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Premenstrual Dysphoric Disorder as a correlate of suicidal ideation, plans, and attempts among a nationally representative sample

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Abstract

Purpose—Suicide is a major public health concern and a leading cause of death in the United States. Psychopathology is an established risk factor for non-fatal suicidal behavior; however, it is unclear whether Premenstrual Dysphoric Disorder (PMDD), a psychiatric disorder specific to women, is correlated with these outcomes. The objective of this study was to determine if PMDD status was associated with suicidal ideation, plans, and attempts, independently of socio-demographic factors and psychiatric comorbidity.

Methods—We conducted a secondary data analysis of 3,965 American women aged 18–40 who participated in the Collaborative Psychiatric Epidemiology Survey. Descriptive statistics and forward stepwise logistic regression modeling were performed using SUDAAN software.

Results—The prevalence of non-fatal suicidal behaviors increased in a graded fashion according to PMDD status. Although control for demographic characteristics and psychiatric comorbidity greatly attenuated the unadjusted association between PMDD and suicidal behaviors, women with PMDD remained significantly more likely than women with no premenstrual symptoms to report suicidal ideation (OR=2.22; 95% CI=1.40–3.53), plans (OR=2.27; 95% CI=1.20–4.28), and attempts (OR=2.10; 95% CI=1.08–4.08). Only the likelihood of suicidal ideation was significantly elevated among women with moderate/severe PMS (OR=1.49; 95% CI=1.17–1.88) compared to women with no premenstrual symptoms.

Conclusions—PMDD was strongly and independently associated with non-fatal suicidal behaviors among a nationally representative sample. These findings suggest that clinicians treating women with PMDD should assess and be vigilant for signs of non-fatal suicidal behavior, and that clinicians evaluate and treat the premenstrual symptoms of women who express these behaviors.

Keywords

Premenstrual Dysphoric Disorder; non-fatal suicidal behavior; epidemiology

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Declaration of interest:

The authors have no competing interests to declare.

Introduction

Suicide is a major public health concern. In 2007, 34,000 Americans completed suicides, making it the eleventh leading cause of death for all ages. Experts estimate that there are twenty-five attempts for every completed suicide, and note that women are three times more likely than men to attempt suicide [1]. Research consistently demonstrates that individuals with a history of depression are at particular risk for suicide, and other mood, anxiety, and substance use disorders have also been identified as risk factors [2, 3]. While these findings clearly demonstrate psychopathology is a risk factor for suicide, few researchers have examined whether Premenstrual Dysphoric Disorder (PMDD), a psychiatric disorder specific to women, may contribute to suicidal behavior.

The affective and physical symptoms of PMDD, such as depressed mood, anxiety, and fatigue, occur during the late luteal phase of the menstrual cycle, about one week before the onset of menses[4]. Symptoms of PMDD are severe enough to impair a woman's normal functioning at work and at home. Prevalent in a significant minority of women (3–8%), PMDD is associated with substantial disability, healthcare costs, and lost productivity [5]. In contrast to PMDD, premenstrual symptoms or premenstrual syndrome [PMS] are highly prevalent in the population and are not associated with significant impairment [5, 6].

Only three studies have examined PMDD in relation to suicidal behavior. In the first study, researchers found that the prevalence of suicidal ideation among women with a 'probable' diagnosis of PMDD was 24%; the prevalence of suicidal ideation was not assessed among women without PMDD[7]. In the second study, researchers found a significantly higher prevalence of PMDD among hospitalized suicide attempters, compared to controls[8]. In the Early Developmental Stages of Psychopathology study(EDSP; [9]), women with PMDD were over four times more likely than women without PMDD to attempt suicide [OR=4.4, 95% CI 2.0–9.7], and over twice as likely to contemplate suicide (OR=2.3, 95% CI 0.5–11.0), although the latter relationship was not statistically significant[10]. Furthermore, women with 'subthreshold PMDD' (defined by authors as premenstrual symptoms that did not fulfill diagnostic criteria for PMDD) were 60% more likely than women without PMDD or subthreshold PMDD to attempt suicide, and 70% more likely to contemplate suicide, although neither of these differences was statistically significant. While findings from the latter two studies suggest a positive relationship between PMDD and suicidal behavior, confirmatory studies among a larger, diverse sample examining multiple suicidal behaviors are needed.

In this study, we address the gaps in the literature by examining PMDD in relation to three non-fatal suicidal behaviors (ideation, plans, and attempts) using data from a nationally representative sample of American women. Based on prior research, we hypothesized that women with PMDD, but not moderate/severe PMS, would be significantly more likely than women without PMDD or moderate/severe PMS to report a history of non-fatal suicidal behaviors.

Methods

Collaborative Psychiatric Epidemiology Surveys

Three nationally representative population surveys, the National Comorbidity Survey-Replication (NCS-R; [11]), the National Latino and Asian American Survey (NLAAS; [12]), and the National Survey of American Life (NSAL; [13]), were combined to form the Collaborative Psychiatric Epidemiology Surveys (CPES) dataset. The methodological details of the individual and combined surveys have been published elsewhere [14, 15]. Briefly, the NCS-R, NLAAS, and the NSAL utilized the same core survey instrument, the

World Mental Health Composite International Diagnostic Interview (WMH-CIDI). The WMH-CIDI is a structured, face-to-face diagnostic interview that is administered by highly trained lay interviewers. The WMH-CIDI yields valid and reliable DSM-IV diagnoses for a number of mood, anxiety, and substance use disorders [16].

NCS-R, NLAAS, and NSAL participants are non-institutionalized adults aged who were selected through a multi-stage, clustered sampling strategy. The NLAAS sample included Latino and Asian American participants only. Although Hispanics and Whites were sampled to participate in the NSAL, these individuals did not complete the entire survey due to lack of funding; and thus the majority of NSAL participants were African American or Caribbean Black. NCS-R and NSAL participants had to complete the survey in English, whereas NLAAS participants were given the choice to complete the survey in English, Spanish, Mandarin, Cantonese, Tagalog, or Vietnamese. Participants received a mailing prior to their participation in the survey, informing them that the survey was about ‘people’s health and health issues’ [15]. Participants provided verbal informed consent. The NCS-R, NLAAS, and NSAL were each reviewed and approved by the Institutional Review Boards at their respective institutions. CPES data have been de-identified and are publicly available.

Sample

From the 11,463 female participants in the CPES, we excluded 1,833 women from the NCS-R and 621 White and Hispanic participants from the NSAL who were not selected to complete Part 2 of the survey, which included modules on non-fatal suicidal behaviors and PMDD. We then excluded 127 women who did not provide valid data for all of the suicide measures, as well as 137 women who did not provide valid data for the PMDD module. We excluded women who reported that their menstrual cycles had stopped temporarily or permanently ($n=3,256$) as well as women who did not report their menstrual status ($n=13$). We excluded women over the age of 40 ($n=1,348$) in order to reduce the likelihood that premenopausal symptoms were misreported as premenstrual symptoms. Finally, we excluded 163 women who had missing data for one or more of the study covariates. Our sample of 3,965 women is described in Table 1. Participants had an average age of were 28.8 years. The majority of participants were White (62.6%), had at least a high school level of education (84.8%), were employed full time (69.5%), and were of normal body weight for their height (51.1%). About 21% of participants met criteria for major depressive disorder (lifetime), 35.8% of participants met criteria for any anxiety disorder (lifetime), and 10.5% of participants met criteria for any substance use disorder (lifetime). Participants’ responses scored very low on the ten-point social desirability scale (Mean=1.6), which measures the degree to which participants provided socially desirable, rather than truthful, responses.

Measures

Dependent variables—The dependent variables in this analysis were binary variables for lifetime suicidal ideation, suicide plans, and suicide attempt(s). Participants were asked to (silently) read a description of behavior from a response card and report to the interviewer whether they had ever engaged in that behavior. If participants could not read, the interviewer read the behaviors aloud. Participants who reported that they had “seriously thought about committing suicide” were then asked if they had “ever made a plan for committing suicide” and if they had “ever attempted suicide.” Positive responses were coded as “1” and negative responses were coded as “0”. Participants without a history of suicidal ideation were assigned codes of “0” for both suicide plans and suicide attempts.

Independent variable—PMDD status had three mutually exclusive levels of response: PMDD, moderate/severe PMS, and no premenstrual symptoms. PMDD status was evaluated

in the “Premenstrual Syndrome” module of the WMH-CIDI. This module included six questions, which are based on DSM-IV criteria for PMDD and evaluated over participants’ lifetimes. Participants were asked if they had ever (1) experienced depressed mood, anxiety or irritability in the week prior to their period, (2) if these mood changes had occurred during at least seven of twelve menstrual cycles (at the point in their lives when symptoms were at their worst), (3) if these mood changes were worse than normal most of the time, and (4) if symptoms such as difficulty concentrating, tiredness, change in appetite or change in sleep were also present in the week prior to the onset of their period. Participants were also asked (5) whether these symptoms led to interference in work, social life, or personal relationships, and (6) if these symptoms contributed to impairment in day to day activities. Women met the case definition of PMDD if they endorsed all of the first four symptoms and at least one impairment or interference symptom (questions five and six). Women who reported at least one of the four symptoms, and did not report impairment or interference related to these symptoms were characterized as having moderate/severe PMS. Women who did not endorse any of these questions were categorized as having no premenstrual symptoms.

Covariates

Covariates were selected on the basis of prior research demonstrating a correlation between PMDD (or premenstrual symptoms) and/or suicidal behavior [17, 18]. Demographic covariates included race/ethnicity (Asian, Hispanic, Black, White), age (range 18–40), educational attainment (0–11 years, 12 years, 13–15 years, 16 years or more), employment status (full time, not employed, not in labor force), and body mass index (BMI; < 18.5, 18.5–24.9, ≥ 25 kg/m²).

Psychiatric comorbidity included the lifetime diagnosis of major depressive disorder (MDD), any lifetime anxiety disorder (AD; includes adult separation anxiety disorder, agoraphobia, generalized anxiety disorder, panic disorder, social phobia, specific phobia, and posttraumatic stress disorder), and any lifetime substance use disorder (SUD; includes alcohol abuse or dependence, and drug abuse or dependence). Finally, we included the Crowne-Marlowe scale (range is 0–10), where higher scores indicate a greater tendency for participants to provide answers that are socially desirable, rather than true [19]. The inclusion of this scale allows us to control for reporting bias [20].

Statistical Analysis

Data analyses were performed with SUDAAN 10.0, which uses Taylor Series Linearization to account for the weighting of the data and the complex survey sampling strategy [21]. The appropriate CPES weighting variable was used at all stages of analysis to produce accurate standard errors and weighted prevalence estimates. These weights account for the probability of selection into the sample, the probability of non-response, and national-representativeness of the sample.

Descriptive analysis was completed with PROC CROSSTAB for categorical variables and PROC DESCRIPT for continuous variables. Bivariate associations were determined with PROC CROSSTAB and PROC REGRESS, for categorical and continuous variables, respectively. To determine the magnitude and direction of the association between PMDD status and suicidal behaviors, we constructed three sets of logistic regression models in PROC RLOGIST using forward stepwise logistic regression modeling. The first model included only PMDD status. To control for possible confounders, we constructed two adjusted models. Confounding is defined as “a situation in which a noncausal association between a given exposure and an outcome is observed as a result of the influence of a third variable (or group of variables)” [22]. The second model included demographic covariates

and social desirability, and the third model included demographic covariates, social desirability, and psychiatric comorbidity (MDD, AD, and SUD). We present odds ratios and 95% confidence intervals for these logistic regression models. Statistical significance was determined using the Wald Chi-squared test of association; the threshold for statistical significance was set at 0.05.

To determine whether confounding by demographic and psychiatric covariates occurred, we examined the relative change in the parameter estimates across models. Relative change was calculated by subtracting the parameter estimate associated with the full model [with additional covariates] from parameter estimate associated with the preceding model (without covariates), and dividing this difference by the parameter estimate from the preceding model (Ex: $[\beta_1 - \beta_2] / \beta_1$). Confounding is thought to occur when the (absolute value) of relative change in the association between two variables is 10–20% [20].

Results

The prevalence of suicidal ideation was 18.6% (n=722); 6.7% of participants reported a history of suicidal plans (n=273), and 6.6% of participants reported a history of one or more suicide attempts (n=280). Race/ethnicity and social desirability were significantly associated with suicidal ideation and plans. Education was significantly associated with suicide attempts. MDD, AD, and SUD were significantly associated with all three suicidal behaviors. These results are presented in Table 2. The prevalence of all non-fatal suicidal behaviors increased in a graded fashion according to PMDD status (Figure 1); tests for linear trend were statistically significant for all non-fatal suicidal behaviors ($p < 0.05$). Among women with no symptoms, moderate/severe PMS, and PMDD, the prevalence of suicidal ideation was 13.3%, 22.0%, and 37.4%, respectively; the prevalence of suicidal plans was 4.6%, 7.6%, and 19.1%, respectively; and the prevalence of suicide attempts was 4.9%, 7.4% and 16.2%, respectively.

The prevalence of PMDD was 4.0% (n=168) and the prevalence of moderate/severe PMS was 50% (n=1,774). In bivariate analysis, PMDD status was significantly associated with educational attainment, employment, age, social desirability, MDD, AD, and SUD ($p < 0.05$; results not shown).

Table 3 presents the unadjusted and multivariate-adjusted associations between PMDD status and suicidal behavior. In the unadjusted logistic regression models, both women with PMDD and women with moderate/severe PMS were significantly more likely than women with no premenstrual symptoms to report suicidal ideation, plans, and attempts. The magnitude of these associations (odds ratios) ranged from 3.8 to 4.9 for PMDD and from 1.6 to 1.9 for moderate/severe PMS.

Adjustment for demographic covariates and social desirability attenuated the association between PMDD status and non-fatal suicidal behaviors, although all previously observed associations remained statistically significant. The odds ratios for these associations ranged from 3.7 to 4.3 for PMDD and from 1.6 to 1.8 for moderate/severe PMS. The relative change in parameter estimates following adjustment ranged from 4.3% to 9.5% for PMDD and 5.4% to 26.4% for moderate/severe PMS. This pattern suggested that demographic covariates and social desirability did not account for the association between PMDD and non-fatal suicidal behaviors, and partially accounted for the association between moderate/severe PMS and non-fatal suicidal behaviors. Race/ethnicity and social desirability remained significantly associated with suicidal ideation; educational attainment remained significantly associated with suicide attempts.

Further adjustment for psychiatric comorbidity greatly attenuated the associations between PMDD status and non-fatal suicidal behaviors, although significant associations remained. For example, women with PMDD were significantly more likely than women with no premenstrual symptoms to report suicidal ideation (OR=2.22; 95% CI=1.40–3.53), plans (OR=2.27; 95% CI=1.20–4.28), and attempts (OR=2.10; 95% CI=1.08–4.08). The relative changes in these parameter estimates were 38.9%, 44.2%, and 48.7% in relation to suicidal ideation, plans, and attempts, respectively.

Women with moderate/severe PMS remained significantly more likely than women with no premenstrual symptoms to report suicidal ideation (OR=1.49; 95% CI=1.17–1.88). Psychiatric comorbidity partially accounted for the association between moderate/severe PMS and suicidal ideation; the relative change in this parameter estimate was 31.5%. In contrast, psychiatric comorbidity fully accounted for the associations between moderate/severe PMS and suicide plans and attempts, which were no longer statistically significant following the addition of these covariates. The relative changes in these parameter estimates were 64.7% and 55.4% for suicide plans and suicide attempts, respectively. In this fully adjusted analysis, a lifetime history of MDD, AD, and SUD were each significantly associated with suicidal thoughts, plans, and attempts. Age was also significantly associated with suicide attempts. No other demographic covariates were significantly associated with non-fatal suicidal behaviors.

Discussion

We examined for the first time the association between PMDD status and non-fatal suicidal behaviors among a nationally representative population sample of women aged 18 to 40. In this study, we found that the baseline prevalence of suicide attempts (i.e., 4.9% among women with no premenstrual symptoms) was consistent with estimates from the Wave 2 of the National Epidemiologic Study of Alcohol and Related Conditions (NESARC; [23]); the lifetime prevalence of suicide attempts was 5.9% among female NESARC respondents (age 20 to 40). This suggests that the subsample of CPES participants selected for this analysis accurately represent the female population who are at risk for non-fatal suicidal behaviors. More importantly, we demonstrated that the prevalence of suicidal ideation, plans, and attempts increased in a dose-response fashion among women with no premenstrual symptoms, moderate/severe PMS, and PMDD, respectively. We also found that PMDD was positively associated with suicidal ideation, plans, and attempts, independently of demographic covariates, social desirability, and psychiatric comorbidity. This result was consistent with our hypothesis. Moderate/severe PMS was significantly associated with suicidal ideation only, after adjustment for these covariates.

While our results demonstrated that the association between PMDD and non-fatal suicidal behaviors was not fully accounted for by comorbid MDD, AD, or SUD, adjustment for these factors greatly attenuated the magnitude of the association between PMDD and non-fatal suicidal behaviors. We undertook additional analyses to more fully explore the role of psychiatric comorbidity in relation to PMDD and non-fatal suicidal behavior. First, we found that psychiatric comorbidity was remarkably common among women with PMDD: 22% met criteria for SUD, 40% met criteria MDD, and 70% met criteria for AD. A recent review highlighted the numerous studies that have documented high rates of comorbid MDD and AD among women with PMDD [24]. Second, we found that separately adjusting for these disorders attenuated the unadjusted association between PMDD and non-fatal suicidal behaviors. While no single disorder emerged as particularly influential on this relationship, separate adjustment for MDD and AD produced more substantial changes in the association between PMDD and non-fatal suicidal behaviors than did adjustment for SUD. The relative change in the parameter estimates for PMDD was 29.2% to 38.1% following adjustment for

MDD, 26.8% to 35.6% following adjustment for AD, and 10.9% to 17.9% following adjustment for SUD.

Although past research has highlighted the clinical similarities between PMDD and MDD, both of which are characterized by feelings of hopelessness, markedly depressed mood, and self-deprecating thoughts [24], the consensus among clinicians is that PMDD and MDD are distinct disorders [25, 26]. Specifically, PMDD is *not* subsyndromal MDD or the premenstrual exacerbation of existing major depressive disorder. Since the mood symptoms common to both PMDD and MDD are highly predictive of non-fatal suicidal behaviors[27], we expected (and found) that PMDD and MDD were positively associated with non-fatal suicidal behaviors. In the event that PMDD and MDD were *not* unique disorders, simultaneously adjusting for these variables would cancel out these statistically significant (unadjusted) associations. In our study, we observed a statistically significant effect of PMDD for all non-fatal suicidal behaviors following adjustment for MDD (which also remained significantly associated with non-fatal suicidal behaviors). Although the relative changes in the parameter estimates for PMDD following adjustment for MDD were substantial, the independent effect of PMDD that remained suggests that while there is shared variance between PMDD and MDD, the disorders are distinct. We also determined that the association between PMDD and non-fatal suicidal behaviors was of essentially the same magnitude among women with MDD, compared to women without MDD. In other words, the association between PMDD and non-fatal suicidal behaviors was not moderated by MDD ($p>0.05$ for all interactions). This provides further evidence that PMDD and MDD are distinct disorders.

Accepting that PMDD and MDD are distinct clinical entities, it might also be argued that measurement error may explain these results. Because the symptom profiles of PMDD and MDD are so similar, it is possible that the WMH-CIDI failed to adequately capture PMDD status. This would mean that “PMDD status” might actually represent MDD. If the measures of PMDD and MDD represented the same construct, we would expect to observe a positive association between PMDD and suicidal behavior among people without MDD, and no association between PMDD and suicidal behavior among people with MDD. However, as we discussed previously, the magnitude of the association between PMDD status and all outcomes was essentially the same for women with MDD compared to women without MDD. Thus, we concluded that the survey instrument correctly assessed PMDD and MDD as separate constructs, and our results are valid.

Although no research has directly investigated the mechanisms that link PMDD to non-fatal suicidal behaviors, a number of studies have examined the relationship between menstrual cycle phase and suicidality. The evidence from this work suggests that serotonin is important, since both PMDD and suicidal behavior are associated with abnormalities in serotonergic function [27, 28]. In their recent review of studies of the menstrual cycle and suicidal behavior, Saunders and Hawton suggested that the lower levels of serotonin present in the low oestrogen (luteal) phases of the cycle may elevate some women’s likelihood for suicidal behavior[29]. Correspondingly, researchers have noted that in the premenstrual phase, women with PMDD have lower whole blood serotonin levels and lower platelet serotonin uptake than women without PMDD [30, 31]. This abnormality may explain the positive association between PMDD and suicidal behavior. To better understand and identify these mechanisms, future research should more closely examine the relationship between the timing of suicidal ideation, plans, and attempts in relation to menstrual phase, among women with PMDD in comparison to healthy controls.

While our study has a number of strengths, its limitations must be addressed. First, we proposed that the relationship between PMDD and non-fatal suicidal behaviors was largely

confounded by psychiatric comorbidity. Since the temporal ordering of the exposure (PMDD), the outcome [non-fatal suicidal behaviors] and the third variable [psychiatric comorbidity] is unknown in this cross-sectional dataset, we cannot establish the exact nature of the relationships among these factors. Our results are consistent with a mediational relationship, rather than confounding relationship, if psychiatric comorbidity falls on the causal pathway between PMDD and non-fatal suicidal behavior. Researchers found a prospective association between PMDD and MDD in a study of 17 women, suggesting that PMDD may be a causal risk factor for the development of MDD[32]. We could not locate any prospective studies showing a prospective association between PMDD and incident AD or SUD; consequently, we cannot offer evidence to support a mediational model over a confounding one for these factors. Future research should explore this possibility, however. Alternatively, PMDD may mediate or confound the relationship between psychiatric disorders and PMDD. In a prospective study, investigators found that a baseline history of AD (OR=2.5; 95% CI=1.1–5.5), but not mood disorders (OR=0.8; 95% CI=0.3–2.1), significantly elevated women's risk for the development of PMDD [33]. However, our data do not provide support for the possible mediating or confounding role of PMDD in the relationship between psychiatric disorders and suicidal behavior. After adjustment for PMDD status, we found that the relative changes in the parameter estimates for MDD, AD, and SUD were well below the threshold of 10–20% for all suicidal behaviors; relative changes ranged from 2.3% to 7.2%.

The second limitation of this study concerns the assessment of PMDD status. The diagnosis of PMDD should be considered 'provisional' because the WMH-CIDI module did not include content to address criteria C and D of the DSM-IV diagnostic criteria for PMDD [4]. The DSM-IV stipulates that PMDD symptoms cannot represent an exacerbation of an existing psychiatric disorder (Criterion C). Although we statistically controlled for the effects of comorbid MDD, AD, and SUD in our analysis, Criterion C is most effectively addressed through a clinical interview. Criterion D states that clinicians must evaluate participants' daily ratings of symptoms for at least two consecutive menstrual cycles. In the absence of a clinical interview and with retrospective symptom reporting, there may have been some error in the assessment of PMDD. However, the prevalence of PMDD in this sample is comparable to what was found by investigators using an assessment tool that more stringently addressed DSM-IV criteria, among a similar population [34]. In light of this evidence, we are relatively secure in concluding that the WMH-CIDI provides a valid diagnosis of PMDD, and the results presented here are accurate.

Our study has several strengths that should be noted. First, this is the first study to examine PMDD status as a correlate of multiple non-fatal suicidal behaviors in a nationally representative sample of American women. Prior work on this topic examined clinical samples or relatively homogenous samples. Second, we adequately controlled for demographic and psychiatric correlates of non-fatal suicidal behaviors in order to isolate the effect of PMDD status. Prior work did not take into account such a wide range of possible confounding/mediating variables. Finally, by controlling for social desirability in our models with the inclusion of scores on the Crown-Marlowe scale, we have greater confidence that the associations we observe are real, and not attributable to reporting bias.

In conclusion, this study is the first to demonstrate a strong, independent association between PMDD and suicidal ideation, plans, and attempts among a nationally representative sample of women. These findings suggest that clinicians treating women with PMDD should assess and be vigilant for signs of suicidal behavior, and that clinicians might evaluate and treat the premenstrual symptoms of women who express suicidal ideation, plans, or attempts. By targeting a gender-specific risk factor for non-fatal suicidal behavior, clinicians

may be able to address a substantial public health problem among reproductive-aged women.

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Figure 1.
Prevalence of non-fatal suicidal behaviors according to PMDD status

Table 1

Demographic characteristics of sample population

Study Characteristic	N	%
Race/ethnicity		
Asian	558	5.9
Hispanic	907	16.5
Black	1599	15.0
White	901	62.6
Education		
0–11 years	691	15.2
12 years	1143	27.4
13–15 years	1207	33.0
16+ years	924	24.4
Work		
Full time	2704	69.5
Unemployed	397	6.6
Not in work force	864	23.9
Body Mass index		
<18.5	197	5.5
18.5–24.9	1777	51.1
25.0+	1991	43.4
Major Depressive Disorder		
Yes	794	20.9
No	3171	79.2
Any anxiety disorder		
Yes	1307	35.8
No	2658	64.2
Any substance use disorder		
Yes	332	10.5
No	3633	89.5
Age	28.8	0.2
Social desirability	1.6	0.0

Table 2

Bivariate associations between demographic covariates, psychiatric comorbidity, social desirability, and non-fatal suicidal behaviors

Study Characteristic	Suicidal ideation				Suicide plans				Suicide attempts			
	Yes		No		Yes		No		Yes		No	
	N	%	N	%	N	%	N	%	N	%	N	%
Race/ethnicity												
Asian	77	13.8	481	86.3	25	5.2	533	94.8	23	4.2	535	95.8
Hispanic	144	14.1	763	86.0	51	4.1	856	96.0	72	7.2	835	92.8
Black	248	15.2	1351	84.8	97	6.4	1502	93.6	90	5.8	1509	94.2
White	253	21.1	648	78.9	100	7.6	801	92.4	95	6.9	806	93.2
Education												
0–11 years	135	23.0	556	77.0	47	6.8	644	93.2	66	11.2	625	88.8
12 years	201	16.3	942	83.7	78	6.2	1065	93.8	79	6.5	1064	93.5
13–15 years	227	18.2	980	81.8	89	6.5	1118	93.5	91	6.4	1116	93.6
16+ years	159	19.0	765	81.0	59	7.3	865	92.7	44	4.2	880	95.8
Work												
Full time	480	18.1	2224	81.9	196	7.2	2508	92.9	180	5.9	2524	94.1
Unemployed	77	21.8	320	78.2	26	6.2	371	93.9	28	7.5	369	92.5
Not in work force	165	19.1	699	80.9	51	5.5	813	94.5	72	8.5	792	91.5
Body Mass index												
<18.5	31	20.0	166	80.0	16	6.3	181	93.7	16	6.2	181	93.8
18.5–24.9	332	17.5	1445	82.6	120	6.3	1657	93.7	117	6.1	1660	93.9
25.0+	359	19.8	1632	80.2	137	7.2	1854	92.9	147	7.3	1844	92.7
Major depressive disorder												
Yes	289	36.4	505	63.6	136	17.1	658	82.9	120	14.5	674	85.5
No	433	14.0	2738	86.0	137	3.9	3034	96.1	160	4.5	3011	93.4
Any anxiety disorder												
Yes	424	30.5	883	69.5	183	13.2	1124	86.8	183	13.0	1124	87.0
No	298	12.0	2360	88.0	90	3.1	2568	96.9	97	3.1	2561	96.9
Any substance use disorder												
Yes	150	41.6	182	58.4	69	19.4	263	80.6	88	22.2	244	78.0

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Table 3
Unadjusted and multivariate-adjusted associations between PMDD status and non-fatal suicidal behavior

	Suicidal ideation		Suicide plans		Suicide attempt(s)	
	OR	95% CI	OR	95% CI	OR	95% CI
Model #1						
PMDD status						
PMDD	3.91***	2.43–6.28	4.86***	2.68–8.83	3.75***	2.09–6.70
Moderate/severe PMS	1.85***	1.44–2.38	1.69***	1.23–2.33	1.55*	1.05–2.31
No symptoms	1.00	--	1.00	--	1.00	--
Model #2						
PMDD status						
PMDD	3.69***	2.33–5.85	4.34***	2.41–7.82	4.25***	2.28–7.94
Moderate/severe PMS	1.79***	1.39–2.31	1.56***	1.13–2.16	1.74***	1.16–2.60
No symptoms	1.00	--	1.00	--	1.00	--
Race/ethnicity						
Asian	0.67	0.45–1.00	0.79	0.46–1.35	0.77	0.42–1.42
Hispanic	0.61*	0.40–0.91	0.58*	0.37–0.93	0.91	0.56–1.49
Black	0.66**	0.49–0.88	0.86	0.58–1.26	0.77	0.52–1.15
White	1.00	--	1.00	--	1.00	--
Education						
0–11 years	1.80*	1.11–2.91	1.39	0.83–2.32	1.92*	1.14–3.22
12 years	1.00	--	1.00	--	1.00	--
13–15 years	1.09	0.77–1.55	1.02	0.64–1.62	0.96	0.59–1.57
16+ years	1.09	0.76–1.58	1.07	0.64–1.78	0.63	0.36–1.10
Work						
Full time	1.00	--	1.00	--	1.00	--
Unemployed	1.42	0.93–2.15	0.95	0.51–1.76	1.13	0.62–2.09
Not in work force	1.14	0.84–1.56	0.83	0.56–1.22	1.41	0.98–2.03
Body Mass index						

	Suicidal ideation		Suicide plans		Suicide attempt(s)	
	OR	95% CI	OR	95% CI	OR	95% CI
18.5–24.9	1.21	0.60–2.44	1.07	0.52–2.20	0.96	0.43–2.13
25.0–29.9	1.00	--	1.00	--	1.00	--
30.0+	1.24	0.95–1.64	1.21	0.78–1.88	1.19	0.88–1.62
Age	1.00	0.98–1.02	1.00	0.98–1.03	0.98	0.94–1.01
Social desirability	0.89*	0.81–0.99	0.88	0.77–1.01	0.90	0.80–1.02
Model #3						
PMDD status						
PMDD	2.22***	1.40–3.53	2.27*	1.20–4.28	2.10*	1.08–4.08
Moderate/severe PMS	1.49***	1.17–1.88	1.17	0.85–1.62	1.28	0.86–1.88
No symptoms	1.00	--	1.00	--	1.00	--
Race/ethnicity						
Asian	0.81	0.66–1.51	1.45	0.85–2.46	1.48	0.78–2.81
Hispanic	0.89	0.20–1.24	0.89	0.56–1.39	1.49	0.90–2.45
Black	0.89	0.65–1.22	1.36	0.91–2.02	1.22	0.79–1.87
White	1.00	--	1.00	--	1.00	--
Education						
0–11 years	1.59	0.91–2.74	1.10	0.63–1.93	1.55	0.96–2.49
12 years	1.00	--	1.00	--	1.00	--
13–15 years	1.18	0.84–1.65	1.08	0.69–1.68	1.03	0.62–1.72
16+ years	1.24	0.84–1.83	1.20	0.74–1.96	0.74	0.41–1.32
Work						
Full time	1.00	--	1.00	--	1.00	--
Unemployed	1.35	0.86–2.10	0.85	0.44–1.64	1.02	0.53–1.96
Not in work force	1.20	0.88–1.64	0.87	0.58–1.29	1.51*	1.06–2.16
Body Mass index						
18.5–24.9	1.31	0.57–3.05	1.14	0.48–2.72	1.06	0.52–2.15
25.0–29.9	1.00	--	1.00	--	1.00	--
30.0+	1.18	0.91–1.53	1.09	0.69–1.73	1.12	0.83–1.51
Major Depressive Disorder						

	Suicidal ideation			Suicide plans			Suicide attempt(s)		
	OR	95% CI		OR	95% CI		OR	95% CI	
Yes	2.48***	1.92–3.21		3.18***	2.00–5.07		2.42***	1.60–3.66	
No	1.00	--		1.00	--		1.00	--	
Any anxiety disorder									
Yes	2.00***	1.45–2.77		2.78***	1.80–4.29		3.09***	2.06–4.62	
No	1.00	--		1.00	--		1.00	--	
Any substance use disorder									
Yes	2.47***	1.67–3.64		2.83***	1.77–4.50		3.63***	2.44–5.41	
No	1.00	--		1.00	--		1.00	--	
Age	0.99	0.97–1.01		0.99	0.97–1.02		0.97*	0.93–1.00	
Social desirability	0.93	0.85–1.03		0.94	0.81–1.08		0.97	0.86–1.10	

* p<0.05,

** p<0.01,

*** p<0.001