Title: Role of young women's depression and stress symptoms in their weekly use and nonuse of contraceptive methods

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Implications and contribution statement

Young women with elevated psychological stress symptoms were at risk for weekly contraceptive nonuse. Those with depression and stress symptoms were also at risk of using less effective contraceptive methods over time. Findings have implications for further evaluation of the relationship between dynamic psychological symptoms, contraceptive behavior and unintended pregnancy.

Abstract

Purpose

We prospectively examined the influence of young women's depression and psychological stress symptoms on their weekly contraceptive method use.

Methods

We examined data from 689 women ages 18-20 years participating in a longitudinal cohort study. Women completed 8,877 weekly journals over the first year, which assessed reproductive, relationship and health information. We focused on baseline depression (Center for Epidemiologic Studies-Depression Scale) and stress (Perceived Stress Scale) symptoms and weekly contraceptive method use. Analyses used multivariate random effects and multinomial logistic regression.

Results

Approximately, one-quarter of women exhibited moderate/severe depression (27%) and stress (25%) symptoms at baseline. Contraception was not used in 10% of weekly journals, while coital and noncoital methods were used in 42% and 48% of weeks, respectively.

In adjusted models, women with moderate/severe stress symptoms had over twice the odds of contraception nonuse than women without stress (OR 2.23, CI 1.02-4.89, p=0.04). Additionally, women with moderate/severe depression (RR 0.52, CI 0.40-0.68, p<0.001) and stress (RR 0.75, CI 0.58-0.96, p=0.02) symptoms had lower relative risks of using long-acting methods than OCs (reference category). Women with stress

symptoms also had higher relative risks of using condoms (RR 1.17, CI 1.00-1.34, p=0.02) and withdrawal (RR 1.29, CI 1.10-1.51, p=0.001) than OCs. The relative risk of dual versus single method use was also lower for women with stress symptoms.

Conclusion

Women's psychological symptoms predicted their weekly contraceptive nonuse and use of less effective methods. Further research can determine the influence of dynamic psychological symptoms on contraceptive choices and failures over time.

Key words: depression; psychological stress; contraceptive behavior; contraceptive methods; contraceptive nonuse

Introduction

The majority of sexually active young women have used contraception and have access to a variety of safe and effective methods (1). However, problems with contraceptive use are common and perfect use is seldom achieved (2-4). Over 90% of the estimated 3.2 million U.S. unintended pregnancies are attributed to contraceptive nonuse, misuse or discontinuation (2-4).

Contraceptive effectiveness, which takes into account typical use, varies according to method. Oral contraceptives (OC), the most commonly used contraceptive in the United States, are highly effective with a 97-98% perfect use efficacy rate (1,3,5). Though, as many as 40% of OC users miss one or more pills per month (8,9) and typical users in the U.S. experience a 9% failure rate in the first year (3). Coital-specific methods are associated with even higher rates of user-related failure. Over 60% of condom users in a recent population-based study reported, within the last three months, not using condoms with every act of intercourse or applying condoms after intercourse had begun (9). Among typical users of condoms, 18% will become pregnant during the first year of use (3).

Selection of an effective contraceptive method is important for all women who want to avoid an unintended pregnancy but is of particular concern for women who may be at risk for user-related method failures (3). Adverse psychological conditions including depression and stress are common among reproductive-aged women (16,17) and have been shown to be associated with non-adherence with general medications (18,19). Young women with psychological distress are also more likely to exhibit characteristics associated with risky sexual practices including multiple sexual partners,

sexually transmitted infection (STI) acquisition, sex while under the influence of drugs and early and unprotected coitarche (20-24). For young women with psychological symptoms, use of effective methods that require little user burden or dual method use may enhance long-term contraceptive adherence and prevent negative reproductive health outcomes. Yet, little is known about how women's psychological symptoms influence their contraceptive method choices and use over time.

We prospectively examined the role of young women's depression and psychological stress symptoms in their weekly use and nonuse of contraceptive methods.

Methods

Sample and design

Our data come from a population-based longitudinal cohort study of 993 young women aged 18 to 20 years residing in a racial/ethnically and socioeconomically diverse Michigan county. State driver's license and personal identification card registers were used for selection of the sampling frame. Names and contact information were randomly selected from these public records and eligible women (age 18-20 at time of recruitment and a resident of the county) were contacted by mail or phone and asked to participate. Sampling occurred between March 2008 and March 2009.

After informed consent, a 60-minute in-person baseline survey interview was conducted by a trained research assistant to elicit information on sociodemographics, relationship characteristics, reproductive attitudes, beliefs and intentions, contraceptive histories, and mental health symptoms. Participants were then invited to participate in the weekly journal-based study for a period of 2.5 years. The weekly journal surveys, which measured contraceptive use patterns, relationship status and pregnancy outcomes, were

completed online for participants with internet access or by phone if internet access was unavailable on a particular week. Participants were compensated $1 per weekly survey with $5 bonuses for on-time completion of five consecutive surveys. The response rate for the baseline interview was 88%; 78% completed at least 12 months of surveys.

Sample selection is presented in Figure 1. The initial sample comprised 993 women. For this analysis, we focused on contraceptive use during the first 12 months of follow-up given the high response rates during this period. We excluded women who 1) became and remained pregnant during the study period (n=60); 2) were not sexually active in any week during the study period (n=301), and 3) had missing contraceptive use information (n=3). We examined those weekly journal entries in which women reported being sexually active and not pregnant over the previous week in order to estimate contraceptive use among those at risk of pregnancy. Our final sample included 689 non-pregnant, sexually-active women who completed 8,877 weekly journals during their first 12 months of study (mean number of journals per woman 58, range 2-146).

This study was approved by the Institutional Review Boards of the University of Michigan and Princeton University.

Measures

Psychological symptoms

Abbreviated versions of standardized depression and psychological stress instruments were administered during the baseline interview.

The Center for Epidemiologic Studies – Depression Scale-5 (CES-D-5) is an abbreviated screening tool that assesses depressive symptoms over the previous week

(25-28). Women were asked how often they felt the following five symptoms over the past 7 days: “like you could not shake off the blues,” “depressed,” “sad,” “life was not worth living,” and “happy.” Responses were scored on a 4-point scale (0=rarely or none of the time, 1=some or little of the time, 2=occasionally or moderate amount of time, 3=most or all of the time); the positively worded item was reverse coded. Items were then summed for a total depression score. Scores range from 0-15; a higher score indicates a higher degree of symptoms. We used a standardized cut-off of ≥4 points to denote moderate/severe depression symptoms (one standard deviation above the population mean)(28).

The Perceived Stress Scale (PSS-4) is a global psychological stress screen that assesses the degree to which life situations are appraised as stressful, unpredictable, uncontrollable, and overloading over the previous month (29-30). Women were asked how often (0=never, 1=almost never, 2=sometimes, 3=fairly often, 4=very often) they felt the following 4 symptoms: “unable to control important things in life,” confident about ability to handle personal problems,” “things were going your way,” and “difficulties were piling up so high that you could not overcome them.” Positively worded items were reverse coded. Items were summed for a total score, which could range from 0-16 with higher scores indicating greater stress. We used the standardized cut-off of ≥9 points (one standard deviation above population mean) to denote moderate/severe stress symptoms (29-30).

Contraceptive use

At baseline, women were asked about previous and current use of any non-coital contraceptive method (OCs, contraceptive patch, ring, injectable, implant, or intrauterine device (IUD)). For this analysis, we categorized the IUD, injectable or implant as long-acting contraceptive methods.

In each weekly survey, women were asked if they had been sexually active the previous week and if so, were then asked whether they had used a non-coital method (listed above) or coital-specific method (condoms, withdrawal, or other coital methods including diaphragm/cervical cap, spermicide, female condom, emergency contraception (EC), rhythm calender method or other non-specified method) during the week since the last survey.

We examined three primary weekly contraceptive use variables: 1) nonuse of a contraceptive method versus any method use (non-coital or coital methods), 2) specific types of contraceptive methods used, and 3) single versus dual method use.

For specific contraceptive method use among women who reported using contraception, we created a categorical variable of "most effective method" in which women were top-coded to their most effective method used: 1) long-acting methods, 2) OCs, 3) contraceptive ring or patch, 4) condoms, 5) other coital methods, and 6) withdrawal.

Single versus dual contraceptive method use included the following categories: 1) a single method alone, which was the reference category, 2) OCs AND condoms, 3) other noncoital methods (long-acting methods/ring/patch) AND condoms, 4) OCs AND withdrawal, and 5) other noncoital methods (long-acting methods/ring/patch) AND withdrawal.

Depression, stress and contraceptive methods

Baseline demographic, social and reproductive characteristics

Sociodemographic characteristics including age, race/ethnicity, educational attainment (type of school currently enrolled), employment status, public assistance recipient, and frequency of religious service attendance, relationship status (married, engaged, in special romantic relationship, having physical/emotional contact with someone or none) and cohabitation status (with marital or non-marital partner) were assessed at baseline. Women were asked whether they had ever had sexual intercourse, their age at coitarche, and lifetime number of sexual partners. Gravidity (none, one, two or more pregnancies) and current pregnancy status was assessed at baseline; current pregnancy status (self-reported positive test or reported being "probably pregnant") and sexual activity were reassessed weekly.

Statistical analysis

We used univariate and bivariate (X^2 tests and student's t-tests) statistics to describe sociodemographic and reproductive characteristics, to estimate women's baseline psychological conditions and weekly contraceptive method use (for each contraceptive variable) and to compare: 1) proportions of moderate/severe baseline psychological conditions and contraceptive method use across participants' sociodemographic characteristics; and 2) proportions of contraceptive method use among women with and without moderate/severe psychological conditions. Using random effects multivariable logistic regression models to account for unobserved respondent-level heterogeneity (the clustering of observations by woman), we first examined the

effect of baseline depression and stress symptoms on weekly contraceptive nonuse. We controlled for the number of journals women completed, baseline sociodemographic and reproductive characteristics. We further used multinomial logistic regression to examine the influence of psychological symptoms on relative risks of using specific contraceptive methods, with the reference category as OCs (most common method used) Results are presented as adjusted odds ratios (OR) and relative risk ratios (RR) with 95% confidence intervals (CI) and p-values (p). A two-tailed alpha of 0.05 was considered significant. All data were analyzed using Stata 11.0 (StataCorp LP, College Station, TX).

Results

Baseline demographic, social, and reproductive characteristics of the sample (Table 1)

Women were ages 18 (43%), 19 (49%) and 20 (8%) years old at enrollment. The majority identified as white (58%) or black (32%) race/ethnicity. Over half of women were enrolled in a 4-year (25%) or 2-year (29%) college or vocational/technical school. Many women were employed (51%) though 28% were receiving public assistance. Weekly religious services attendance was reported by 21% of women. Over half (57%) were in a special romantic relationship; 21% were living with a romantic partner and 11% were married or engaged. One fifth of women (20%) had experienced coitarche at age ≤14 years and 39% reported having ≥ 4 lifetime sexual partners; 25% had a history of pregnancy. Nearly all women (88%) had used contraception in the past but 51% had unprotected intercourse experience. Contraceptive use at enrollment was reported by 60% of women, with OCs being the most common method used (36%).

Depression, stress and contraceptive methods

Baseline psychological symptoms

The sample's mean (± standard deviation) baseline CES-D-5 depression symptom score was 3±3 points (range 0-15). Twenty-seven percent of women (n=185) met criteria for moderate/severe depression symptoms (≥4 points). Having moderate/severe depression symptoms was associated with race/ethnicity (p=0.002), educational enrollment (p=0.005), number of sexual partners (p=0.02), age at coitarche (<0.001), and gravidity (p=0.009): black women, high school drop-outs, women with a younger age at coitarche, more lifetime sexual partners and multi-gravidous women had greater depression symptoms than their counterparts.

The mean baseline PSS-4 stress symptom score was 6±3 points (range 0-15). Twenty-five percent of women (n=173) met criteria for moderate/severe stress symptoms (≥ 9 points). Having moderate/severe stress symptoms was associated with lifetime number of sexual partners (p=0.001) and age at coitarche (p=0.003): women with more lifetime sexual partners and younger age at coitarche had greater stress symptoms than their counterparts.

Young women's depression and stress symptoms were correlated: 62% of women with moderate/severe depression symptoms also had moderate/severe stress symptoms; similarly, 66% of those with stress symptoms also had depression symptoms (p<0.001, Pearson's r=0.51).

Contraceptive methods used each week

Of the 8,877 weeks (journals) in which women (n=689) were at risk of unintended pregnancy (sexually active and not pregnant) during the first year of follow-up, 878 weeks (10%) were not covered by a contraceptive method while contraception was used 90% of the time: 48% of woman-weeks were covered by non-coital method and 42% by a coital-specific method alone.

For the most effective methods used among weeks in which women reported contraceptive use (n=7,999), women used long-acting methods including injectable (6%), IUD (<1%) and implant (<1%), OCs (44%), other hormonal methods including the ring (1%) and patch (1%), condoms (27%), other coital methods (1%) and withdrawal (17%). In 96 journals, method type was not specified.

For dual method use, 18% of weeks were covered by OCs AND condoms, 3% by other noncoital methods (long-acting/ring/patch) AND condoms, 14% by OCs AND withdrawal, and 3% by other noncoital methods (long-acting/ring/patch) AND withdrawal. Use of a single method alone was reported in 63% of weeks.

Weekly contraceptive method use varied across all of women's sociodemographic and reproductive characteristics including age, race/ethnicity, educational attainment, employment status, receipt of public assistance, relationship and cohabitation status, religious service attendance, age at coitarche, number of lifetime sexual partners, and number of pregnancies (all p-values <0.001) (Table 1).

Associations between baseline psychological symptoms and weekly contraceptive method use

Depression, stress and contraceptive methods

In unadjusted analyses, baseline depression and stress symptoms were associated with weekly contraceptive nonuse and with specific methods used (all p-values<0.001) (Table 2). Women with moderate/severe depression and stress symptoms had higher proportions of weeks in which no contraceptive was used (13% and 14%, respectively) compared to those without depression and stress symptoms (9% and 9%). Women with moderate/severe depression and stress symptoms also had lower proportions of using non-coital methods (42% and 42%, respectively) than women without moderate/severe psychological symptoms (50% and 51%).

When comparing the most effective specific methods used, women with moderate/severe psychological symptoms had lower proportions of using long-acting methods and OCs but higher proportions of condom use than women without psychological symptoms (Table 2). However, slightly higher proportions of other hormonal method use (ring/patch) were noted among women with depression and stress symptoms versus those without (4% versus 2% for both depression and stress).

Additionally, compared to women without moderate/severe depression and stress symptoms, those with symptoms had higher proportions of using a single contraceptive method alone (62% and 60% versus 65% and 70%, respectively) and lower proportions of nearly all combinations of dual method use (Table 2).

Relationships between baseline psychological symptoms and weekly contraceptive method use: multivariate results

Depression, stress and contraceptive methods

In random effects logistic regression models controlling for woman-specific effects, number of journals completed and covariates, women with moderate/severe stress had twice the odds of contraceptive nonuse than women without moderate/severe stress (OR 2.23, CI 1.02-4.89, p=0.04) (Table 3).

Among women who used contraception, moderate/severe depression and stress symptoms were associated with using less effective methods each week (Table 4). For women with moderate/severe depression (RR 0.52, CI 0.40-0.68, p<0.001) and stress (RR 0.75, CI 0.58-0.96, p=0.02) symptoms, the relative risk of using long-acting methods was lower than for OCs (reference category). Additionally, women with stress symptoms had higher relative risks of using condoms (RR 1.17, CI 1.00-1.34, p=0.02) and withdrawal (RR 1.29, CI 1.10-1.51, p=0.001) than OCs. However, the relative risk of using the ring/patch versus OCs was higher for women with both depression (RR 2.75, CI 1.90-4.00, p<0.001) and stress (RR 2.92, CI 2.11-4.05, p<0.001) symptoms.

The relative risks of nearly all combinations of dual method use were lower than for single method use among women with moderate/severe stress symptoms (Table 4). Women with depression symptoms had slightly higher relative risk of using OCs AND withdrawal than of using a single method alone (RR 1.24, CI 1.05-1.49, p=0.02).

Other sociodemographic factors significantly associated with contraceptive nonuse and specific method us in multivariate models included educational attainment and employment status (Table 3).

Discussion

Depression, stress and contraceptive methods

Ours is the first study of which we are aware to prospectively measure weekly method choice *and* sexual activity among a population-based cohort. Building upon other researchers' work of contraceptive method use (1), we found that OCs and condoms were consistently young women's preferred contraceptives over time. However, 10% of these women's weeks were not covered by a contraceptive method. Our findings provide new insights into contraceptive nonuse and specific method use patterns among women at risk of pregnancy each week.

We found that psychological stress symptoms predicted weekly nonuse of contraceptive methods. Others who have noted associations between psychological distress and contraceptive nonuse among young cohorts (20-24,31), though these studies have used cross-sectional or retrospective designs and focused on unprotected intercourse at coitarche or at last sexual encounter (20-24,31). By using a prospective, longitudinal approach and assessing sexual activity each week, we found that stressed women at risk of pregnancy had over twice the odds of not using contraception than women without elevated stress symptoms.

Women's moderate/severe psychological symptoms also predicted use of less effective contraceptive methods. Women with moderate/severe depression and stress symptoms had lower relative risks of using long-acting methods than compared to OCs; those with stress symptoms also had higher relative risks of using coital methods like condoms and withdrawal. While condom use is important for preventing STIs among women with mental health symptoms, use of the most effective methods to prevent unintended pregnancy is also of priority (33). Unfortunately, only 21% of weeks were covered by dual use of an effective contraceptive method *and* condoms.

Depression, stress and contraceptive methods

Using clinic-based data from 2,476 predominantly black and Latina women (ages not specified) in New York City, Garbers *et al.* found that women screening positive for depression (Patient Health Questionnaire-9) had 45% higher odds of selecting condoms and 39% lower odds of selecting hormonal methods at their clinic visit compared to women without depressive symptoms (32). In another study using cross-sectional national data from 53,255 women ages 18 and older in the Behavioral Risk Factor Surveillance System, Farr *et al.* found that low income women with frequent mental distress (measured by days of "not good mental health" in the past month) had lower odds of using long-acting/hormonal methods (OR 0.5) and condoms (OR 0.6) than other less effective methods (33). Overall, our prospective study builds upon this retrospective and cross-sectional work to highlight associations between psychological symptoms and women's weekly contraceptive method use patterns, suggesting that young women's depression and stress symptoms may negatively influence contraceptive behavior and choices over time.

Unfortunately, like the other studies, ours did not ascertain reasons for contraceptive nonuse or specific method choices. Thus, data do not illuminate why women with psychological symptoms may resort to less effective methods or forgo contraception altogether each week. It may be that women with psychological symptoms are more likely to perceive or fear side effects and long-term consequences of hormonal or long-acting methods, potentially deterring them from using more effective contraception (34). It may also be that these women wish to avoid or are unable to cope with the behavioral diligence required of many user-dependent options like OCs (33). Alternatively, depression and stress may negatively interact with cognitive processes and

decision-making around contraception and sexual behavior (18). These hypotheses require further study.

Additionally, our small sub-samples limited adequate assessment of certain contraceptive methods, particularly the ring and patch. The positive association between psychological symptoms and use of the ring/patch was difficult to interpret since it was based upon only 20 women; however, it may be at least partially explained by the reproductive characteristics of these women who chose other hormonal methods (they were more likely to be multi-gravidous). Additional investigations of the influence of psychological and contextual factors on use of the contraceptive ring and patch are needed.

Our psychological variables were measured at baseline, so we were unable to evaluate time-varying relationships between dynamic depression and stress symptoms and contraceptive method use patterns. It may be that long-term effects of psychological symptoms on contraceptive use diminish over time, improve with positive changes or worsen with negative changes in mental health status. These hypotheses require additional investigation. Although we used items from standardized psychological instruments, our abbreviated versions prevented an in-depth assessment of depression and stress symptoms. Finally, other important health-related characteristics such as general, mental, physical and sexual health history (including STI history) and medication history, which may have been important factors influencing women's contraceptive method selection, were not assessed.

Conclusion

Depression, stress and contraceptive methods

Our findings suggest that young women with elevated stress symptoms are at risk of contraceptive nonuse and those with depression and stress symptoms are at risk of using less effective methods each week, which subsequently increases their likelihood of unintended family planning outcomes. Consideration of women's psychological symptoms is clinically important when assisting patients with initiation, management or switching of contraceptive methods. Long-acting reversible methods provide highly effective contraceptive options with less adherence concerns and may facilitate successful contraceptive outcomes for young women with adverse psychological symptoms (38); though, specific counseling and intervention strategies around contraceptive method selection and continuation in the context of mental health issues require further study. Additional comprehensive measurement of dynamic depression and stress symptoms can provide a greater understanding of how young women's adverse psychological symptoms may impact their family planning behaviors and outcomes over the course of their reproductive lifespan.

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Table 1. Weekly contraceptive method use by women's baseline demographic, social and reproductive characteristics

	Percentage of weeks of contraceptive method use including nonuse (n=8,877)							
Baseline characteristics **Full sample (n=689 women)**	None (n=878, 10%)	Condoms (n=2,128 24%)	Withdrawal (n=1366, 15%)	Other Coital[a] (n=106, 1%)	OCs (n=3537, 40%)	Ring or patch (n=195, 2%)	Long-acting[b] (n=572, 6%)	P-value
Age								<0.001
18 years (n=291, 43%)	12	24	13	2	40	2	6	
19 years (n=340, 49%)	9	23	19	1	40	2	6	
20 years (n=58, 8%)	3	28	7	1	44	<1	14	
Race/ethnicity								<0.001
Non-Hispanic White (n=397, 58%)	10	22	15	1	45	2	6	
Non-Hispanic Black (n=218, 32%)	13	33	15	2	26	1	11	
Hispanic (n=58, 8%)	3	21	16	2	47	7	3	
Asian/Other (n=16, 2%)	11	17	30	0	27	3	8	
Educational enrollment								<0.001
Not enrolled (n=162, 24%)	14	25	18	1	36	1	4	
High school (n=90, 13%)	17	27	15	2	30	1	8	
2 year college (n=201, 29%)	7	22	19	1	40	2	8	
4 year college (n=174, 25%)	4	21	9	1	55	4	6	
High school drop-out (n=62, 9%)	26	30	23	1	11	2	7	
Employment status								<0.001
Employed (n=354, 51%)	7	22	14	1	47	2	6	
Unemployed (n=335, 49%)	13	25	17	2	33	2	7	
Receiving public assistance								<0.001
Yes (n=191, 28%)	15	30	16	2	23	2	12	
No (n=498, 72%)	8	22	15	1	45	2	5	

Frequency of religious service attendance								<0.001
Never (n=156, 23%)	10	24	10	1	41	4	10	
< weekly (n=386, 56%)	10	20	20	1	42	1	4	
≥ weekly (n=147, 21%)	6	34	9	2	35	3	9	
Relationship status								<0.001
Married (n=13, 2%)	8	20	10	1	40	0	21	
Engaged (n=62, 9%)	13	25	20	4	31	3	5	
Special romantic relationship (n=390,57%)	10	21	13	1	44	3	7	
Physical/emotional contact (n=120, 17%)	10	31	23	1	30	1	5	
None (n=104, 15%)	6	27	14	1	44	1	6	
Cohabitation status								<0.001
Cohabitating (n=145, 21%)	15	17	21	2	36	2	6	
Not cohabitating (n=544, 79%)	8	25	13	1	42	2	7	
Age at first vaginal intercourse								<0.001
No sex at enrollment (n=62, 9%)	3	41	10	3	40	2	1	
< 14 years (n=138, 20%)	15	23	16	2	30	4	9	
15-16 years (n=289, 42%)	10	20	18	1	43	2	6	
≥ 17 years (n=200, 29%)	8	26	12	1	45	2	7	
Lifetime number of sexual partners								<0.001
0 (n=62, 9%)	3	41	10	3	40	2	1	
1 (n=134, 20%)	8	22	10	1	50	3	6	
2 (n=106, 15%)	10	27	16	1	31	5	11	
3 (n=118, 17%)	8	21	14	2	45	2	7	
≥ 4 (n=269, 39%)	12	22	20	1	38	1	6	
Pregnancies								<0.001
0 (n=519, 75%)	8	23	14	1	46	2	5	
1 (n=113, 16%)	15	26	23	1	19	1	13	
≥2 (n=57, 8%)	18	29	11	3	21	5	12	

Results are presented as percentages of weekly use of each contraceptive method (including nonuse) by women's demographic, social and reproductive characteristics. Weekly use of contraception is exclusive and top-coded to the most effective method used that week. Comparisons across sociodemographic groups are with chi-square analysis, alpha significant <0.05. [a]Other coital methods includes spermicide, diaphragm, female condom, rhythm calendar method, emergency contraception, or other methods. [b]Long-acting methods include IUD, implant or injectable. In 96 journals, method type was not specified.

Table 2. Weekly contraceptive method use by moderate/severe depression and stress symptoms

Proportion of weekly contraceptive method use by women's baseline moderate/severe psychological symptoms						
	Depression symptoms			Stress symptoms		
	Moderate/severe (≥4pts CES-D) (n=185 women)	< Moderate/severe (<4pts CES-D) (n=504 women)	p-value	Moderate/severe (≥9pts PSS-4) (n=173 women)	< Moderate/severe (<9pts PSS-4) (n=516 women)	p-value
Contraceptive method use* (n=8,877 weeks)			<0.001			<0.001
None (n=878)	13	9		13	9	
Coital (n=3,695)	45	41		45	41	
Noncoital (n=4,304)	42	51		42	50	
Most effective method used* (n=7,999)			<0.001			<0.001
[a]Long-acting (n=571)	6	8		6	8	
OCs (n=3,537)	40	46		39	46	
Ring or patch (n=195)	4	2		4	2	
Condoms (n=2,128)	30	26		29	26	
[b]Other coital (n=106)	2	1		2	1	
Withdrawal (n=1,366)	19	17		20	17	
Single versus dual method use* (n=7,999)			0.002			<0.001
Single method only (n=5020)	65	62		70	60	
OCs AND condoms (n=1427)	16	18		14	19	
Other noncoital methods (long-acting/ring/patch) AND condoms (n=1427)	4	3		2	3	

OCs AND withdrawal (n=1105)	13	14		12	15	
Other noncoital methods (long-acting/ring/patch) AND withdrawal (n=205)	2	3		3	3	

Center for Epidemiologic Studies – Depression Scale (CES-D-5). Perceived Stress Scale - 4 (PSS-4). Results are presented as proportions of contraceptive method use among women with and without moderate/severe psychological symptoms. P-values from unadjusted chi-square tests significant at alpha <0.05. *Categorical results for contraceptive outcomes are exclusive and top-coded to most effective method reported. In 96 journals method type was not specified. [a] Long-acting methods include IUD, implant or injectable. [b]Other coital methods includes spermicide, diaphragm, female condom, rhythm calendar method, emergency contraception, or other methods.

Table 3. Effect of depression and stress symptoms on weekly nonuse of contraception

	Odds of contraceptive nonuse among women with moderate/severe **depression symptoms**[a] OR (95% CI) p-value	**Odds of contraceptive nonuse** among women with moderate/severe **stress symptoms**[b] OR (95% CI) p-value
Less than moderate psychological symptoms	ref	ref
Moderate/severe psychological symptoms	1.29 (0.59-2.83) 0.53	2.23 (1.02-4.89) 0.04
Sociodemographic and reproductive covariates		
Age		
18 years	ref	ref
19 years	0.98 (0.47-2.05) 0.96	0.97 (0.46-2.03) 0.93
20 years	0.88 (0.23-3.33) 0.84	0.93 (0.25-3.50) 0.92
Race/ethnicity		
White	ref	ref
Black	1.31 (0.57-3.01) 0.52	1.31 (0.57-3.00) 0.52
Hispanic	0.36 (0.09-1.53) 0.17	0.36 (0.09-1.48) 0.15
other	1.74 (0.21-14.02) 0.61	2.01 (0.25-16.42) 0.52
Education enrollment		
Not enrolled	ref	ref
High school	1.40 (0.45-4.36) 0.56	1.51 (0.48-4.72) 0.58
2-year college	0.45 (0.17-1.15) 0.10	0.49 (0.19-1.26) 0.14
4 year college	0.17 (0.05-0.49) 0.001	0.18 (0.06-0.53) 0.002
High school drop-out	1.52 (0.43-5.38) 0.51	1.58 (0.45-5.58) 0.48
Employment status		
Unemployed	ref	ref
Employed	0.43 (0.21-0.89) 0.02	0.43 (0.21-0.89) 0.02

Receiving public assistance		
No	ref	ref
Yes	1.61 (0.69-3.74) 0.27	1.78 (0.76-4.12) 0.18
Frequency of religious service attendance		
Never	ref	ref
< weekly	1.43 (0.60-3.38) 0.42	1.48 (0.62-3.51) 0.38
≥ weekly	0.47 (0.15-1.53) 0.21	0.43 (0.13-1.41) 0.17
Age at coitarche		
No sexual intercourse experience at enrollment	ref	ref
< 14 years	3.94 (0.77-20.10) 0.10	3.13 (0.61-16.13) 0.10
15-16 years	1.66 (0.35-7.88) 0.53	1.42 (0.29-6.78) 0.53
≥ 17 years	1.49 (0.28-7.93) 0.65	1.21 (0.23-6.54) 0.65
Lifetime number of sexual partners		
0	ref	ref
1	0.66 (0.23-1.90) 0.44	0.73 (0.25-2.11) 0.56
2	0.69 (0.23-2.04) 0.51	0.79 (0.26-2.34) 0.67
≥ 3	0.59 (0.22-1.57) 0.29	0.63 (0.24-1.67) 0.35
Number of pregnancies		
0	ref	ref
1	1.47 (0.55-3.89) 0.44	1.46 (0.55-3.88) 0.45
≥2	2.93 (0.80-10.65) 0.10	3.00 (0.99-1.02) 0.09

N=689 women; 8,877 weeks. Results are presented as odds ratios (OR) with 95% confidence intervals (CI) and p-values from full multivariable random effects logistic regression illustrating the effect of moderate/severe depression and stress symptoms on weekly nonuse of a contraception. Reference category is use of a contraceptive method. All regression models with random effects for woman-specific effects and controlling for number of journal completed. Depression and stress variables entered into separate models. [a]Center for Epidemiologic Studies – Depression Scale (CES-D-5) – 4 point cut-off for moderate/severe depression symptoms. [b]Perceived Stress Scale - 4 (PSS-4) - 9-point cut-off for moderate/severe stress symptoms.

Table 4 Effect of depression and stress symptoms on weekly use of specific contraceptive methods

Relative risks of weekly contraceptive method use for women with psychological symptoms		
Specific contraceptive methods used each week among women reporting contraceptive use N=689 women, 7,999 weeks	Effect of moderate/ severe **depression symptoms (≥4points)** RR (95% CI) p-value	Effect of moderate/ severe **stress symptoms (≥9 points)** RR (95% CI) p-value
Oral contraceptives	ref	ref
Long-acting methods[a]	0.52 (0.40-0.68) <0.001	0.75 (0.59-0.96) 0.02
Contraceptive ring or patch	2.75 (1.90-4.00) <0.001	3.00 (2.11-4.05) <0.001
Condoms	1.02 (0.88-1.17) 0.84	1.17 (1.02-1.34) 0.02
Other coital methods[b]	1.30 (0.84-2.04) 0.24	1.45 (0.92-2.27) 0.11
Withdrawal	0.88 (0.75-1.04) 0.14	1.29 (1.10-1.51) 0.001
Single or dual method use each week N=689 women, 7,999 weeks		
Single method only	ref	ref
Oral contraceptives AND condoms	0.99 (0.84-1.16) 0.88	0.71 (0.61-0.83) <0.001
Other noncoital methods (long-acting/ring/patch) AND condoms	1.15 (0.84-1.59) 0.38	0.65 (0.46-0.93) 0.02
Oral contraceptives AND withdrawal	1.24 (1.04-1.48) 0.02	0.76 (0.64-0.90) 0.002
Other noncoital methods (long-acting/ring/patch) AND withdrawal	1.29 (0.86-1.93) 0.23	1.21 (0.85-1.71) 0.29

Results are presented as relative risk ratios (RR) with 95% confidence intervals (CI) and p-values from reduced multinomial logistic regression models illustrating the effect of moderate/severe depression and stress symptoms on weeks of specific contraceptive method use among women who reported using contraception. Contraceptive method outcomes are categorical and top-coded to most effective method reported: method use is exclusive – women are counted in only one category for specific methods and for single vs. dual method use. Reference categories are the most frequently reported categories: oral contraceptive use and single method use. [a] Long-acting methods include IUD, implant or injectable. [b]Other coital methods includes spermicide, diaphragm, female condom, rhythm calendar method, emergency contraception, or other methods. Method type was not specified in 96 weekly journals.
Results are from reduced multinomial regression models controlling for woman effect, number of journals completed, education, employment status, religious participation, number of sexual partners and number of pregnancies. Depression and stress variables were entered into separate models.

Figure 1. Selection of the Sample