, even, rejection or abuse (Wingood and DiClemente, 2000).

With this background, it seemed crucial to separately understand the determinants of these different types of risk behavior. In doing so, this study pursued distinctions, in associations governing different types of risk behavior, infrequent in prior literature. We drew on parameters with explanatory power in prior studies. This study examined the association between substance use, depressive symptoms, and HIV sexual risk behavior in substance users in treatment.

The three types of HIV/STD sexual risk behavior were driven by mostly common and some distinct associations. For all three types, older age had a protective effect on sexual risk

behavior. This is an oft-cited finding (Reynolds et al, 2010)—which may reflect two factors. One is: the positive influence of maturity on practicing safer sex. The other factor is: the effect of being in a cohort that has come of age with safer sex messages, and that has been moved by HIV losses among their peers.

For all three types of HIV/STD sexual risk behavior, problem drinking had an exacerbating effect on risk behavior. This is a common finding (Arasteh and Des Jarlais, 2009)—which is likely caused by disinhibition and lapsing control from alcohol. For all three types, cocaine use had an exacerbating effect of risk behavior. This is also a widespread finding (Mathers et al., 2008) – which is likely the result of hypersexuality and disinhibition from cocaine use. Rapid addiction and intense drug hunger, from cocaine, can press users to engage in sexual risk behavior, in exchange for drugs. For all three types, severity of drug use was associated with greater sexual risk behavior. Similarly, both for sexual behavior with primary or non-primary partners, current drug injector status was associated with greater sexual risk behavior. These results underscore the potent connection between drug use and sexual risk behavior – through disinhibition, sex-for-drug exchange, or other risk-enhancing features of drug use.

In analyses of sexual risk behavior with primary partners only, depressive symptoms were found to have a protective effect on risk behavior. This is a common finding (Pilowsky, Wu, Burchett, Blazer, & Ling, 2011) which may reflect two factors. One is: libido, and, therefore, impetus to engage in sexual risk behavior, may be reduced by depression. The other factor is: Worry, including about health and illness, and, possibly, risk of HIV, may be heightened by depression. The fact that, in our data, this finding was restricted to analysis of primary partner sexual risk behavior may be due to differences in the distributions of the different types of risk behavior in our sample. This may be because the proportion of people engaging in this risk behavior was greater than those for the other types of risk behavior, and allowed for greater variation in level of risk behavior among them. In turn, this variation may have influenced the extent to which association with determinants could be detected.

Expected variation in unprotected sexual behavior by relationship status for the different types of sexual risk behavior was observed. In as much as being married is a form of primary partnership, the finding of greater odds of unprotected sex with primary partners in married individuals was expected. Similarly, the finding of lower odds of sex with non-primary partners in married individuals was expected.

Caution should be observed in drawing any conclusion about a possible association between ethnicity and sexual risk behavior. In analyses of unprotected sex while high or drunk, African American ethnicity was found to be protective. This association did not hold for unprotected sex with primary or non-primary partners. This variation lacks theoretical or epidemiological basis. Examination of possible ethnic disparities in sexual risk behavior would be more appropriately studied in samples with greater proportions of drug users in each of the ethnic categories.

Caution should also be expressed about the methodological limitations of this study. First, despite its national scope, the population was limited to individuals in substance abuse

treatment programs not currently offering on-site HIV testing. As such, generalizability to the large population of substance abusers who are out-of-treatment as well as individuals residing in urban areas where testing is routinely included in substance abuse treatment is problematic. Second, assessment was limited to self-report of sexual risk behavior – without validation on either STI testing (i.e. for sexual risk behavior) or toxicology screens (i.e. for drug use).

CONCLUSION

Sexual risk behavior is common among individuals in outpatient substance abuse treatment. Study results highlight the roles of problem drinking and cocaine in sex risk behavior. They also demonstrate the utility of making distinctions between partner types and presence/absence of alcohol/drugs during sex. Findings argue for the need to integrate sex risk reduction into drug treatment, in both the assessment and counseling process. Addressing sexual risk behavior may enhance relapse prevention in this vulnerable population.

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Table 1

Demographic Characteristics of the Sample (N=1258)

Variables	N	(%)	Mean	SD
Age			40.06	11.28
Education				
College	110	8.74		
High School	798	63.43		
< High School	350	27.82		
Marital Status				
Married	204	16.22		
Cohabiting	115	9.14		
Widowed	49	3.90		
Divorced or Separated	352	27.98		
Single	538	42.77		
Race				
Hispanic	145	11.53		
Black	277	22.02		
Other	91	7.23		
White	745	59.22		
Gender				
Female	493	39.19		
Male	765	60.81		
IDU status				
IDU, past	353	28.06		
IDU, current	261	20.75		
Never IDU	644	51.19		
Problem Drinking	904	71.86		
Used Marijuana	551	43.80		
Used Opioids	465	36.96		
Used Cocaine	494	39.27		
DAST-10			5.23	3.70
QIDS Depression			9.27	5.78
Sexual Risk Behavior			<u>Mean</u> *	<u>C.I.</u> *
Unprotected Sex-High/Drunk	527	41.86	3.28	3.13, 3.44
Unprotected Sex-Primary Partner	633	50.28	3.85	3.73, 3.97
Unprotected Sex-Non-Primary Partner	299	23.75	2.12	1.40, 2.84

Key:

* Predicted means and 95% Confidence Intervals, from zero-inflated negative binomial model.

Table 2

Predictors of HIV Sexual Risk Behavior

Variables	Unprotected Sex When High or Drunk				Unprotected Sex With Primary Partner				Unprotected Sex With Non-Primary Partner			
	OR	95%CI	IRR	Incidence Rate Ratio	OR	95%CI	Odds Ratio	Incidence Rate Ratio	OR	95%CI	Odds Ratio	Incidence Rate Ratio
Age	0.60***	0.47 – 0.76	0.87	0.71 – 1.06	0.70***	0.59 – 0.84	0.75***	0.64 – 0.87	0.57***	0.44 – 0.74	0.90	0.66 – 1.24
Education												
College	0.70	0.33 – 1.48	0.66	0.35 – 1.24	0.57	0.32 – 1.00	1.18	0.74 – 1.88	1.10	0.43 – 2.82	0.39	0.14 – 1.10
High School	0.93	0.61 – 1.42	0.99	0.72 – 1.35	0.82	0.59 – 1.15	1.09	0.85 – 1.39	1.11	0.70 – 1.75	0.71	0.43 – 1.18
<High School(Ref)												
Marital Status												
Married	3.15***	1.75 – 5.69	1.01	0.69 – 1.46	6.15***	3.62 – 10.43	0.73*	0.55 – 0.98	0.50*	0.28 – 0.92	1.88	0.89 – 3.97
Cohabiting	2.69**	1.34 – 5.37	1.16	0.76 – 1.78	5.43***	2.90 – 10.19	0.82	0.58 – 1.14	0.51	0.25 – 1.04	1.38	0.61 – 3.15
Widowed	1.09	0.41 – 2.93	1.74	0.53 – 5.75	0.83	0.38 – 1.81	1.91	0.82 – 4.43	5.72	0.67 – 48.93	0.07***	0.02 – 0.28
Divorced or Separated	1.98**	1.22 – 3.22	0.99	0.67 – 1.45	1.84***	1.28 – 2.64	0.75	0.55 – 1.01	1.67	0.99 – 2.84	1.25	0.73 – 2.14
Single (Ref)												
Race												
Hispanic	1.10	0.56 – 2.14	0.75	0.44 – 1.28	1.45	0.85 – 2.47	0.93	0.63 – 1.39	0.85	0.39 – 1.86	0.72	0.29 – 1.81
African American	0.46**	0.28 – 0.77	0.85	0.57 – 1.29	0.68	0.45 – 1.01	0.82	0.59 – 1.13	1.01	0.57 – 1.79	0.74	0.41 – 1.32
Other	0.83	0.40 – 1.69	1.39	0.80 – 2.44	0.97	0.56 – 1.68	1.09	0.69 – 1.71	0.61	0.27 – 1.37	0.76	0.27 – 2.12
White (Ref)												
Gender												
Female	1.17	0.78 – 1.75	1.30	0.94 – 1.81	1.60**	1.15 – 2.21	1.18	0.91 – 1.53	1.58	0.99 – 2.53	0.80	0.47 – 1.36
Male (Ref)												
IDU status												
IDU, past	0.77	0.48 – 1.24	1.20	0.84 – 1.72	0.83	0.58 – 1.19	1.31	0.97 – 1.75	0.81	0.48 – 1.38	2.28**	1.30 – 3.99
IDU, current	0.82	0.45 – 1.49	1.78**	1.19 – 2.66	1.02	0.65 – 1.58	1.46*	1.05 – 2.03	0.89	0.48 – 1.64	3.44***	1.87 – 6.32
Never IDU (Ref)												
Problem Drinking	3.70***	2.39 – 5.74	0.80	0.52 – 1.22	1.47*	1.05 – 2.05	0.98	0.74 – 1.29	3.04***	1.80 – 5.12	0.44*	0.21 – 0.91
Used Marijuana	0.95	0.63 – 1.43	1.11	0.83 – 1.49	0.80	0.58 – 1.10	1.02	0.79 – 1.32	0.85	0.54 – 1.33	1.32	0.83 – 2.11

Variables	Unprotected Sex When High or Drunk				Unprotected Sex With Primary Partner				Unprotected Sex With Non-Primary Partner			
	OR	95%CI	IRR	Incidence Rate Ratio	OR	95%CI	Odds Ratio	Incidence Rate Ratio	OR	95%CI	Odds Ratio	Incidence Rate Ratio
Used Opioids	1.50	0.91 – 2.49	1.31	0.94 – 1.83	0.89	0.61 – 1.29	1.13	0.85 – 1.49	1.08	0.65 – 1.81	1.43	0.89 – 2.31
Used Cocaine	2.07**	1.30 – 3.31	0.79	0.57 – 1.11	1.21	0.85 – 1.72	0.79	0.60 – 1.05	1.93**	1.19 – 3.14	0.80	0.46 – 1.37
DAST 10	1.68***	1.30 – 2.19	1.23*	1.00 – 1.51	1.31**	1.07 – 1.61	1.14	0.98 – 1.33	1.41*	1.04 – 1.90	0.86	0.61 – 1.21
QIDS Depression	1.04	0.86 – 1.26	1.07	0.92 – 1.24	0.81**	0.69 – 0.94	1.01	0.89 – 1.13	1.17	0.94 – 1.45	1.05	0.84 – 1.33

* P<.05;

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p<.01;

*** p<.001