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Social disparities in the relationship between depression and unintended pregnancy during adolescence and young adulthood

Dr. Kelli Stidham Hall, PhD MS,

Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Emory University, 1518 Clifton Road, NE, GCR 560, Atlanta, GA 30322, USA, kelli.s.hall@emory.edu (t) 404-727-8741 (f) 404-727-1369

Ms. Jennifer L. Richards, MPH, PhD(c), and

Department of Epidemiology, Rollins School of Public Health, Emory University

Dr. Kathleen Mullan Harris, PhD

Department of Sociology; Carolina Population Center, University of North Carolina at Chapel Hill

Abstract

Purpose—We investigated the influence of depression on subsequent risk of unintended pregnancy, and social disparities within this relationship, during adolescence and young adulthood.

Methods—Drawing upon 15-year, nationally-representative data from 8,810 young U.S. women in the National Longitudinal Study of Adolescent to Adult Health, we estimated associations between depression and time to first pregnancies reported as unintended, overall and stratified by race/ethnicity, socioeconomic status, and age, with Cox proportional hazard models.

Results—Moderate/severe depression symptoms were associated with an increased risk of unintended first pregnancy (HR 1.21, CI 1.02–1.44). In stratified models, depression increased the pregnancy risk for all minority groups (HR's 1.36–3.25) but not White women. Depression increased the pregnancy risk for women with \$0–19,999 (HR 1.48, CI 1.11–1.98) and \$20,000–49,999 (HR 1.33, CI 1.05–1.68) income levels but not those at higher levels. Depression increased the pregnancy risk for adolescents <20yrs (HR 1.35, CI 1.07–1.71) but decreased the risk for women >24yrs (HR 0.47, CI 0.25–0.86).

Conclusion—Findings may inform more equitable, holistic public health strategies that target depression as a modifiable risk factor for adverse reproductive outcomes during adolescence and young adulthood.

Correspondence to: Kelli Stidham Hall.

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DISCLOSURES:

We have no relevant disclosures or conflicts of interest to report.

IMPLICATIONS & CONTRIBUTION STATEMENT

Findings contribute new insights into social inequities in young women's experiences with depression and unintended pregnancy during adolescence and young adulthood. Findings have implications for more equitable, holistic, and integrated models of reproductive health care that can concurrently address young women's mental health, social context, and family planning needs.

Keywords

depression; unintended pregnancy; social disparities; reproductive health; race/ethnicity; socioeconomic status

INTRODUCTION

While rates of unintended pregnancy in the United States have declined in recent years, they continue to be among the highest in the Western world.[1–3] Moreover, persistent social disparities in U.S. unintended pregnancy rates exist by race/ethnicity and socioeconomic status.[3] Black and Hispanic women experience unintended pregnancy rates two-to-three times higher than White Women.[3] Even worse inequities are noted among poor women, with those below 200% of the federal poverty level experiencing unintended pregnancy rates five times that of women at the highest income level.[3] Although there is a need for more rigorous work to better measures pregnancy intentions generally, some research has indicated that unintended pregnancy is associated with a host of negative health outcomes, outcomes which disproportionately impact socially disadvantaged women.[4–8] Reducing rates of and inequities in unintended pregnancy has been a major U.S. public health goal for more than three decades.[9]

Demographic, social, and cognitive behavioral factors associated with unintended pregnancy have been well-documented.[1,10–12] Less research has focused on health-related predictors of unintended pregnancy, though an increasing number of studies (ours and others') have pointed to the potential role of mental health in contributing to unintended pregnancy and its proximate determinants (i.e. sex and contraceptive behaviors).[13–24] In the National Comorbidity Survey of nearly 6,000 U.S. men and women aged 15–54 years, those who reported having an early onset psychiatric disorder had a higher cumulative probability of also having experienced a teenage birth compared to those without a psychiatric history.[17] In a birth cohort study of pregnant Japanese women, Takahashi and colleagues found that depression and anxiety diagnoses were associated with increased likelihoods of reporting the current pregnancy as mistimed and unwanted, respectively.[14] In our own recent community-based study of 992 18–19 year-olds in Michigan, we found effects of moderate/severe stress, and to a lesser extent depression, symptoms, on elevated rates of contraceptive nonuse, misuse, use of less effective methods, sexual intercourse activity, and unintended pregnancy over one year.[13]

Collectively, this work has contributed some insight into whether depression may be an under-recognized risk factor for unintended pregnancy. However, prior studies have often been limited by methodological issues, including small sample sizes ($Ns < 100$ to < 1000), retrospective, cross-sectional, or short follow-up (< 1 year) designs, clinical or geographically constrained settings, a focus on pregnant or postpartum women alone, and samples lacking racial/ethnic and socioeconomic diversity.[13–18] Thus, the extent to which existing evidence can inform our understanding of and approaches to depression and unintended pregnancy using population data, life course perspectives, and social determinants of health frameworks has been limited.

We estimated the association between depression and risk of subsequent pregnancy, specifically first pregnancies reported as unintended, among a large, nationally-representative cohort of U.S adolescent and young adult women followed over a 15-year period. We further explored potential differences in the magnitude of the association by race/ethnicity and socioeconomic status. We hypothesized that: 1) higher levels of depressive symptoms would be associated with an increased risk of pregnancy, especially unintended first pregnancies; and 2) the magnitude of association between depression and unintended pregnancy would be greater for racial/ethnic minority young women and those from lower income backgrounds as compared to their socially advantaged counterparts.

METHODS

Data were drawn from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally-representative, school-based, longitudinal cohort study of U.S. adolescents followed through adulthood.[25] Between 1994–1995, more than 90,000 students completed an In-School Questionnaire. A nationally representative core sample of adolescents (n=12,105) was then randomly chosen for in-home interviews that were conducted with respondents in four survey waves in 1995 (Wave 1 n=20,745, participants from grades 7–12), 1996 (Wave 2 n=14,738, participants grades 8–12), 2001–2002 (Wave 3 n=15,197, participants aged 18–26) and 2008–2009 (Wave 4 n=15,701; participants aged 24–32).

We drew upon data from all four Add Health Waves. For our analysis, 9,204 Add Health participants who self-identified as female and completed Wave 1 and at least one additional Wave of data collection were considered eligible for inclusion (89% of females from Wave 1). Women were excluded if they had a history of pregnancy before Wave 1 (n=344) or if they had missing data on pregnancies or pregnancy intendedness (n=50). Of the remaining 8,810 eligible women, 7,528 (85%) were last followed at Wave 4, 838 (10%) at Wave 3, and 444 (5%) at Wave 2. In our bivariate and multivariable analyses, we also excluded 656 women reporting no history of sexual intercourse experience by Wave 4. Data were weighted to adjust for the complex sampling design per Add Health guidelines (<http://www.cpc.unc.edu/projects/addhealth/documentation/guides/wt-guidelines.pdf>). Our analysis was approved by the Institutional Review Board of Emory University.

Measures

Depressive symptoms were measured at each Wave with the Center for Epidemiologic Studies Depression Scale (CES-D) (19-item scale in Waves 1 and 2; 9-item scale, comprising a subset of the 19 items, in Waves 3 and 4).[26] We used the 9-item version to characterize depression exposure over time. Respondents were asked how often during the last seven days, on a four-point Likert scale (0 never or rarely to 3 most of the time or all of the time), they felt the following depression symptoms: you were bothered by things that usually don't bother you; you could not shake off the blues, even with help from your family and your friends; you felt that you were just as good as other people (reverse); you had trouble keeping your mind on what you were doing; you felt depressed; you felt too tired to do things; you enjoyed life (reverse); you felt sad; you felt that people disliked you. For each

Wave, responses were added for a total score, ranging from 0 to 27, with higher scores denoting higher levels of symptoms. Mean responses were imputed into missing items, but if women were missing more than 5 items for any particular Wave, their depression score was set to the value of the score from the last available Wave with non-missing data. We examined depression as a time-varying primary independent variable in two ways: as continuous depression scores and as binary indicator of moderate/severe depression symptoms (using the threshold CES-D score of 10) versus <moderate symptoms (score <10).[27,32] The CES-D has demonstrated good sensitivity, specificity, and high validity in adolescent and young adult samples and demonstrates strong internal consistency in the Add Health sample (Wave 1 $\alpha = 0.82$, Wave 2 $\alpha = 0.83$, Wave 3 $\alpha = 0.83$).[26]

Pregnancy—Our outcome of interest was time to first unintended pregnancy. Each Wave included a series of items assessing women's pregnancy history. We relied primarily upon the Wave 4 Pregnancy Table, which represents the most comprehensive pregnancy data for the entire study period. Respondents were first asked, "Have you ever been pregnant," which included any current or past pregnancies that ended in live birth, abortion, stillbirth, miscarriage, or ectopic/tubal pregnancy. Those who reported a history of pregnancy were then asked about the number of pregnancies, the specific dates that pregnancy(ies) ended (month and year), and pregnancy outcomes. Respondents were also asked about intendedness of the pregnancy(ies), "Thinking back to the time just before this pregnancy with {Partner}, did you want to have a child then," to which women responded yes or no. Women responding no were considered to have an unintended pregnancy. Slight item wording and response options differences were included in the Wave 2 survey, with an additional option of "neither wanted nor didn't want." Women responding to this option ($n=5$ pregnancies in our sample) were categorized as unintended. For women who were lost to follow up prior to Wave 4, pregnancy data were drawn from the last available Wave. We examined first pregnancies as our primary outcome in two ways: any first pregnancy occurring during the study period and first pregnancies considered unintended, which provided an opportunity to potentially disentangle depression's effects on pregnancy generally versus on unintended pregnancy. We hypothesized an overall effect of depression on pregnancy risk but stronger effects for pregnancies reported as unintended.

Sociodemographic covariates were selected based upon our prior work.[13] We were particularly interested in differences by race/ethnicity (self-reported Wave 1; we collapsed categories into White, Black, Hispanic, Asian, and Other for analytic purposes) and by socioeconomic status, for which we used parental income level at Wave 1 as a proxy (< \$25,000, \$25–\$49,999, \$50–\$74,999, \$75,000). Other covariates included: age (time-varying), educational attainment (time-varying), birthplace (Wave 1), receipt of public assistance (Wave 1), parents' highest educational attainment (Wave 1), geography of residence (Wave 1), religious denomination (Wave 1), frequency of religious service attendance (Wave 1), self-rated health status (Wave 1), relationship status (time-varying), age at first sexual intercourse (from last reported Wave), and total number of lifetime sexual partners (from last reported Wave).

Statistical Analysis

We used univariate statistics to describe sociodemographic, health, and sexual history background characteristics. We estimated mean depression scores and the proportion of women with moderate/severe depressive symptoms for each wave. We estimated rates of first pregnancy during the Add Health study period (any and unintended). We conducted unadjusted bivariate tests (Chi-square, T-tests) to compare background characteristics among those with and without moderate/severe depressive symptoms and among those who experienced an unintended first pregnancy versus those who did not experience an unintended first pregnancy (i.e. no history of pregnancy or pregnancies that were intended).

We estimated the effect of time-varying depressive symptoms on risk of a first pregnancy (any and unintended) over the study period using multivariable Cox proportional hazard models, censoring women after their first pregnancy. Person-months since entry into the Add Health study was the time scale. Covariates were considered for inclusion in regression models if their p-value in bivariate tests was 0.25 or less, as a conservative approach to ensure we captured potential confounders. For variables that appeared to be collinear (e.g. sexual history variables highly correlated with one another and similarly associated with the outcome in regression models), we retained variables with the strongest associations with our outcome in final models. We employed a step-wise approach, modeling depression alone, then adding sociodemographics, followed by sexual history variables. The effects of depression were stable across all models, and so we present full model results.

We examined models stratified by race/ethnicity, parental income level (Wave 1), and age at which first pregnancy occurred (<20 years, 20–24 years, and >24 years). We also examined depression-by-race/ethnicity, -income, and -age interaction terms. Associations between depression and any first pregnancy versus unintended first pregnancy were similarly significant, but with modestly stronger effects for unintended first pregnancy; these results are presented. Finally, we conducted sensitivity analyses in which we examined models among the sub-sample of women who completed all Waves of data collection versus women who completed Wave 1 with at least one additional Wave. Results were similar, and so we present the latter models in order to maximize data.

We present exponentiated coefficients from regression models as adjusted hazard ratios (HR) and corresponding 95% confidence intervals (CI). Two-tailed alphas of $P<0.05^*$, $P<0.01^{**}$, and $P<0.001^{***}$ were considered significant. All data were analyzed using SAS 9.4 (Cary, North Carolina) and SUDAAN 11.0 (Research Triangle Institute, Research Triangle Park, North Carolina).

RESULTS

Sociodemographic, health, and sexual history characteristics of the sample are described in Table 1. The mean age of the sample at Wave 1 was 15 years. The majority were White (66.0%), followed by Black (15.8%), Hispanic (11.7%), Asian (3.7%), and “other” (2.7%) race/ethnicity. Two-thirds of the sample (62.7%) reported an annual parental income level of <\$50,000; a quarter received welfare or public assistance (25.7%). The proportions of the sample meeting criteria for moderate/severe depressive symptoms were 21.7% (Wave 1),

21.9% (Wave 2), and 14.2% (Wave 3). Over half of women experienced a first pregnancy during the Add Health study period (57.1%); 30.4% experienced an unintended first pregnancy.

Depressive symptoms (by mean score and % with moderate/severe symptoms) were higher among women with an unintended first pregnancy versus those without a pregnancy (M 6.89 vs. 6.15, $p<0.001$ and 24.6% vs. 17.5%, $p<0.001$, respectively). With the exception of age and birthplace, all other sociodemographic, health and reproductive characteristics were associated with moderate/severe depressive symptoms in unadjusted analyses (Table 2).

Rates of unintended first pregnancy were higher among women with moderate/severe depressive symptoms versus those with <moderate symptoms at all Waves (Wave 1: 39.0% vs. 31.2%, $p<0.001$; Wave 2: 38.5% vs. 31.0%, $p<0.001$; Wave 3 38.8% vs. 31.4%, $p<0.001$) (Table 3). With the exception of birthplace, all covariates were significantly associated with unintended pregnancy in unadjusted analyses (Table 3, p -values<0.02).

In multivariable hazard models (Table 4), the risk of unintended first pregnancy among women with moderate/severe depressive symptoms was 1.21 times that of women with <moderate symptoms (CI 1.02–1.44, $p=0.03$). Compared to White women, Black (HR 1.61, CI 1.34–1.93, $p<0.001$) and Asian (HR 1.61, CI 1.11–2.33, $p=0.01$) women had a higher risk of unintended first pregnancy. Similarly, women with lower parental incomes experienced an increased risk of unintended first pregnancy compared to women with parental incomes \$75,000 (\$20,000–\$49,999 HR 1.28, CI 1.01–1.61, $p=0.04$). Other covariates associated with unintended first pregnancy included parents' education, household structure, religious denomination and frequency of service attendance, relationship status, age at first sexual intercourse, and total number of sexual partners.

In models stratified by race/ethnicity (Table 5), moderate/severe depressive symptoms (versus less than moderate symptoms) were associated with an increased risk of unintended first pregnancy among Black (HR 1.36, CI 1.00–1.83, $p=0.048$), Hispanic (HR 1.44, CI 1.01–2.06, $p=0.045$), and Asian (HR 3.25, CI 1.62–6.53, $p<0.001$) women but not among White women or those of "other" race/ethnicity. In models stratified by parental income level, moderate/severe depressive symptoms were associated with an increased risk of unintended first pregnancy among women at the lowest (\$0–\$19,999 HR 1.48, CI 1.11–1.98, $p=0.01$; \$20,000–\$49,999 HR 1.33, CI 1.05–1.68, $p=0.02$) but not the highest (\$50,000–\$74,999 and \$ 75,000) income levels. Depression-by-race/ethnicity ($p=0.15$) and depression-by-income level ($p=0.07$) interaction terms were not significant. Finally, in age-stratified models, moderate/severe depressive symptoms were associated with an increased risk of unintended first pregnancy among women <20 years (HR 1.35, CI 1.07–1.71, $p=0.01$) and a decreased risk of pregnancy among women >24 years (HR 0.47, CI 0.25–0.86, $p=0.01$). The depression-by-age interaction term was highly significant ($p<0.001$).

DISCUSSION

The majority of rigorous studies on unintended pregnancy and mental health have focused on abortion, and refuted depression as a *consequence* of it.[28–30] Less research has focused

on the role of depression in shaping the risk of unintended pregnancy, especially across the formative years of adolescence and young adulthood.[13–17] Our study fills this important knowledge gap, and findings – that depression symptoms were associated with an increased risk of pregnancy, especially unintended first pregnancy – supported our hypothesis and the results of a few previous related studies. Perhaps more clearly than prior work, though, our findings suggest a relatively strong, consistent, and independent effect of depression overall, across the time period of adolescence and young adulthood, and across sub-groups of women (e.g. HRs range 1.27–3.30).

Notably, strengths of the present analysis address several limitations of prior research and advance the body of evidence, by employing: 1) a 15-year longitudinal design that captures critical stages of the reproductive life course and differences in associations occurring in adolescence vs. adulthood; 2) a population-based sample of young women representative of the entire U.S. and different sociodemographic contexts; 3) a well-established depression instrument, which permitted examination of time-varying mental health symptoms across multiple survey Waves; 4) detailed pregnancy history calendar data, which enabled us to estimate time to *first* pregnancy, thus establishing a temporal order of depression exposure and reproductive outcomes; and 5) a robust set of bio-psycho-social measures, which allowed for adequate control of many known confounders.

Such methodological strengths enabled us to conduct a more nuanced assessment of age differences in relationships between mental health and subsequent unintended pregnancy. Based upon prior work,[13–17] we would have hypothesized that effects would be the strongest for adolescents, and indeed they were, with stronger effects among the youngest group in stratified models and a significant age-by-depression interaction term. Thus, it appears that depression in adolescence may be more predictive of subsequent unintended pregnancy than depression at young adult ages. Interestingly, we found an inverse association among women >24 years – moderate/severe depressive symptoms were associated with a reduced risk of unintended pregnancy among the adult women. Reasons for these findings are not fully clear. It may be an effect of age alone (i.e. decreasing risk of unintended pregnancy by age generally) or rather that adult women are likely more aware of their depressive symptoms (i.e. older women have higher rates of receiving a diagnosis and/or treatment than younger women),[31] which could impact their intentions and desires to avoid pregnancy, use contraception or engage in sexual activity. Such mechanisms, which have been hypothesized as potentially explaining associations between depression and contraceptive behavior following abortion,[18] require further consideration.

Another contribution of this analysis is our focus on social disparities, for which the large, nationally-representative Add Health study enabled us to more comprehensively pursue than in prior work. Little (if any) mental health and unintended pregnancy research has explored racial/ethnic and socioeconomic differences, largely due to inadequate sample sizes, settings, and measures. We found that minority and poor young women experienced higher rates of depressive symptoms, unintended first pregnancy, and stronger relationships between the two, compared to their socially advantaged counterparts. In the U.S., unintended pregnancy and its sequelae have long occurred disproportionately among these groups.[1,3] While depression is also known to be more common among low versus high income women,

mental health disparities by race/ethnicity have been less clear. Some national surveillance data suggest that White and Asian women report higher rates of depression diagnoses than Black and Hispanic women overall; although, Black and Hispanic women are less likely to receive a diagnosis or treatment compared to their counterparts.[24,31] Like ours, other analyses of Add Health have reported higher rates of depressive symptoms among minority adolescents, including Blacks, compared to Whites.[28,32] Important distinctions between our data and those from other large, population-based surveys include Add Health's 15-year study period specifically capturing adolescence through young adulthood and measurement of depression via a standardized screening instrument. The CES-D is a validated, widely used scale that captures symptomatology and not diagnoses, and some have questioned the scale's reliability and validity among racial/ethnic minorities.[33] Additionally, it is noteworthy that the effects of depression were more modest in some groups than others (e.g. point estimates for Asian women were stronger in some cases than for other minorities). While such findings may simply reflect varying sub-group sample sizes, they also require further exploration as to the nature and implications of disparities associations between depression and unintended pregnancy. Regardless, prior demographic and health studies of depression prevalence may underestimate the proportion of minority and poor young women with clinical-level but under-diagnosed and under-treated symptoms – symptoms which our study suggests have important implications for their reproductive health outcomes.

From a broader social determinants of health perspective, relationships between depression, unintended pregnancy and social inequities within this link are likely driven by other concurrent risk factors operating in profound ways across multiple levels of adolescents' environments.[12] For instance, poor health, risky health behaviors, disrupted family dynamics, negative peer influence, school problems, limited education and access to health care, neighborhood context, and adverse life events including discrimination and violence are among the many factors potentially compounding negative mental and reproductive health outcomes among minority and poor adolescents.[8,12–24,28,29,34] Adjusting for all of the many potential diverse, multi-level confounders, including >50 adverse life events measured across Add Health's four Waves, was beyond the scope of this analysis. Given the relationship between depression and unintended pregnancy is likely a complex one that may be potentially explained by a common risk factors model,[29] however, our findings here should be interpreted with caution, and our ongoing work is further capitalizing on Add Health's rich dataset to examine whether social context may further explain rates of and disparities in depression and unintended pregnancy.

Several other limitations of our study are notable. Add Health does not capture the experiences of young women who had dropped out of school in 1994; though this has been shown to present little bias as dropouts were followed up after Wave 1. Missing parental income data reduced our sample sizes for income-stratified models; thus, findings may not be fully representative of adolescents with unknown or lower incomes. Pregnancy dates were based upon self-report, so recall bias may have impacted our hazard estimates and age-based models. Measurement of the complex construct of unintended pregnancy within Add Health is limited to a few inconsistently worded items across survey Waves that do not adequately capture or distinguish between pregnancy intentions, mistiming, unwantedness, or ambivalence. This is notable since it is unclear how the construct of pregnancy

unintendedness, which is not stable over time, may be *uniquely* related to women's experiences with depression, especially for racial/ethnic minority women for whom conceptions of pregnancy intentions may differ from those of majority women.[35] Thus, findings around race/ethnicity should be interpreted with caution and would benefit from additional studies designed to better measure pregnancy intentions across socially-disadvantaged groups and their association with adverse mental and reproductive health outcomes.

Our study contributes new insights into young women's experiences with depression and unintended pregnancy during adolescence and young adulthood, experiences which appear to be most pronounced for minority and poor women but require further research. Findings may have implications for more equitable, holistic, and integrated models of reproductive health care that can concurrently address young women's mental health, social context, and family planning needs within clinical settings and elsewhere. Improved access to mental health services for socially disadvantaged (and all) women may have implications for improved reproductive health outcomes.[24,31] Studies are needed to test contraceptive education and counseling interventions that entail core mental health components and to evaluate the impact of depression treatment on family planning outcomes. Findings may inform more comprehensive public health approaches that target depression as a modifiable risk factor for unintended pregnancy, including strategies implemented across individual, systems, and macro-social levels of young women's environments. More broadly, research is warranted to disentangle the complex bio-psycho-social and multi-level pathways linking mental and reproductive health and social wellbeing during adolescence and young adulthood.

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ABBREVIATIONS

Add Health	National Longitudinal Study of Adolescent to Adult Health
CES-D	Center for Epidemiologic Studies Depression Scale
CI	Confidence interval
HR	Hazard ratio
SES	socioeconomic status

U.S.

United States

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Table 1**Sociodemographic, Health, and Sexual History Characteristics of the Sample**

	(N=8,810)	Unweighted n	(Weighted %)
Age at Wave 1			
Mean (SE of mean)		15.27	(0.12)
<13 years		279	(3.7)
13 years		1,078	(16.2)
14 years		1,293	(17.3)
15 years		1,639	(17.7)
16 years		1,701	(17.1)
17 years		1,601	(15.3)
18 years		1,056	(11.1)
>18 years		163	(1.7)
Race/ethnicity			
Hispanic		1,449	(11.7)
Black		1,948	(15.8)
Asian		595	(3.7)
Other		234	(2.7)
White		4,575	(66.0)
Missing		9	
Highest educational attainment			
Less than high school		845	(11.1)
Completed high school		1,866	(21.1)
Some college		3,205	(36.9)
Bachelor's degree or higher		2,891	(30.9)
Missing		3	
Birthplace			
Born in U.S.		8,042	(93.7)
Not born in U.S.		764	(6.3)
Missing		4	
Parents' highest educational attainment			
Less than high school		1,120	(11.7)
High school diploma, vocational/technical, or GED		2,292	(28.8)
Some college or business/trade school after HS		2,430	(28.8)
Graduated from college/university or more		2,827	(30.6)
Missing		141	
Parental income			
0 to \$19,999		1,408	(22.0)
\$20,000 to \$49,999		2,719	(40.7)
\$50,000 to \$74,999		1,476	(23.0)
\$75,000 or higher		939	(14.2)
Missing		2,268	

	(N=8,810)	Unweighted n	(Weighted %)
Received welfare or public assistance			
Yes		1,939	(25.7)
No		5,606	(74.3)
Missing		1,265	
Childhood family structure			
Two biological parents		4,545	(54.0)
Other		4,261	(46.0)
Missing		4	
Geography of residence			
Rural		2,223	(28.5)
Suburban		3,159	(37.8)
Urban		3,233	(32.7)
Other		99	(1.1)
Missing		96	
Religious denomination			
Baptist		1,969	(23.4)
Other Mainline Protestant		2,238	(26.3)
Catholic		2,310	(24.7)
Other Christian Affiliation		810	(9.5)
Religious non-Christian		374	(4.6)
None		961	(11.5)
Missing		148	
Frequency of religious service attendance			
Once a week or more		3,546	(39.9)
Once a month or more, but less than once a week		1,697	(18.6)
Less than once a month		1,588	(17.9)
Never		1,966	(23.6)
Missing		13	
Self-rated health status			
Excellent or very good		5,642	(64.7)
Good, fair, or poor		3,158	(35.3)
Missing		10	
Relationship status at Wave 1			
Married or previously married		23	(0.3)
In a relationship		3,107	(33.7)
Single/no reported relationship		5,638	(66.0)
Missing		42	
Relationship status at Wave 2			
Married or previously married		43	(0.6)
In a relationship		2,556	(36.3)
Single/no reported relationship		4,084	(63.1)
Missing		14	

	(N=8,810)	Unweighted n	(Weighted %)
Not assessed		2,113	
Relationship status at Wave 3			
Married or previously married		1,391	(19.4)
In a relationship		3,342	(47.5)
Single/no reported relationship		2,461	(33.1)
Missing		38	
Not assessed		1,578	
Age at first sexual intercourse			
<15 years		2,126	(25.2)
15–18 years		4,563	(51.5)
>18 years		1,459	(15.5)
Never had sexual intercourse		656	(7.7)
Missing		6	
Total number of sexual partners			
<2 partners		1,204	(13.6)
2–5 partners		2,877	(32.6)
6–10 partners		2,021	(25.2)
>10 partners		1,677	(20.5)
Never had sexual intercourse		656	(8.0)
Missing		375	
Depression score at Wave 1			
Mean (SE of mean)		6.33	(0.10)
Depression score 10			
Yes		2,078	(21.7)
No		6,709	(78.3)
Missing		23	
Depression score at Wave 2			
Mean (SE of mean)		6.33	(0.09)
Depression score 10			
Yes		1,558	(21.9)
No		5,134	(78.1)
Missing		5	
Not assessed		2,113	
Depression score at Wave 3			
Mean (SE of mean)		4.90	(0.09)
Depression score 10			
Yes		1,057	(14.2)
No		6,170	(85.8)
Missing		5	
Not assessed		1,578	
Pregnancy history			
Had a pregnancy		5,118	(57.1)

	(N=8,810)	Unweighted n	(Weighted %)
Had an unwanted pregnancy		2,737	(30.4)
No pregnancy		3,692	(42.9)

N=8,810 Results are unweighted Ns and weighted proportions. Depression score measured as continuous variable via Center for Epidemiologic Studies Depression Scale. Moderate/severe depression symptoms indicated via a score of 10 on the Center for Epidemiologic Studies Depression Scale and reference category is less than moderate symptoms (<10 score).

Table 2

Factors Associated with Moderate/Severe Depression Symptoms at Wave 1

	Moderate/Severe Depression Score 10 (N=1,939)	< Moderate Depression Score <10 (N=6,199)	
	Weighted % or mean	Weighted % or mean	p-value
Age at Wave 1			
Mean (SE of mean)	15.6 (0.1)	15.2 (0.1)	<0.001 ***
Race/ethnicity			
Hispanic	27.8	72.2	<0.001 ***
Black	25.8	74.2	
Asian	27.7	72.3	
Other	20.3	79.7	
White	19.7	80.3	
Highest educational attainment			
Less than high school	36.5	63.5	<0.001 ***
Completed high school	29.2	70.8	
Some college	20.1	79.9	
Bachelor's degree or higher	15.0	85.0	
Birthplace			
Born in U.S.	21.6	78.4	0.20
Not born in U.S.	26.1	73.9	
Parents' highest educational attainment			
Less than high school	30.2	69.8	<0.001 ***
High school diploma, vocational/technical, or GED	23.5	76.5	
Some college or business/trade school after HS	21.7	78.3	
Graduated from college/university or more	16.2	83.8	
Parental income			
0 to \$19,999	27.1	72.9	<0.001 ***
\$20,000 to \$49,999	19.6	80.4	
\$50,000 to \$74,999	20.5	79.5	
\$75,000 or higher	15.8	84.2	
Received welfare or public assistance			
Yes	28.0	72.0	<0.001 ***
No	18.9	81.1	
Childhood family structure			
Two biological parents	17.4	82.6	<0.001 ***
Other	26.9	73.1	
Geography of residence			
Rural	22.3	77.7	0.06
Suburban	19.9	80.1	

	Moderate/Severe Depression Score 10 (N=1,939)	< Moderate Depression Score <10 (N=6,199)	
	Weighted % or mean	Weighted % or mean	p-value
Urban	23.8	76.2	
Other	16.7	83.3	
Religious denomination			
Baptist	20.2	79.8	0.02 *
Other Mainline Protestant	19.1	80.9	
Catholic	22.0	78.0	
Other Christian Affiliation	25.2	74.8	
Religious non-Christian	26.5	73.5	
None	25.2	74.8	
Frequency of religious service attendance			
Once a week or more	19.7	80.3	0.02 *
Once a month or more, but less than once a week	21.2	78.8	
Less than once a month	21.8	78.2	
Never	26.1	73.9	
Self-rated health status			
Excellent or very good	16.2	83.8	<0.001 ***
Good, fair, or poor	32.1	67.9	
Relationship status at Wave 1			<0.001 ***
Married or previously married	53.3	46.7	
In a relationship	24.7	75.3	
Single/no reported relationship	20.2	79.8	
Age at first sexual intercourse			
<15 years	29.4	70.6	<0.001 ***
15–18 years	20.4	79.6	
>18 years	14.1	85.9	
Total number of sexual partners			
<2 partners	17.1	82.9	<0.001 ***
2–5 partners	19.4	80.6	
6–10 partners	23.6	76.4	
>10 partners	25.0	75.0	
Pregnancy history			
Ever pregnant	25.9	74.1	<0.001 ***
Never pregnant	19.9	80.1	
Unintended pregnancy history			
Ever had unintended pregnancy	24.6	75.4	<0.001 ***
Never had unintended pregnancy	17.5	82.5	

NOTES: Results are from unadjusted bivariate analyses of factors associated with moderate/severe depression symptoms presented as weighted proportions or means. N's are unweighted. P-values obtained from chi-square tests for categorical variables and Student's t-test for continuous variables.

P-values significant at * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

Denominators for all variables in Table 2 limited to women who reported ever having sexual intercourse and who had non-missing depression score at Wave 1 ($n = 8,138$). Moderate/severe depression symptoms indicated via a score of ≥ 10 on the Center for Epidemiologic Studies Depression Scale and reference category is less than moderate symptoms (< 10 score).

Table 3**Factors Associated with Unintended First Pregnancy**

	Had Unintended First Pregnancy (n = 2,730)	No Unintended First Pregnancy (n = 5,424)	
	Weighted % or mean	Weighted % or mean	p-value
Age at Wave 1			
Mean (SE of mean)	15.2 (0.1)	15.3 (0.1)	0.22
Race/ethnicity			
Hispanic	34.2	65.8	<0.001 ***
Black or African American	47.9	52.1	
Asian	33.0	67.0	
Other	37.4	62.6	
White	28.9	71.1	
Highest educational attainment			
Less than high school	33.2	66.8	<0.001 ***
Completed high school	41.6	58.4	
Some college	39.2	60.8	
Bachelor's degree or higher	19.1	80.9	
Birthplace			
Born in U.S.	32.8	67.2	0.65
Not born in U.S.	34.2	65.8	
Parents' highest educational attainment			
Less than high school	39.8	60.2	<0.001 ***
High school diploma, vocational/technical, or GED	37.3	62.7	
Some college or business/trade school after HS	33.8	66.2	
Graduated from college/university or more	24.7	75.3	
Parental income			
0 to \$19,999	40.6	59.4	<0.001 ***
\$20,000 to \$49,999	35.6	64.4	
\$50,000 to \$74,999	26.6	73.4	
\$75,000 or higher	23.3	76.7	
Received welfare or public assistance			
Yes	39.4	60.6	<0.001 ***
No	30.1	69.9	
Childhood family structure			
Two biological parents	26.5	73.5	<0.001 ***
Other	40.1	59.9	
Geography of residence			
Rural	31.1	68.9	<0.001 ***
Suburban	30.2	69.8	

	Had Unintended First Pregnancy (n = 2,730)	No Unintended First Pregnancy (n = 5,424)	
	Weighted % or mean	Weighted % or mean	p-value
Urban	37.6	62.4	
Other	32.4	67.6	
Religious denomination			
Baptist	36.0	64.0	<0.001 ***
Other Mainline Protestant	31.8	68.2	
Catholic	29.1	70.9	
Other Christian Affiliation	40.1	59.9	
Religious non-Christian	24.3	24.3	
None	33.6	66.4	
Frequency of religious service attendance			
Once a week or more	29.2	70.8	<0.001 ***
Once a month or more, but less than once a week	38.2	61.8	
Less than once a month	32.7	67.3	
Never	34.7	65.3	
Self-rated health status at Wave 1			
Excellent or very good	30.7	69.3	<0.001 ***
Good, fair, or poor	36.9	63.1	
Relationship status at Wave 1			
Married or previously married	27.9	72.1	<0.01 **
In a relationship	36.3	63.7	
Single/no reported relationship	31.1	68.9	
Relationship status at Wave 2			
Married or previously married	48.2	51.8	<0.01 **
In a relationship	35.3	64.7	
Single/no reported relationship	30.9	69.1	
Relationship status at Wave 3			
Married or previously married	35.8	64.2	<0.001 ***
In a relationship	34.3	65.7	
Single/no reported relationship	27.3	72.7	
Age at first sexual intercourse			
<15 years	46.1	53.9	<0.001 ***
15–18 years	32.5	67.5	
>18 years	12.4	87.6	
Total number of sexual partners			
<2 partners	15.9	84.1	<0.001 ***
2–5 partners	28.1	71.9	
6–10 partners	37.3	62.7	
>10 partners	44.7	55.3	

	Had Unintended First Pregnancy (n = 2,730)	No Unintended First Pregnancy (n = 5,424)	
	Weighted % or mean	Weighted % or mean	p-value
Depression score at Wave 1			
Mean (SE of mean)	6.9 (0.1)	6.2 (0.1)	<0.001 ***
Proportion with depression score ≥ 10 Wave 1			
Yes	39.0	61.0	<0.001 ***
No	31.2	68.8	
Depression score at Wave 2			
Mean (SE of mean)	7.0 (0.1)	6.1 (0.1)	<0.001 ***
Proportion with depression score ≥ 10 Wave 2			
Yes	38.5	61.5	<0.001 ***
No	31.0	69.0	
Depression score at Wave 3			
Mean (SE of mean)	5.4 (0.1)	4.7 (0.1)	<0.001 ***
Proportion with depression score ≥ 10 Wave 3			
Yes	38.8	61.2	<0.01 **
No (<10 depression score)	31.4	68.6	

NOTES: Results are from unadjusted bivariate analyses of factors associated with unintended first pregnancy are presented as weighted proportions or means. N's are unweighted. P-values obtained from chi-square tests for categorical variables and Student's t-test for continuous variables.

P-values significant at * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

Denominators for all variables in Table 3 limited to women who reported ever having sexual intercourse (n = 8,154) There were 7 pregnancies reported to women who also reported never having sexual intercourse; these are excluded. Depression score measured as continuous variable via Center for Epidemiologic Studies Depression Scale. Moderate/severe depression symptoms indicated via a score of ≥ 10 on the Center for Epidemiologic Studies Depression Scale and reference category is less than moderate symptoms (<10 score).

Hazard Models Estimating the Effect of Depression on the Risk of Unintended First Pregnancy

Table 4

	Model 1 Depression Treated as Continuous Score			Model 2 Depression Treated as Moderate/Severe Symptoms (Score 10)		
	HR ^c	(95% CI)	p	HR ^d	(95% CI)	p
Depression	1.02	(1.01, 1.04)	<0.01 ^{**}	1.21 1.00	(1.02, 1.44) (Reference)	0.03 [*]
Mean age in years	0.98	(0.95, 1.02)	0.31	0.98	(0.95, 1.02)	0.32
Race/ethnicity						
Hispanic	1.19	(0.92, 1.55)	0.18	1.21	(0.93, 1.56)	0.15
Black or African American	1.61	(1.34, 1.94)	<0.001 ^{***}	1.61	(1.34, 1.93)	<0.001 ^{***}
Asian	1.61	(1.11, 2.32)	0.01 [*]	1.61	(1.11, 2.33)	0.01 [*]
Other	1.18	(0.76, 1.82)	0.47	1.18	(0.77, 1.83)	0.44
White	1.00	(Reference)		1.00	(Reference)	
Educational attainment						
Less than high school	1.02	(0.60, 1.74)	0.94	1.05	(0.61, 1.78)	0.87
Completed high school	1.10	(0.67, 1.79)	0.71	1.11	(0.68, 1.82)	0.66
Some college	1.52	(0.96, 2.41)	0.07	1.55	(0.98, 2.45)	0.06
Bachelor's degree or higher	1.00	(Reference)		1.00	(Reference)	
Parents' highest educational attainment						
Less than high school	1.44	(1.14, 1.83)	<0.01 ^{**}	1.45	(1.14, 1.84)	<0.01 ^{**}
High school diploma, vocational/technical, or GED	1.32	(1.08, 1.62)	<0.01 ^{**}	1.32	(1.08, 1.62)	<0.01 ^{**}
Some college or business/trade school after HS	1.28	(1.07, 1.52)	<0.01 ^{**}	1.28	(1.08, 1.52)	<0.01 ^{**}
Graduated from college/university or more	1.00	(Reference)		1.00	(Reference)	
Parental income						
0 to \$19,999	1.24	(0.94, 1.64)	0.12	1.25	(0.95, 1.65)	0.11
\$20,000 to \$49,999	1.27	(1.01, 1.61)	0.04 [*]	1.28	(1.01, 1.61)	0.04 [*]
\$50,000 to \$74,999	1.11	(0.88, 1.41)	0.37	1.11	(0.88, 1.41)	0.37
\$75,000 or higher	1.00	(Reference)		1.00	(Reference)	

	Model 1 Depression Treated as Continuous Score			Model 2 Depression Treated as Moderate/Severe Symptoms (Score 10)		
	HR ^c	(95% CI)	P	HR ^d	(95% CI)	P
Received welfare or public assistance						
Yes	1.03	(0.87, 1.21)	0.76	1.02	(0.87, 1.20)	0.80
No	1.00	(Reference)		1.00	(Reference)	
Childhood family structure						
Two biological parents	1.00	(Reference)		1.00	(Reference)	
Other	1.22	(1.06, 1.40)	<0.01 ^{**}	1.22	(1.06, 1.40)	<0.01 ^{**}
Geography of residence						
Rural	0.93	(0.78, 1.10)	0.37	0.93	(0.78, 1.10)	0.40
Suburban	0.92	(0.79, 1.09)	0.33	0.92	(0.79, 1.09)	0.34
Urban	1.00	(Reference)		1.00	(Reference)	
Other	0.81	(0.42, 1.56)	0.53	0.80	(0.41, 1.56)	0.51
Religious denomination						
Baptist	0.91	(0.76, 1.09)	0.30	0.91	(0.76, 1.09)	0.30
Other Mainline Protestant	1.00	(Reference)		1.00	(Reference)	
Catholic	0.90	(0.74, 1.09)	0.27	0.89	(0.74, 1.08)	0.25
Other Christian Affiliation	1.21	(0.97, 1.51)	0.09	1.21	(0.97, 1.51)	0.10
Religious non-Christian	0.79	(0.52, 1.19)	0.26	0.79	(0.52, 1.20)	0.26
None	0.80	(0.64, 0.99)	0.04 [*]	0.79	(0.64, 0.98)	0.04 [*]
Frequency of religious service attendance						
Once a week or more	1.00	(Reference)		1.00	(Reference)	
Once a month or more, but less than once a week	1.19	(1.01, 1.40)	0.03 [*]	1.19	(1.02, 1.40)	0.03 [*]
Less than once a month	1.07	(0.89, 1.28)	0.47	1.07	(0.89, 1.29)	0.45
Never	1.14	(0.91, 1.42)	0.25	1.14	(0.91, 1.43)	0.24
Self-rated health status						
Very good to excellent	1.00	(Reference)		1.00	(Reference)	
Good, fair, poor	1.11	(0.96, 1.28)	0.16	1.12	(0.97, 1.29)	0.11
Relationship status						

	Model 1 Depression Treated as Continuous Score			Model 2 Depression Treated as Moderate/Severe Symptoms (Score 10)		
	HR ^c	(95% CI)	P	HR ^d	(95% CI)	P
Married or previously married	1.00	(Reference)		1.00	(Reference)	
In a relationship	2.42	(1.59, 3.67)	<0.001 ***	2.45	(1.61, 3.72)	<0.001 ***
Single/no reported relationship	2.05	(1.32, 3.18)	<0.01 **	2.07	(1.33, 3.22)	<0.01 **
Age at first sexual intercourse						
<15 years	1.36	(1.18, 1.57)	<0.001 ***	1.37	(1.18, 1.58)	<0.001 ***
15–18 years	1.00	(Reference)		1.00	(Reference)	
>18 years	0.48	(0.38, 0.61)	<0.001 ***	0.48	(0.38, 0.61)	<0.001 ***
Total number of sexual partners						
<2 partners	0.68	(0.50, 0.93)	0.01 *	0.68	(0.50, 0.92)	0.01 *
2–5 partners	1.00	(Reference)		1.00	(Reference)	
6–10 partners	1.37	(1.16, 1.62)	<0.001 ***	1.37	(1.16, 1.62)	<0.001 ***
>10 partners	1.47	(1.26, 1.70)	<0.001 ***	1.47	(1.27, 1.71)	<0.001 ***

NOTES: N = 5,552 women who were not missing any data on exposure, outcome, and covariates.

^a Adjusted for sociodemographic covariates: age (time-varying), race/ethnicity, educational attainment (time-varying), parents' highest educational attainment, parental income, receipt of welfare or public assistance, household structure, geography of residence, religious denomination, frequency of religious service attendance, self-rated health status, and age at first sexual intercourse, total number of sexual partners, and relationship status (time-varying).

^c Hazard ratio estimates the association between a 1-point increase in continuous depression score and unintended first pregnancy.

^d Hazard ratio estimates the association between moderate/severe depression symptoms (score 10, compared with less than moderate symptoms score of <10) and unintended first pregnancy.

P-values significant at *p<0.05, **p<0.01 and ***p<0.001.

Table 5

Models Estimating Effect of Depression on Risk of Unintended First Pregnancy Stratified by Race/Ethnicity, Parental Income Level, and Age

RACE/ETHNICITY	Hispanic (n = 843)			Black or African-American (n = 1,148)			Asian (n = 275)			Other (n = 141)			White (n = 3,145)		
	HR	(95% CI)	p	HR	(95% CI)	p	HR	(95% CI)	p	HR	(95% CI)	p	HR	(95% CI)	p
Moderate/severe depression	1.44	(1.01, 2.06)	0.045*	1.36	(1.00, 1.83)	0.048*	3.25	(1.62, 6.53)	<0.01**	1.16	(0.31, 4.33)	0.83	1.12	(0.89, 1.41)	0.34
PARENTAL INCOME	\$0 to \$19,999 (n = 1,170)			\$20,000 to \$49,999 (n = 2,300)			\$50,000 to \$74,999 (n = 1,271)			\$75,000 or higher (n = 811)					
	HR	(95% CI)	p	HR	(95% CI)	p	HR	(95% CI)	p	HR	(95% CI)	p			
Moderate/severe depression	1.48	(1.11, 1.98)	0.01*	1.33	(1.05, 1.68)	0.02*	0.79	(0.54, 1.15)	0.21	0.87	(0.47, 1.61)	0.65			
AGE GROUP	<20 years (n = 5,547) ^a			20–24 years (n = 5,639) ^b			>24 years (n = 3,978) ^c								
	HR	(95% CI)	p	HR	(95% CI)	p	HR	(95% CI)	p						
Moderate/severe depression	1.35	(1.07, 1.71)	0.01*	1.15	(0.90, 1.46)	0.27	0.47	(0.25, 0.86)	0.01*						

NOTES: Results are from multivariable logistic regression hazard models estimating the effects of moderate/severe depression (versus <moderate depression symptoms) on the hazard of unintended first pregnancy, stratified by race/ethnicity, parental income, and age at first unintended pregnancy.

N = 5,552 women who were not missing any data on exposure, outcome, and covariates. N's are unweighted. All models adjusted for sociodemographic covariates (age [time-varying], educational attainment [time-varying], parents' highest educational attainment, parental income, receipt of welfare or public assistance, household structure, geography of residence, religious denomination, frequency of religious service attendance, self-rated health status) and sexual/reproductive health covariates (age at first sexual intercourse, total number of sexual partners, and relationship status [time-varying]). Moderate/severe depression symptoms indicates moderate/severe depression symptoms via a score of 10 on the Center for Epidemiologic Studies Depression Scale. Reference category is less than moderate symptoms (<10 score).

Age stratified:

^a Analyses based on 817 women with unwanted pregnancies that occurred <20 years old compared with 4,730 women who either did not have a pregnancy or had a wanted pregnancy and entered the Add Health study before their 20th birthday.

^b Analyses based on 789 women with unwanted pregnancies that occurred at 20–24 years old compared with 3,500 women who either did not have a pregnancy or had a wanted pregnancy and remained in the Add Health study beyond their 20th birthday.

^c Analyses based on 218 women with unwanted pregnancies that occurred at >24 years old compared with 2,381 women who either did not have a pregnancy or had a wanted pregnancy and remained in the Add Health study beyond their 25th birthday.

P-values significant at *p<0.05, **p<0.01 and ***p<0.001.