The Association Between Social Isolation and *DSM-IV* Mood, Anxiety, and Substance Use Disorders: Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions

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ABSTRACT

Objective: The objective of this study is to document the prevalence of social isolation from close friends and religious group members and to test the association of having infrequently contacted close friends and members of religious groups with the current *DSM-IV* mood, anxiety, and substance use disorders.

Method: We conducted a secondary data analysis based on a cross-sectional, population-based study conducted in 2004–2005 that consists of a nationally representative sample of 34,653 American community-dwelling adults aged 18 years and older. Mood, anxiety, and substance use disorders were assessed using the Alcohol Use Disorder and Associated Disabilities Interview Schedule–*DSM-IV* version. Due to missing values for social network characteristics, we focused on 33,368 subjects in this study.

Results: We found that many Americans lacked frequently contacted close friends (10.1%; 95% CI, 9.6%–10.6%) or religious group members (58.7%; 95% CI, 57.5%–59.9%) in their social network. After adjusting for sociodemographic variables, lifetime diagnosis of the disorder in question, and social isolation in terms of 10 other social ties, we found that the absence of close friends was associated ($P < .01$) with an increased risk of major depressive disorder, dysthymic disorder, social phobia, and generalized anxiety disorder; the absence of frequently contacted religious group members in a network was positively related ($P < .01$) to alcohol abuse and dependence, drug abuse, and nicotine dependence.

Conclusions: These results suggest that social isolation is common in the United States and is associated with a higher risk of mental health problems. Results provide valuable information for prevention and treatment.

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Humans are inherently social creatures. The yearning for social bonds is a fundamental human drive[1] that induces actions and has a detrimental impact on health if left unfulfilled.[2,3] Not surprisingly, numerous studies[4–6] have examined the relationship between social networks and health. However, the evidence[7,8] shows that this is a complex relationship when it comes to psychiatric disorders and that it could operate via 2 modes, namely, direct and stress-buffering effects. It has been suggested that structural aspects of a social network (such as its size and the frequency of contacts with other members) may operate via the main effect while its functional aspects operate through the stress-buffering mechanism.[9,10] Although investigation of the link between social isolation (being alone) as distinct from loneliness (feeling alone or perceiving oneself as socially isolated)[11–13] and psychiatric disorders dates back as far as Durkheim,[14,15] most previous studies neglected the frequency of contacts in the measurement of size of social network.[10,16–21] Furthermore, most research in this area has focused on depression,[16,21] common mental disorders,[18,19] dementia,[22,23] and general psychiatric distress.[20,24] The association between social isolation and a wide range of specific psychiatric disorders has not been examined systematically.

Isolation from 2 specific types of social relationship—close friends and acquaintances made during participation in religious activities—is particularly interesting and worthy of further investigation because these relationships are the most discretionary of human relationships and they may have a stronger harmful effect on mental health than those relationships that are linked by blood.[20,25] Previous studies have often combined close friends and relatives in their analyses[22] and have focused on the impact of close friends on the mental health of adolescents.[26] Consequently, the unique contribution made to psychiatric disorders by the absence of frequently contacted close friends is unknown in the general population. In addition, even though peer substance use has been shown to be a predictor of such use in adolescents and young adults,[27–29] the association between having no frequently contacted close friends per se and substance use disorders has not been examined.

Furthermore, recent studies have indicated that religious attendance is associated with a lower risk of psychiatric morbidities, especially major depressive[30–32] and substance use disorders.[33] However, the association between isolation from this particular type of social tie and psychiatric disorders has not been addressed in prior studies. Therefore, in this study, we examined the association of 2 indicators of an adverse social environment, namely, the absence of frequently contacted close friends and of frequently contacted fellow members of religious groups with 12-month *DSM-IV* mood, anxiety, and substance use disorders. Previous studies also provided little information on the linkage between social isolation in a specific social network and individual psychiatric disorder after adjusting for social isolation in other social networks because they have not examined a wide range of social ties systematically. Therefore, we also controlled the effect of the social isolation in other important social networks, including spouse, adult children, parents, parents-in-law, relatives, classmates or teachers, coworkers, neighbors, and people who had been met during volunteer work or community service in this study. Lastly, previous

studies have suggested that there may be gender differences in the associations between social isolation and mental well-being.[16,17,20,21,34,35] Therefore, the interaction effect between social isolation and gender on psychiatric disorders was assessed in this study, too. This analysis was based on Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).

METHOD

Sample

Wave 1 of the NESARC was conducted in 2001–2002, and the design of the study has been described previously.[36,37] The second wave was conducted in 2004–2005.[38] The Wave 1 NESARC was a nationally representative survey of 43,093 respondents with a response rate of 81.0%. About 3 years later, 86.7% of eligible respondents (n = 34,653) were successfully reinterviewed in the Wave 2 NESARC. Due to missing values for some variables examined in this study, we focused on 33,368 subjects in this analysis. Wave 2 data were weighted to reflect the design characteristics of the NESARC, accounting for oversampling, nonresponse, and the presence of any lifetime Wave 1 NESARC substance use or other psychiatric disorder, and this adjustment was performed at both household and person levels.[38] Weighted data were then adjusted to be representative of the civilian population of the United States in terms of socioeconomic variables based on the 2000 decennial census.

In order to test whether the nonresponse adjustment had been successful, Wave 2 respondents and the target population (comprising Wave 2 respondents and eligible nonrespondents) were compared in terms of a number of baseline (Wave 1) sociodemographic and diagnostic measures. This indicated that there were no significant differences between the Wave 2 respondents and the target population in terms of age; race/ethnicity; sex; socioeconomic status; or the presence of any lifetime substance, mood, anxiety, or personality disorder.

Psychiatric Disorders

DSM-IV diagnoses of psychiatric disorders were assessed using the Alcohol Use Disorder and Associated Disabilities Interview Schedule–*DSM-IV* Version (AUDADIS-IV),[39] Wave 2 version,[40] which had been developed for use by trained lay interviewers. Axis I disorders were examined in the Wave 2 versions of the AUDADIS-IV and obtained information on current (that is, in the year preceding the Wave 2 interview) and the lifetime (disorder occurring prior to the past year) prevalence of psychiatric disorders. The mood disorders included were *DSM-IV* primary major depressive disorder (MDD), dysthymic disorder, and bipolar disorders (including I and II). Anxiety disorders included *DSM-IV* primary panic disorder (with and without agoraphobia), social and specific phobias, generalized anxiety disorder (GAD), and posttraumatic stress disorder (PTSD). The AUDADIS-IV methods used to diagnose these disorders are described in detail elsewhere.[41–47] Consistent with the *DSM-IV*, "primary" AUDADIS-IV diagnoses excluded those that were substance-induced or due to medical conditions. Diagnoses of MDD ruled out bereavement. Test-retest reliabilities for the AUDADIS-IV mood and anxiety diagnoses in the general population and clinical settings ranged from fair to good ($\kappa = 0.40–0.77$).[48–50] The test-retest reliabilities of AUDADIS-IV for personality disorders were better than those obtained in patient samples using semistructured personality interviews.[51] Convergent validity was good to excellent for all mood and anxiety diagnoses,[42–47,52–54] and these diagnoses indicated good agreement ($\kappa = 0.64–0.68$) with psychiatrists' reappraisals.[48]

The extensive questioning in the AUDADIS-IV covered the *DSM-IV* criteria for nicotine dependence, alcohol and drug-specific abuse, and dependence on 10 classes of substances (amphetamine, opioid, sedative, tranquilizer, cocaine, inhalant/solvent, hallucinogen, cannabis, heroin, and other drugs). A *DSM-IV* abuse diagnosis necessitated the presence of 1 or more of the 4 abuse criteria, whereas a *DSM-IV* dependence diagnosis demanded 3 or more of the 7 dependence criteria to be met. Although *DSM-IV* diagnoses of abuse are preempted hierarchically by diagnoses of dependence, prospective studies have shown that individuals with histories of dependence can develop abuse without dependence[55,56] and vice versa. Therefore, the hierarchical relationship between alcohol and drug abuse and dependence was not invoked in the estimation of the incidence of these disorders. The test-retest reliability of the AUDADIS-IV substance use disorder diagnoses was found to be good to excellent ($\kappa = 0.70–0.91$) in clinical and general population samples.[48–50,57–59] The good to excellent convergent, discriminant, and construct validity of AUDADIS-IV substance use disorder criteria and diagnoses has been well documented,[55,60–63] including in the World Health Organization/National Institutes of Health International Study on Reliability and Validity,[64–69] in which clinical reappraisals demonstrated good validity for *DSM-IV* alcohol and drug use disorder diagnoses ($\kappa = 0.54–0.76$).[48,64]

Social Isolation

Data on whether or not the respondent had a frequently contacted close friend and was in frequent contact with members of his or her religious group were obtained by using 4 items selected from the Social Network Index[2]: "How many close friends do you have?"; "How many of these close friends do you see or talk to at least once every 2 weeks?"; "How often do you attend religious services at church, synagogue, mosque, or other place of worship?"; and "How many members of your church or religious group do you talk to at least once every 2 weeks?" [2] If respondents either had no close friend or did not see and talk to their close friends at least once every 2 weeks, they were classified as being without a frequently contacted close friend. Similarly, if respondents did not attend any religious services or did not see or talk to members of their church or religious groups at least once every 2 weeks, they were counted as being without frequently contacted members of their religious groups.

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Covariates

Social isolation in terms of the other 9 social ties (ie, spouse, frequently contacted adult children, parents, parents-in-law, relatives, classmates or teachers, coworkers, neighbors, and people who had been met during volunteer work or community service) was also included as covariates, and all these items were selected from the Social Network Index. Demographic variables assessed in the surveys included sex, age, race, family income, marital status, education, urbanicity, and region of residence.

Statistical Analyses

Weighted percentages were computed to derive the sociodemographic and clinical characteristics of respondents and the 2 indicators of social isolation, namely the absence of frequently contacted close friends and of frequently contacted members of the religious group to which the respondent belonged. Four sets of logistic regressions examined the associations between the absence of frequently contacted close friends and the 12-month mood, anxiety, and substance use disorders. The first set adjusted only for the sociodemographic characteristics (except the marital status) assessed in this study. The second set further adjusted for the presence of other comorbid psychiatric disorders, and the third included the absence of frequently contacted members of religious groups in the person's network and also isolation from the other 9 social ties. The final set was performed to assess the association of the interaction term between the absence of frequently contacted close friends and gender with each disorder. Similarly, another 4 sets of logistic regression were carried out to examine associations between the absence of frequent contact with members of the respondent's religious group with the 12-month mood, anxiety, and substance use disorders. Data were analyzed using SUDAAN 9.0,[70] a software program that uses Taylor series linearization to adjust for the design effects of the complex sampling methodology of the NESARC. To adjust for multiple tests, the significance level for all tests was set at $P < .01$ to reduce type I error and increase the likelihood that the effects will be replicated in future studies. All standard errors and 99% confidence intervals were adjusted for the design effects of the Wave 2 NESARC sample.

Table 1. Prevalence and Odds Ratios (ORs) of the Absence of Frequently Contacted Close Friends and Frequently Contacted Members of Religious Groups and Sociodemographic Characteristics

	Absence of Frequently Contacted Close Friends		Absence of Frequently Contacted Members of Religious Groups	
Variable	% (SE)	OR (99% CI)	% (SE)	OR (99% CI)
Sex				
Male	11.2 (0.4)	1 [reference]	63.0 (0.7)	1 [reference]
Female	9.4 (0.3)	0.82 (0.73–0.92)	55.0 (0.7)	0.72 (0.67–0.77)
Age, y				
20–29	5.8 (0.4)	1 [reference]	67.1 (1.0)	1 [reference]
30–44	8.5 (0.3)	1.52 (1.21–1.90)	60.9 (0.8)	0.77 (0.68–0.86)
45–64	11.5 (0.4)	2.12 (1.73–2.60)	57.7 (0.8)	0.67 (0.59–0.76)
≥ 65	14.6 (0.6)	2.80 (2.19–3.57)	50.4 (1.0)	0.50 (0.44–0.57)
Race-ethnicity				
White	9.4 (0.2)	1 [reference]	59.8 (0.7)	1 [reference]
Black	10.9 (0.6)	1.18 (0.99–1.41)	42.1 (1.4)	0.49 (0.42–0.57)
Native American	11.8 (1.7)	1.29 (0.84–1.98)	66.1 (2.2)	1.31 (1.01–1.69)
Asian or Pacific Islander	13.3 (1.4)	1.48 (1.06–2.06)	68.2 (2.1)	1.44 (1.11–1.86)
Hispanic	13.4 (0.8)	1.49 (1.24–1.79)	63.9 (1.1)	1.19 (1.03–1.36)
Family income, $				
0–19,999	14.9 (0.6)	1 [reference]	61.7 (0.8)	1 [reference]
20,000–34,999	10.8 (0.5)	0.69 (0.57–0.83)	59.1 (0.9)	0.90 (0.81–0.99)
35,000–69,999	9.9 (0.4)	0.62 (0.54–0.73)	58.7 (0.8)	0.88 (0.80–0.97)
≥ 70,000	7.3 (0.3)	0.45 (0.38–0.53)	56.9 (1.0)	0.82 (0.73–0.92)
Marital status				
Married	11.0 (0.3)	1 [reference]	55.3 (0.7)	1 [reference]
Separated/widowed/ divorced	11.3 (0.5)	1.04 (0.90–1.19)	60.9 (0.8)	1.26 (1.15–1.37)
Never married	6.5 (0.4)	0.57 (0.48–0.67)	69.5 (0.8)	1.84 (1.66–2.05)
Education				
Less than high school graduate	17.3 (0.8)	1 [reference]	64.2 (0.9)	1 [reference]
High school graduate	11.2 (0.4)	0.61 (0.50–0.73)	60.7 (0.8)	0.86 (0.76–0.98)
Some college or higher	8.2 (0.3)	0.42 (0.36–0.50)	56.7 (0.8)	0.73 (0.64–0.82)
Urbanicity				
Urban	10.3 (0.3)	1 [reference]	58.9 (0.7)	1 [reference]
Rural	10.1 (0.4)	0.97 (0.86–1.10)	58.7 (0.7)	0.99 (0.92–1.07)
Region				
Northeast	10.3 (0.5)	1 [reference]	58.7 (1.0)	1 [reference]
Midwest	9.8 (0.5)	0.95 (0.78–1.16)	59.7 (1.0)	1.04 (0.90–1.21)
South	10.4 (0.4)	1.02 (0.86–1.20)	58.3 (0.8)	0.98 (0.86–1.12)
West	10.3 (0.5)	1.00 (0.83–1.20)	59.1 (0.9)	1.02 (0.88–1.17)

Abbreviation: SE = standard error.

RESULTS

Sociodemographic Characteristics

The overall prevalence of the absence of frequently contacted close friends and of frequent contact with members of a religious group was 10.1% (95% CI, 9.6%–10.6%) and 58.7% (95% CI, 57.5%–59.9%), respectively. Table 1 provides a summary of the sample characteristics, comparing adults with and without the frequently contacted close friends and religious friends. The odds of not having frequently contacted close friends in one's social network were significantly higher for men than for women and also greater for those aged 30 years and older than for those aged between 20 and 29 years. Asian Americans and Hispanics had higher odds of not having frequently contacted close friends than whites. The presence of this indicator of social isolation was also less common among those with family incomes of more than $19,999. Compared with those who were currently married, those who had never been married were less likely to report the absence of frequently contacted close friends. Lastly, the presence of this indicator of social isolation was significantly

less common in individuals who had at least a high school education.

The risk of not having frequently contacted members of a religious group in one's social network was lower among women. Respondents in the youngest age groups were also more likely to have this indicator of social isolation. Interestingly, while Native Americans, Asian Americans, and Hispanics had higher odds of not having frequently contacted members of religious groups in their network than did whites, the odds for blacks were lower than for whites. Risk for this indicator of social isolation was increased among respondents with family incomes less than $19,999 per year and those who were separated, widowed, divorced, or never married. The presence of this indicator of social isolation was significantly less common in individuals who had at least a high school education.

Absence of Close Friends

After controlling for sociodemographic characteristics, we found that individuals who did not have frequently contacted close friends were significantly more likely to have 12-month Axis I disorder, mood disorder, MDD, dysthymic disorder, anxiety disorder, panic disorder with agoraphobia, social phobia, GAD, and nicotine dependence but less likely to have 12-month alcohol use and alcohol abuse disorders (Table 2). The association of not having a frequently contacted close friend with Axis I, panic disorder (with or without agoraphobia), and nicotine dependence became insignificant after adjustment for lifetime history of that disorder occurring prior to the past 12 months. Once all other indicators of social isolation had been controlled for, the absence of frequently contacted close friends was significantly associated with mood disorder, MDD, dysthymic disorder, social phobia, GAD, alcohol use disorder, and alcohol abuse disorder.

The amount of variance accounted for by the absence of close friends was very low and ranged from 0.0002% (for drug dependence disorder) to 0.25% (for dysthymic disorder) for specific disorder and from 0.004% (for substance use disorder) to 0.14% (for mood disorder) for general types of disorder. When sociodemographic characteristics were added to the model, the amount of variance explained by the model was increased to about 7.95% for substance use disorder and about 4.0% for mood or anxiety disorders, while in specific disorder, the amount of variance explained was also increased to about 1.0% in dysthymic and drug dependence disorders as well as 5.4% for alcohol use disorder. After the lifetime history of the disorder in question was added to the model, the amount of variance accounted for by the model was substantially increased to 31.3%, 23.7%, and 17.9% in anxiety, mood, and substance use disorders, respectively. Finally, the addition of the absence of 9 other social ties to the model had minimal effect on the increment of variances accounted for, ie, less than 1% in general.

Absence of Frequently Contacted Religious Members

After we adjusted for sociodemographic variables, those who did not have frequently contacted members of their religious group in their social networks were more likely than those who did to report all disorders we examined, except bipolar disorder and panic disorder without agoraphobia (Table 3). After adjusting for lifetime diagnosis of the disorder in question, all associations remained significant, except dysthymic disorder, panic disorder (with or without agoraphobia), GAD, and PTSD. Finally, after further adjusting for the other 9 indicators of social isolation, we found that the associations of this social isolation with any mood disorder, MDD, any anxiety disorder, social phobia, specific phobia, and drug dependence disorder became insignificant. Table 3 shows that, in the final model, the absence of frequently contacted members of a religious group in one's social network was positively and significantly associated with any Axis I disorder, any substance use disorder, alcohol use disorder, alcohol abuse disorder, alcohol dependence disorder, drug use disorder, drug abuse disorder, and nicotine dependence, with adjusted odd ratios ranging from 1.37 to 1.73. The variance accounted for by the absence of religious friends was modest and ranged from 0.5% (for GAD) to 1.9% (for nicotine dependence) for specific disorder and from 0.16% (for anxiety disorder) to 2.84% (for substance use disorder) for general types of disorder. When covariates were added to the model, the changes of variance accounted for by the models were similar to the results related to the absence of close friends described earlier.

Interaction Between Gender and Social Isolation

To examine the interaction between gender and the absence of frequently contacted close friends or religious members, we examined the association between the interactions of gender with those 2 social isolation indicators and the disorders. Only 1 of the 40 coefficients was found to be significant, which is no more than we would expect by chance (results available upon request from the first author).

DISCUSSION

To our knowledge, this is the first study to have examined the association of social isolation in terms of 2 specific social ties, namely, close friends and members of one's religious group, taking into account the frequency of contacts, and a wide range of *DSM-IV* Axis I psychiatric disorders, and adjusted for the effect of social isolation from other social networks in the general population using a large, representative sample. We can observe that the absence of both frequently contacted close friends and members of religious groups with whom one is in frequent contact is common in the United States and that these 2 indicators of social isolation are significantly associated with high rates of current mood, anxiety, and substance use disorders. The associations were not explained by the confounding factors of age, sex, race/ethnicity, income, marital status, education, the lifetime history of that psychiatric disorder, or social isolation in other social ties such as marriage, children, parents, parents-in-law, relatives, coworkers, neighbors, and acquaintances made through volunteer work or community service. In general,

Table 2. Twelve-Month Prevalence and Odds Ratios (ORs) of *DSM-IV* Axis I Psychiatric Disorders by the Absence of Frequently Contacted Close Friends

Disorder	Presence of Frequently Contacted Close Friends (n = 29,866), % (SE)	Absence of Frequently Contacted Close Friends[a] (n = 3,502), % (SE)	OR (99% CI)	AOR[b] (99% CI)	AOR[c] (99% CI)	AOR[d] (99% CI)
Any Axis I disorder	35.0 (0.5)	37.4 (1.1)	1.11 (0.99–1.24)	1.21 (1.07–1.35)	1.14 (0.99–1.31)	1.08 (0.93–1.25)
Any mood disorder	10.1 (0.3)	14.0 (0.8)	1.45 (1.21–1.74)	1.54 (1.28–1.85)	1.38 (1.12–1.72)	1.28 (1.03–1.61)
Major depressive disorder	8.0 (0.2)	11.4 (0.7)	1.47 (1.21–1.79)	1.55 (1.28–1.89)	1.41 (1.13–1.75)	1.30 (1.03–1.65)
Dysthymic disorder	1.0 (0.1)	3.1 (0.4)	3.20 (2.16–4.76)	2.83 (1.85–4.34)	2.12 (1.28–3.53)	1.77 (1.02–3.07)
Bipolar disorder	3.4 (0.1)	4.3 (0.4)	1.27 (0.94–1.71)	1.34 (0.97–1.85)	1.20 (0.86–1.69)	1.08 (0.77–1.52)
Any anxiety disorder	16.2 (0.3)	19.0 (0.8)	1.21 (1.04–1.41)	1.29 (1.11–1.51)	1.22 (1.01–1.47)	1.15 (0.94–1.41)
Panic without agoraphobia	1.8 (0.1)	2.4 (0.3)	1.37 (0.93–2.02)	1.43 (0.94–2.16)	1.25 (0.82–1.92)	1.23 (0.78–1.96)
Panic with agoraphobia	0.7 (0.1)	1.4 (0.3)	1.91 (1.11–3.28)	1.88 (1.06–3.34)	1.38 (0.66–2.88)	1.18 (0.54–2.57)
Social phobia	2.3 (0.1)	4.9 (0.4)	2.15 (1.66–2.78)	2.33 (1.80–3.01)	1.88 (1.32–2.67)	1.68 (1.17–2.41)
Specific phobia	7.5 (0.2)	8.4 (0.6)	1.13 (0.91–1.40)	1.21 (0.97–1.51)	1.16 (0.91–1.49)	1.11 (0.85–1.44)
Generalized anxiety disorder	3.6 (0.2)	6.0 (0.5)	1.70 (1.31–2.19)	1.76 (1.34–2.30)	1.67 (1.20–2.32)	1.51 (1.06–2.14)
PTSD	6.5 (0.2)	7.7 (0.5)	1.19 (0.98–1.46)	1.21 (0.98–1.48)	0.95 (0.70–1.31)	0.90 (0.64–1.26)
Any substance use disorder	21.5 (0.5)	20.6 (1.0)	0.95 (0.82–1.09)	1.01 (0.88–1.17)	0.98 (0.83–1.15)	0.93 (0.79–1.10)
Alcohol use disorder	10.1 (0.3)	6.5 (0.5)	0.62 (0.49–0.78)	0.73 (0.57–0.94)	0.73 (0.57–0.94)	0.76 (0.59–0.99)
Alcohol abuse disorder	8.4 (0.3)	5.3 (0.4)	0.61 (0.47–0.77)	0.73 (0.56–0.94)	0.72 (0.56–0.93)	0.76 (0.58–0.99)
Alcohol dependence disorder	4.5 (0.2)	3.6 (0.4)	0.80 (0.58–1.09)	0.90 (0.64–1.27)	0.95 (0.66–1.37)	0.97 (0.67–1.40)
Drug use disorder	2.4 (0.1)	2.1 (0.3)	0.85 (0.55–1.32)	1.01 (0.64–1.60)	0.95 (0.59–1.51)	0.93 (0.57–1.51)
Drug abuse disorder	2.3 (0.1)	1.9 (0.3)	0.82 (0.51–1.30)	0.98 (0.60–1.60)	0.90 (0.55–1.49)	0.88 (0.53–1.49)
Drug dependence disorder	0.8 (0.1)	0.9 (0.2)	1.06 (0.48–2.33)	1.13 (0.48–2.67)	1.19 (0.50–2.80)	0.99 (0.41–2.41)
Nicotine dependence	13.8 (0.4)	16.4 (0.9)	1.22 (1.05–1.42)	1.23 (1.06–1.43)	1.15 (0.94–1.39)	1.05 (0.86–1.28)

[a]Those without close friends or without frequently contacted close friends.
[b]Odds ratios adjusted for race, age, education, income, urbanicity, and region.
[c]Odds ratios adjusted for race, age, education, income, urbanicity, region, and lifetime history of row-defined disorder (disorder occurring prior to the past 12 months).
[d]Odds ratios adjusted for race, age, education, income, urbanicity, region, and lifetime history of row-defined disorder (disorder occurring prior to the past 12 months); the absence of frequently contacted members of religious groups; and the absence of spouse, frequently contacted children, parents, parents-in-law, relatives, classmates or teachers, coworkers, neighbors, and people met in volunteer work or community service.
Abbreviations: AOR = adjusted odds ratio, PTSD = posttraumatic stress disorder, SE = standard error.

Table 3. Twelve-Month Prevalence and Odds Ratios (ORs) of *DSM-IV* Axis I Psychiatric Disorders by the Absence of Frequently Contacted Members of Religious Groups

Disorder	Presence of Frequently Contacted Members of Religious Groups (n = 14,197), % (SE)	Absence of Frequently Contacted Members of Religious Groups[a] (n = 19,171), % (SE)	OR (99% CI)	AOR[b] (99% CI)	AOR[c] (99% CI)	AOR[d] (99% CI)
Any Axis I disorder	27.8 (0.6)	40.5 (0.7)	1.77 (1.61–1.93)	1.64 (1.50–1.79)	1.47 (1.32–1.62)	1.37 (1.23–1.53)
Any mood disorder	8.8 (0.3)	11.7 (0.4)	1.38 (1.21–1.57)	1.30 (1.14–1.48)	1.20 (1.03–1.40)	1.10 (0.94–1.30)
Major depressive disorder	6.9 (0.3)	9.4 (0.3)	1.41 (1.23–1.62)	1.34 (1.16–1.55)	1.24 (1.06–1.46)	1.12 (0.94–1.34)
Dysthymic disorder	0.8 (0.1)	1.5 (0.1)	2.02 (1.37–2.97)	1.88 (1.28–2.77)	1.37 (0.93–2.03)	1.18 (0.77–1.80)
Bipolar disorder	2.9 (0.2)	3.9 (0.2)	1.34 (1.09–1.63)	1.17 (0.95–1.43)	1.12 (0.89–1.42)	1.10 (0.86–1.40)
Any anxiety disorder	14.8 (0.4)	17.8 (0.4)	1.25 (1.13–1.38)	1.24 (1.12–1.38)	1.20 (1.04–1.38)	1.15 (1.00–1.33)
Panic without agoraphobia	1.5 (0.1)	2.0 (0.1)	1.32 (1.00–1.75)	1.20 (0.90–1.60)	1.11 (0.81–1.51)	1.07 (0.78–1.46)
Panic with agoraphobia	0.5 (0.1)	1.0 (0.1)	1.88 (1.25–2.82)	1.65 (1.09–2.51)	1.37 (0.85–2.22)	1.37 (0.84–2.24)
Social phobia	1.9 (0.1)	3.0 (0.2)	1.62 (1.30–2.01)	1.47 (1.16–1.86)	1.31 (1.01–1.71)	1.15 (0.87–1.52)
Specific phobia	6.7 (0.3)	8.3 (0.3)	1.26 (1.09–1.47)	1.27 (1.09–1.48)	1.23 (1.01–1.48)	1.19 (0.98–1.45)
Generalized anxiety disorder	3.3 (0.2)	4.2 (0.2)	1.27 (1.05–1.54)	1.25 (1.02–1.52)	1.15 (0.91–1.45)	1.02 (0.80–1.31)
PTSD	5.9 (0.3)	7.1 (0.2)	1.21 (1.05–1.39)	1.21 (1.05–1.41)	1.24 (0.99–1.54)	1.20 (0.95–1.52)
Any substance use disorder	13.3 (0.4)	27.1 (0.7)	2.43 (2.18–2.71)	2.13 (1.91–2.37)	1.77 (1.57–1.99)	1.64 (1.45–1.87)
Alcohol use disorder	5.9 (0.3)	12.4 (0.4)	2.25 (1.96–2.58)	1.92 (1.66–2.21)	1.60 (1.37–1.87)	1.52 (1.29–1.78)
Alcohol abuse disorder	5.0 (0.3)	10.3 (0.4)	2.19 (1.88–2.56)	1.86 (1.59–2.18)	1.54 (1.29–1.83)	1.45 (1.21–1.73)
Alcohol dependence disorder	2.5 (0.2)	5.8 (0.2)	2.40 (1.94–2.96)	1.93 (1.56–2.41)	1.74 (1.38–2.18)	1.62 (1.27–2.07)
Drug use disorder	1.0 (0.1)	3.4 (0.2)	3.33 (2.52–4.40)	2.57 (1.91–3.44)	1.91 (1.42–2.57)	1.67 (1.22–2.29)
Drug abuse disorder	1.0 (0.1)	3.2 (0.2)	3.44 (2.57–4.62)	2.66 (1.95–3.63)	2.01 (1.47–2.74)	1.73 (1.24–2.41)
Drug dependence disorder	0.4 (0.1)	1.1 (0.1)	2.79 (1.75–4.45)	2.02 (1.25–3.28)	1.68 (1.04–2.72)	1.39 (0.82–2.36)
Nicotine dependence	8.4 (0.4)	18.0 (0.6)	2.39 (2.10–2.73)	2.10 (1.84–2.40)	1.82 (1.57–2.11)	1.67 (1.43–1.96)

[a]Those who did not have frequently contacted members of religious groups.
[b]Odds ratios adjusted for race, age, education, income, urbanicity, and region.
[c]Odds ratios adjusted for race, age, education, income, urbanicity, region, and lifetime history of row-defined disorder (disorder occurring prior to the past 12 months).
[d]Odds ratios adjusted for race, age, education, income, urbanicity, region, and lifetime history of row-defined disorder (disorder occurring prior to the past 12 months); the absence of close friends; and the absence of spouse, frequently contacted children, parents, parents-in-law, relatives, classmates or teachers, coworkers, neighbors, and people met in volunteer work or community service.
Abbreviations: AOR = adjusted odds ratio, PTSD = posttraumatic stress disorder.

the account of variance accounted for by the absence of religious friends is greater than that explained by the absence of close friends, while more variance of mood or anxiety disorders is explained by the absence of close friends, but more variance of substance use disorder is accounted for by the absence of religious friends. Specifically, the absence of frequently contacted close friends was positively associated with MDD, dysthymic disorder, social phobia, and GAD, while the absence of religious friends was positively related to alcohol abuse or dependence disorder, drug abuse disorder, and nicotine dependence. Although the magnitude of these positive associations were generally modest, with ORs in the range of 1.3 to 1.7, our findings still have substantial significance for public health due to the high overall prevalence of the absence of religious friends (approximately 60%) and any substance use disorder (approximately 20%). Compared with those who had frequent contact with fellow members of religious groups, the estimated prevalence of current alcohol abuse and nicotine dependence increased from 5% and 8% to 10% and 18%, respectively. These figures illustrate the public health importance of the association given the negative consequences of alcohol use and smoking on individuals and society as a whole.[71–74]

In this article, the social isolation is perceived as a risk factor leading to psychiatric disorder. We are also aware of another approach in which large social network size is conceptualized as a protective factor contributing to psychiatric disorder. Our approach is based on findings of animal studies in which rats were randomly assigned to isolation: rearing (1 rat per cage) and group-housed rearing (3 rats per cage) after weaning.[75] In those animal experimental studies, social isolation is found to constitute a stressful experience leading to nervous and aggressive behavior in adulthood,[76,77] and the isolation from social counterparts also increases emotional reactivity to stress and produces an anxiety state.[75,78] Consequently, it has been proposed that social isolation may be a risk factor for depression, anxiety disorder, and schizophrenia.[79–81] In addition, researchers in previous studies arbitrarily used total of close social network of 3 people as a cutoff point to differentiate people with small or large network.[18,82] Whether the social network should be conceptualized as the risk or protective factors leading to psychiatric disorders is largely still open for discussion and should be addressed in future studies.

The NESARC offers several advantages over previous community surveys used to examine the relationship between social isolation and psychiatric disorders. First, the sample was designed to be an accurate representation of the community-dwelling population of the United States. Thus, our results can be generalized to this population. Second, the study assessed a broad range of *DSM-IV* Axis I psychiatric disorders, including 3 mood, 5 anxiety, and 5 substance use disorders. Third, these disorders were assessed using a well-validated structured diagnostic interview, and the social isolation variables were measured by instruments that have been validated and are widely used in the social network literature. As a consequence, the association we have identified between social isolation and psychiatric disorders can be expected to be accurate. Finally, because the data also included social isolation in terms of the other 9 social ties, the effect of these covariates could be adjusted for in our study.

However, due to the nature of the cross-sectional data in this study, our results do not indicate a direction for this causal relationship. It is possible that social isolation increases the risk of psychiatric disorders, but it would be equally correct to suggest that the presence of a psychiatric disorder may lead to social isolation, especially for some illnesses such as social phobia. We have no way of distinguishing the direction of the causal relationship and it may be reciprocal. However, previous longitudinal studies have established the temporal order between the size of social network and the recovery of mental disorder.[16] Furthermore, the animal studies mentioned above also provide some empirical findings to support the direction of causal relation we propose in this study. In addition, social isolation and psychiatric disorders may be also linked via some common cause or a third factor, be it genetic, environmental, or biologic. Nevertheless, the information on the association between social isolation and psychiatric disorders identified in this study may begin to inform prevention and treatment programs. Moreover, it may also provide a good candidate for the adverse social environment that may interact with individuals' genetic disposition to create the incidence, remission, and recurrence of specific psychiatric disorders.

The main findings from this study indicated that there were positive associations of the absence of close friends with depression and anxiety disorders. These findings corroborate previous research in which small, close social network is found to be associated with depression and anxiety symptoms.[18] An interesting finding is observed in the negative association between the absence of frequently contacted friends and alcohol abuse disorder. It is not clear the reason for the beneficial effect of social isolation from close friends on alcohol abuse. However, it is possible that the absence of close friends may reduce the occasions for social drinking, which may lead to alcohol abuse among these respondents. In addition, alcoholics have fairly good-sized social networks, with the mean numbers of 7 to 8,[83] and over half of their social network members are also alcoholics.[83] Therefore, it seems that the impact of close friends on alcohol problem is affected by whether an individual's close friends have alcohol problems.

Moreover, we have found that the absence of frequently contacted members of one's religious group is associated with higher risk of alcohol abuse or dependence disorder, drug abuse disorder, and nicotine dependence. These findings are in line with previous studies showing that lower levels of religious involvement are positively associated with tobacco and drug use in adolescents[84] as well as with smoking in the general population.[85,86] Our results suggest that the harmful impact of no religious involvement on substance use may be due to the absence of religious friends. Needless to say, there are other mechanisms that are posited to explain the presumed effect of the absence of religious involvement on

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substance use,[4,87] and future studies must be undertaken to identify the underlying mechanisms. Previous studies have consistently found a negative relationship between religious service attendance and depression.[30,32,88,89] By contrast, the absence of religious friends is not associated with depression in this study. This finding means that the effects of religion may be operated through other means such as cognitive psychological mechanisms in which people cognitively reorient their value patterns based on their beliefs[90] or use religion as a coping strategy.[91]

Social isolation of these 2 social ties occurred across all sociodemographic strata in our survey. However, it was less common among those with higher education levels and income, suggesting that inequality is manifested not only in physical health but also in social relations. Similarly, a gender difference was found in social isolation. Specifically, women were less likely to report the absence of frequently contacted close friends and religious group members than men. This difference confirms findings in previous studies that indicate that the effect of education on social isolation is strong and negative[92] and that women have larger social networks than men.[92,93] Interestingly, age, marital status, and race have a different and previously undocumented impact on these 2 indicators of social isolation. Being old was positively related to the absence of frequently contacted close friends but negatively associated with a lack of frequently contacted members of religious groups in one's network. The former findings are consistent with the previous studies in which the size of social network of close relations decreases with age,[93–95] and the latter result is also in line with the previous findings showing that the size of social network in wider scope (including family, friends, neighbors, formal group membership) increases with age.[96] Asian Americans and Hispanic, but not blacks, were more likely to report the absence of frequently contacted close friends than whites. These findings are partially consistent with the previous findings that nonwhites tend to have smaller social networks than their white counterparts.[93,96,97] On the other hand, blacks were less likely to report the absence of frequently contacted members of religious groups in their network than whites, possibly suggesting a racial or cultural dimension to this social tie because blacks are found to be more likely to be actively involved in religious activities than whites.[98–100]

Lastly, no interaction effect of gender with social isolation was found on specific psychiatric disorders in the current study. This finding may be explained by the previous results that the effect of small, close social network size on mental health is conditional not only on gender but also on the baseline mental health status.[19] It seems that women with small, close social network predict worse prognosis[16,21] but not onset of disorder.[17,35] On the other hand, the opposite is true for men.[19] Again, because the current study is cross-sectional in nature, longitudinal data are needed to explore this possibility.

There are 4 limitations to the present investigation. First, as we mentioned earlier, it is based on cross-sectional data. Consequently, any predictions should be understood only in a statistical sense and not a causal one. Longitudinal data (data collected across more than 2 points of time) are needed to further understand the causal and temporal relations between the social network variables and psychiatric disorders examined in the current study. Second, we relied on self-reports of social network behavior, which may not be reliable in certain subgroups, such as those with psychiatric disorders like MDD and abusers of alcohol. Third, although our sample size was large, a small number of respondents were diagnosed with panic disorder with agoraphobia and drug dependence disorder. Further studies with a larger sample size are needed to confirm our findings. Fourth, the lifetime prevalence of psychiatric disorder was collected retrospectively in the baseline assessment of the current survey, and systematic recall bias in these reports could have introduced errors in our estimates of the associations. Despite these limitations, using a representative sample of adults in the United States, we have provided information to support the conclusion that social isolation is not only common but also significantly associated with a range of common mood, anxiety, and substance use disorders in the general US population. Future studies must be conducted to clarify the direction and underlying mechanisms of these relationships.

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