

Abortion and subsequent depressive symptoms: an analysis of the National Longitudinal Study of Adolescent Health

A. M. Gomez

Sexual Health and Reproductive Equity (SHARE) Program, School of Social Welfare, University of California, Berkeley, Berkeley, CA, USA

Background. Twenty states currently require that women seeking abortion be counseled on possible psychological responses, with six states stressing negative responses. The majority of research finds that women whose unwanted pregnancies end in abortion do not subsequently have adverse mental health outcomes; scant research examines this relationship for young women.

Methods. Four waves of data from the National Longitudinal Study of Adolescent Health were analyzed. Population-averaged lagged logistic and linear regression models were employed to test the relationship between pregnancy resolution outcome and subsequent depressive symptoms, adjusting for prior depressive symptoms, history of traumatic experiences, and sociodemographic covariates. Depressive symptoms were measured using a nine-item version of the Center for Epidemiologic Studies Depression scale. Analyses were conducted among two subsamples of women whose unwanted first pregnancies were resolved in either abortion or live birth: (1) 856 women with an unwanted first pregnancy between Waves 2 and 3; and (2) 438 women with an unwanted first pregnancy between Waves 3 and 4 (unweighted *n*'s).

Results. In unadjusted and adjusted linear and logistic regression analyses for both subsamples, there was no association between having an abortion after an unwanted first pregnancy and subsequent depressive symptoms. In fully adjusted models, the most recent measure of prior depressive symptoms was consistently associated with subsequent depressive symptoms.

Conclusions. In a nationally representative, longitudinal dataset, there was no evidence that young women who had abortions were at increased risk of subsequent depressive symptoms compared with those who give birth after an unwanted first pregnancy.

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Introduction

The question of whether there is a relationship between having an abortion and subsequent mental health has been the focus of much policy and research over the past 20 years. While some researchers have found that having an abortion is not associated with subsequent depression (Major *et al.* 2000; Pope *et al.* 2001; Schmiege & Russo, 2005; Warren *et al.* 2010; Steinberg *et al.* 2011; Biggs *et al.* 2017), self-esteem (Russo & Zierk, 1992; Pope *et al.* 2001; Warren *et al.* 2010; Steinberg *et al.* 2011), anxiety (Pope *et al.* 2001; Steinberg & Russo, 2008; Steinberg & Finer, 2011; Steinberg *et al.* 2014; Biggs *et al.* 2017; van

Ditzhuijzen *et al.* 2017), mood disorder (Steinberg & Finer, 2011; Steinberg *et al.* 2014; van Ditzhuijzen *et al.* 2017), suicidal ideation (Steinberg *et al.* 2014), stress (Harris *et al.* 2014), or post-traumatic stress (Biggs *et al.* 2016), limited research has indicated that women who have abortions may be more likely to report depression (Cogle *et al.* 2003; Rue *et al.* 2004; Coleman *et al.* 2009), anxiety (Cogle *et al.* 2003), substance abuse (Coleman *et al.* 2002; Reardon *et al.* 2004; Coleman *et al.* 2009) and receiving psychological counseling (Coleman, 2006). Three critical reviews (Charles *et al.* 2008; Major *et al.* 2009; Robinson *et al.* 2009) have attributed these disparate findings to significant methodological flaws in studies that find an association between having an abortion and mental health. These flaws included the use of inappropriate comparison groups; failure to adjust for mental health status prior to pregnancy; lack of or inadequate adjustment for co-occurring and pre-existing risk factors, particularly demographic, social and structural

Address for correspondence: A. M. Gomez, Ph.D., Sexual Health and Reproductive Equity (SHARE) Program, School of Social Welfare, University of California, Berkeley, 120 Haviland Hall MC 7400, Berkeley, CA 94720-7400, USA.
(Email: anugomez@berkeley.edu)

variables that may be associated with both abortion and mental health outcomes; sampling bias; measurement and temporality of abortion and mental health variables; and use of inappropriate statistical analysis techniques. Despite the lack of empirical support for such policies, 20 states currently mandate that women seeking abortions be counseled on potential psychological consequences of abortion, with six states emphasizing information on negative emotional responses (Guttmacher Institute, 2017a).

To date, few studies examining abortion and mental health in the USA have focused specifically on the experiences of young women, particularly using nationally representative data. The definition of young adulthood varies, but it commonly encompasses ages 18–29, with some scholars extending the maximum age to 40, and others identifying ages 18–25 as a distinct transitional period between adolescence and young adulthood (Levinson, 1986; Erikson & Erikson, 1998; Arnett, 2000; Arnett *et al.* 2014). Understanding the relationship between abortion and mental health during the various developmental stages of the life course is critical, given the normative timing of key events related to relationships, sexual behavior and reproduction, and ubiquity of instability and uncertainty during the transition to adulthood (Arnett, 2000; Arnett *et al.* 2014). For example, 76% of pregnancies among 18–19-year-old women were classified as unintended in 2012, compared with 45% among all women of reproductive age (Finer & Zolna, 2016); and women younger than age 30 constitute 72% of all abortion patients (Jerman *et al.* 2016). In the USA, young adults experience mental disorders at higher rates than other age groups (Kessler *et al.* 2005). While some research has examined abortion during adolescence and subsequent mental health, this relationship has not been investigated during young adulthood, when many women experience their first pregnancies (Zabin *et al.* 1989; Pope *et al.* 2001; Warren *et al.* 2010; Leppälähti *et al.* 2016). In particular, it is unclear whether the impact of having an abortion after an unwanted first pregnancy on subsequent mental health varies by age of first pregnancy. Populations experiencing the greatest social and health inequities – such as women identifying with racial or ethnic minority groups or of low-income status – have their first pregnancies, on average, earlier than their more advantaged counterparts in the USA (Finer & Zolna, 2016; Romero *et al.* 2016). These same groups are more likely to experience trauma, such as adverse childhood experiences and intimate partner violence, which has important implications for subsequent mental health (Lipsky *et al.* 2009; Slopen *et al.* 2016).

Two studies have utilized data from the National Longitudinal Study of Adolescent Health (Add

Health) to examine the impact of abortion during adolescence in the USA. Using the first two waves of Add Health data, Coleman (2006) found that adolescents who had abortions had increased odds of ever receiving counseling for psychological counseling and sleep difficulties compared with adolescents who gave birth after an unintended pregnancy. However, in this study, both the pregnancy and mental health measures reflected the last 12 months, thus making it impossible to determine if the abortion occurred before or after the outcome. In the second analysis, Warren *et al.* (2010) examined a subsample of 289 female adolescents who experienced an unintended pregnancy between the first and second waves of data collection. Compared with adolescents whose unintended pregnancies resulted in live births, adolescents who had abortions had no increased risk of subsequent depressive symptoms or self-esteem.

The present analysis builds on the prior research with Add Health and utilizes longitudinal data capturing pregnancies experienced after adolescence, when more than half of female respondents experienced their first pregnancy. In particular, this analysis aimed to understand whether there was a relationship between having an abortion and subsequent depressive symptoms among women who experienced unwanted first pregnancies in young adulthood. Analyses focused on first pregnancies in order to most accurately determine the sequence of pregnancy and depressive symptoms (Steinberg *et al.* 2011). Moreover, this study was informed by the common risk factors framework, which posits that factors beyond the immediate pregnancy context, such as socioeconomic status, prior mental health, or history of violence victimization, are critical in post-abortion mental health. Neglecting to account for such factors may generate a spurious association between having an abortion and subsequent mental health (Steinberg & Finer, 2011).

Methods

Data from the 15-year National Longitudinal Study of Adolescent Health, commonly known as Add Health, were utilized. Add Health is a school-based study, nationally representative of students in grades 7–12 during the 1994–1995 school year (Harris, 2013). This rich, longitudinal dataset has been utilized by thousands of researchers to study wide-ranging, policy-relevant topics, including physical activity, youth violence, and sexual behavior. Schools were the primary sampling unit, with the sample frame derived from the Quality Education Database. Using this frame, 80 schools were selected for a sample stratified by urbanicity, region, school type (public or private), racial/

ethnic composition, and school size. At Wave 1 (1994–1995), a core sample of 20 745 students was selected to complete in-home questionnaires. Parents of these adolescents were recruited to complete a separate parental survey. One year later (1996), Wave 2 in-home data were collected for all participants who had not yet graduated high school. Approximately 5 years later (2001–2002), Wave 3 data were collected, when participants were between the ages of 18 and 25. Finally, Wave 4 data were collected when the Add Health participants were between ages 24 and 32 (2007–2008). This analysis utilized the full, restricted-use dataset, available to certified researchers only by contractual agreement with the University of North Carolina at Chapel Hill. The Committee for Protection of Human Subjects at the University of California, Berkeley approved the study protocol.

Measures

Depressive symptomatology was both the outcome variable and a primary independent variable of interest. Several systematic reviews have indicated that failure to adjust for prior mental health in statistical models is a critical methodological flaw in studies examining abortion and mental health (Charles *et al.* 2008; Major *et al.* 2009; Steinberg & Russo, 2009). Thus, data from all four waves of Add Health were utilized in this analysis. Depressive symptoms in the last 7 days were measured at each wave using a condensed version of the Center for Epidemiological Studies Depression Scale (CES-D). The CES-D is a well-validated, self-report scale for assessing depressive symptomatology (Radloff, 1977). The full CES-D includes 20 items assessing negative affect, positive affect, somatic complaint and interpersonal relations. The CES-D has been frequently used to examine mental health in the Add Health study population (Goodman, 1999; Shrier *et al.* 2001; Rushton *et al.* 2002; Swallen *et al.* 2005; Spriggs & Halpern, 2008; Primack *et al.* 2009; Warren *et al.* 2010; Frisco *et al.* 2013). Previous research has indicated that use of as few as four CES-D items provides predictive validity similar to the full scale (Grzywacz *et al.* 2006). The number of CES-D items included in Add Health varied by survey wave, with 19 items in Waves 1 and 2; 9 items in Wave 3; and 10 items in Wave 4. Nine items appeared in all four waves of Add Health. Respondents were asked how often in the prior 7 days the following had occurred: they felt sad, enjoyed life, felt as good as other people, had trouble keeping their mind on what they were doing, were depressed, felt that people disliked them, were bothered by things that do not usually bother them, and could not shake off the blues. Respondents selected how frequently

each item occurred (never, rarely, most of the time, or all of the time). After reverse coding positively worded items, CES-D scores were computed using these nine items. If respondents were missing five or fewer items, the mean of the answered items was substituted for the missing items (Hall *et al.* 2017). For each wave, the internal consistency (Cronbach's alpha) was calculated for all women surveyed and was greater than 0.80. The nine-item CES-D scores for Waves 1, 2 and 4 each had correlations greater than 0.95 with the scores using the full sets of available items, indicating high criterion validity of the briefer version. The CES-D score was utilized in two ways: (1) as a continuous variable; and (2) to create a binary variable indicative of moderate to severe depressive symptoms. Following previous research using Add Health data, respondents who scored 11 or higher on the nine-item CES-D were classified as having moderate or severe depressive symptoms (Spriggs & Halpern, 2008; Primack *et al.* 2009; Frisco *et al.* 2013; Nkansah-Amankra & Tettey, 2015). Sensitivity analyses were conducted to examine using a cutoff score of 10 with the 9-item measure, or one standard deviation above the mean using all CES-D items available at each wave (Gotlib *et al.* 1995). The relationship between abortion and the binary depressive symptoms variable was consistent across the various measurement approaches.

The key independent variable was the outcome of unwanted first pregnancy (abortion or live birth). At Wave 4, each respondent provided a complete, retrospective pregnancy history. For each pregnancy, participants were asked, 'Thinking back to the time just before this pregnancy with [partner's initials], did you want to have a child then?' Pregnancies were considered unwanted when participants responded 'no' to this question. The pregnancy outcome (including abortion and live birth) was also solicited.

Extending the common risk factors approach to investigating the relationship between abortion and mental health, another key independent variable is an index of traumatic experiences before age 18 (Steinberg & Finer, 2011). Eight items drawn from the Waves 3 and 4 surveys were included in the trauma index. These included five types of traumatic experiences occurring before age 18 (psychological, physical, and sexual abuse by a parent or adult caregiver; death of a parent or parental figure; and incarceration of a parent or parental figure); two items capturing physical and non-physical experiences of forced sex by someone other than a parent or caregiver prior to the measurement of the outcome variable; and experience of intimate partner violence in the past year. The trauma index was constructed as an ordinal variable (0, 1, 2, or 3+ traumatic experiences reported).

Additional covariates included current age (Wave 4); age at first pregnancy (Wave 4); length of time between the pregnancy and measurement of the outcome variable, in months (Waves 3 and 4); receipt of public assistance by a household member before age 18 (reported at any wave or in the Wave 1 parental survey); race/ethnicity (Hispanic, non-Hispanic Black, non-Hispanic White, non-Hispanic other; Wave 1); current educational attainment (Wave 3 or 4); and relationship to partner at the time of pregnancy (Wave 4).

Sample

First, data from all women who completed the Wave 4 survey and were not missing data on pregnancy end dates were used to understand the distribution of age at first pregnancy in the Add Health sample (unweighted $n = 7870$). Second, to investigate the relationship between having an abortion after an unwanted first pregnancy and subsequent depressive symptoms, pregnancy histories of women who completed all four Add Health surveys and were not missing the end date of their first pregnancy were used to identify two analytic subsamples. The Wave 3 subsample included 856 women who experienced an unwanted first pregnancy between Waves 2 and 3, while the Wave 4 subsample included 438 women whose unwanted first pregnancy occurred between Waves 3 and 4 (unweighted n 's). Because the models were organized around respondents' first pregnancy, there was no overlap between the two subsamples, nor with a previous analysis examining pregnancies prior to Wave 2 (Warren *et al.* 2010). To ensure the creation of an appropriate comparison group, women whose first pregnancies were considered wanted or resolved in outcomes other than abortion or live birth were excluded (Charles *et al.* 2008; Steinberg & Russo, 2008; Major *et al.* 2009). Additionally, any woman who gave birth three months prior to an interview date was excluded, as the depressive symptoms measure may be indicative of postpartum depression (Charles *et al.* 2008). There were six cases excluded for data quality because multiple, singleton first pregnancies with different pregnancy resolution outcomes and/or wantedness were reported in the same month. Finally, women missing more than five CES-D items at any wave, the relevant grand sample weight, pregnancy end dates, the wantedness or outcome of first pregnancy, or covariate data were excluded from the subsamples.

Statistical analyses

All analyses were conducted using Stata statistical analysis software, version 13.1 (College Station, TX: StataCorp LP). F tests were employed to assess statistically significant differences between the timing of

first pregnancy and demographic characteristics reflecting social disadvantage (race/ethnicity, educational attainment, and maternal educational attainment), as well as to compare characteristics of women included in each subsample. Population-averaged lagged logistic and linear regression models were used to examine the association of unwanted first pregnancy outcome with subsequent depressive symptoms. Multivariable models adjusted for lagged depressive symptoms, the trauma index, sociodemographic characteristics, relationship, status and age when the pregnancy ended. For each subsample, four logistic and four linear regression models were estimated: (1) an unadjusted model; (2) an adjusted model including lagged depressive symptoms and covariates; (3) an adjusted model including the trauma index and covariates; and (4) a fully adjusted model including lagged depressive symptoms, the trauma index, and covariates. To adjust for the complex design features of Add Health, Stata's SVY commands were employed for all analyses, including application of sampling weights, adjustments for clustering and usage of Taylor series linearized standard errors (Chantala & Tabor, 2010).

Results

By the Wave 4 interview, nearly two-thirds (63.0%) of female Add Health participants had experienced their first pregnancy (Table 1). The majority of participants had their first pregnancy by age 25. Bivariate analyses indicated that women who were members of groups typically experiencing greater social advantage in the USA were more likely to have never been pregnant or to first become pregnant at an older age. For example, 25.3% of Black women had never been pregnant, compared with 39.6% of White women, 37.3% of Latina women, and 40.5% of women with other racial/ethnic identities ($p < 0.001$). The majority of women with a college degree (59.4%) had never been pregnant, compared with a minority of women with lower levels of educational attainment (18.5–27.0%, $p < 0.001$). A similar trend existed for maternal educational attainment.

Descriptive statistics for the subsamples of women with unwanted first pregnancies ending in abortion or live birth are provided in Table 2, as well as results of F tests comparing the two subsamples with regards to race/ethnicity, receipt of public assistance before age 18, relationship to partner at the time of first pregnancy, and the binary measures of moderate/severe depressive symptoms at Waves 1–4. The profile of Wave 3 subsample participants was characterized by markers of greater social disadvantage than their older counterparts in the Wave 4 subsample. For

Table 1. Age at first pregnancy by selected demographic characteristics

| | 17 or younger (%) | 18–19 (%) | 20–24 (%) | 25 or older (%) | Never pregnant (%) |
|------------------------------------|-------------------|-----------|-----------|-----------------|--------------------|
| Age first pregnancy ended | 10.3 | 13.5 | 25.4 | 13.8 | 37.0 |
| Race*** | | | | | |
| Latina | 14.6 | 14.2 | 24.1 | 9.8 | 37.3 |
| Black | 17.9 | 18.6 | 29.0 | 9.2 | 25.3 |
| Other | 6.4 | 15.9 | 22.1 | 15.2 | 40.5 |
| White | 8.0 | 12.0 | 25.0 | 15.5 | 39.6 |
| Educational attainment, Wave 4*** | | | | | |
| Less than high school | 30.5 | 23.1 | 22.7 | 5.2 | 18.5 |
| High school degree or equivalent | 12.8 | 17.8 | 35.2 | 8.5 | 25.7 |
| Some college | 11.3 | 17.7 | 30.9 | 13.1 | 27.0 |
| College degree | 3.3 | 3.8 | 14.5 | 18.9 | 59.4 |
| Maternal educational attainment*** | | | | | |
| Less than high school | 16.2 | 17.8 | 27.8 | 12.1 | 26.1 |
| High school degree or equivalent | 11.3 | 15.3 | 29.1 | 12.6 | 31.7 |
| Some college | 9.0 | 13.6 | 25.3 | 14.6 | 37.6 |
| College degree | 4.7 | 7.0 | 17.3 | 16.7 | 54.3 |

Notes: Unweighted $n=7870$. Data collected in the USA between 1994 and 2008. *** $p<0.001$. Two women were missing data on educational attainment, and 124 women were missing data on maternal educational attainment.

example, greater proportions of Black and Latina women were represented in the Wave 3 subsample ($p<0.01$). Among the Wave 3 subsample, 28.9% of women reported living in households receiving public assistance before age 18, compared with 21.9% of the Wave 4 subsample ($p<0.05$). Greater proportions of women in the Wave 3 subsample experienced depressive symptoms in adolescence (Waves 1 and 2, $p<0.01$) and young adulthood (Wave 3, $p<0.05$) compared with the Wave 4 subsample. Notably, there was not a statistically significant difference between the two subsamples with regards to pregnancy outcome (abortion or live birth) or Wave 4 depressive symptoms.

In Table 3, unadjusted and adjusted results from population-averaged lagged logistic and linear regression models for the Wave 3 subsample are presented. In the unadjusted (1) and adjusted (2–4) models for both binary and continuous outcome measures of depressive symptoms, there was not an association between having an abortion after an unwanted first pregnancy and subsequent depressive symptoms. In the adjusted logistic regression model (2) including lagged depressive symptoms measures and covariates, the most recent (Wave 2) measure of prior depressive symptoms was the strongest correlate of depressive symptoms at Wave 3 (OR 2.72, 95% CI 1.54–4.80). In the linear regression models, both Wave 1 and 2 CES-D scores were positively associated with the Wave 3 CES-D score. In adjusted model 3, the trauma index was positively associated with the binary depressive symptoms outcome (OR 1.41, 95% CI

1.10–1.81) and the CES-D score (β 0.75, 95% CI 0.39–1.10). In the fully adjusted model (4) including lagged depressive symptoms at Waves 1 and 2, the trauma index, and covariates, Wave 2 depressive symptoms (OR 2.65, 95% CI 1.48–4.72) and the trauma index (OR 1.35, 95% CI 1.05–1.73) were positively associated with the binary Wave 3 depressive symptoms outcome. In the fully adjusted linear regression model (4), the trauma index (β 0.57, 95% CI 0.25–0.89), Wave 1 CES-D score (β 0.19, 95% CI 0.11–0.27), and Wave 2 CES-D score (β 0.22, 95% CI 0.12–0.31) were positively associated with the Wave 3 CES-D score.

Similarly, for the Wave 4 subsample (Table 4), there was not a relationship between having an abortion and subsequent depressive symptoms in unadjusted (1) or adjusted (2–4) models employing either analytic approach. In model 2, adjusting for prior depressive symptoms and covariates, the most recent (Wave 3) measure of depressive symptoms had the strongest relationship to Wave 4 depressive symptoms for both the binary and continuous outcomes. In the adjusted model (3) including the trauma index, there was a positive relationship between trauma and Wave 4 depressive symptoms as a binary (OR 1.63, 95% CI 1.13–2.35) and continuous outcome (β 0.97, 95% CI 0.54–1.40). For the fully adjusted logistic regression model (4), depressive symptoms at Wave 3 had a positive and statistically significant relationship with Wave 4 depressive symptoms (OR 8.26, 95% CI 3.30–20.65), while the relationship between trauma and depressive symptoms was attenuated. For the linear regression

Table 2. Characteristics of subsamples

| | Wave 3 subsample First pregnancy between Waves 2 and 3 (%) | Wave 4 subsample First pregnancy between Waves 3 and 4 (%) |
|---|--|--|
| Time varying characteristics | | |
| Mean age, years (range) | 21.4 (18–25) | 27.3 (24–31) |
| Educational attainment | | |
| Less than high school | 14.5 | 4.0 |
| High school degree or equivalent | 77.9 | 14.1 |
| Some college | 3.8 | 52.9 |
| College degree or more | 3.9 | 29.0 |
| Number of traumatic experiences | | |
| 0 | 24.4 | 27.6 |
| 1 | 30.9 | 30.4 |
| 2 | 22.1 | 18.0 |
| 3 or more | 22.6 | 24.1 |
| Other characteristics | | |
| Race/ethnicity** | | |
| Latina | 14.2 | 8.3 |
| Black | 24.1 | 18.7 |
| Other | 4.3 | 5.5 |
| White | 57.3 | 67.5 |
| Receipt of public assistance by a household member before age 18* | 28.9 | 21.9 |
| Relationship to partner at the time of first pregnancy*** | | |
| Married | 13.2 | 21.5 |
| Cohabiting | 22.0 | 35.5 |
| In a steady relationship | 33.9 | 23.1 |
| Other | 31.0 | 19.8 |
| Moderate or severe depression symptoms | | |
| Wave 1** | 22.7 | 13.9 |
| Wave 2** | 24.9 | 15.0 |
| Wave 3* | 15.0 | 10.1 |
| Wave 4 | 15.7 | 13.4 |
| Outcome of unwanted first pregnancy | | |
| Live birth | 76.0 | 72.3 |
| Abortion | 24.0 | 27.7 |

Notes: Wave 3 unweighted $n = 848$. Wave 4 unweighted $n = 438$. Data collected in the USA between 1994 and 2008.

Moderate or severe depressive symptoms were indicated by a score of 11 or higher on the nine-item Center for Epidemiologic Studies Depression Scale.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

model, both the Wave 3 CES-D score (β 0.42, 95% CI 0.30–0.54) and the trauma index (β 0.53, 95% CI 0.11–0.94) were significantly associated with the Wave 4 CES-D score.

Discussion

Using nationally representative, longitudinal data, this analysis found that young women whose unwanted first pregnancies ended in abortion were at no greater risk of subsequent depressive symptoms than their counterparts who gave birth. Similar to an earlier study with Add Health data, this was the case even

before adjusting for prior depressive symptoms and trauma history (Warren *et al.* 2010). For both the Wave 3 and Wave 4 subsamples, prior measures of depressive symptoms were consistently associated with subsequent depressive symptoms in adjusted logistic and linear regression models. In three of the fully adjusted models, the trauma index also was associated with subsequent depressive symptoms. Notably, in comparing the subsample demographic profiles, there were some differences by social advantage, yet the relationship between having an abortion and subsequent depressive symptoms was consistent across the models and analytic approaches.

Table 3. Unadjusted and adjusted population-average logistic and linear regression analysis results for unwanted first pregnancies occurring between Waves 2 and 3

| | Logistic regression results OR (95% CI) | Linear regression results β (95% CI) |
|--|--|---|
| Model 1: Unadjusted | | |
| First unwanted pregnancy ended in abortion | 0.91 (0.53 to 1.56) | 0.10 (−0.81 to 1.01) |
| Model 2: Adjusted for prior depressive symptoms and covariates | | |
| First unwanted pregnancy ended in abortion | 1.28 (0.70 to 2.35) | 0.64 (−0.22 to 1.51) |
| Prior depressive symptoms | | |
| Wave 1 | 1.80 (1.02 to 3.16)* | 0.21 (0.12 to 0.29)*** |
| Wave 2 | 2.72 (1.54 to 4.80)** | 0.22 (0.12 to 0.32)*** |
| Model 3: Adjusted for trauma and covariates | | |
| First unwanted pregnancy ended in abortion | 1.14 (0.62 to 2.08) | 0.53 (−0.43 to 1.49) |
| Trauma index | 1.41 (1.10 to 1.81)** | 0.75 (0.39 to 1.10)*** |
| Model 4: Adjusted for prior depressive symptoms, trauma and covariates | | |
| First unwanted pregnancy ended in abortion | 1.27 (0.69 to 2.34) | 0.63 (−0.23 to 1.49) |
| Prior depression | | |
| Wave 1 | 1.70 (0.96 to 3.02) ⁺ | 0.19 (0.11 to 0.27)*** |
| Wave 2 | 2.65 (1.48 to 4.72)** | 0.22 (0.12 to 0.31)*** |
| Trauma index | 1.35 (1.05 to 1.73)* | 0.57 (0.25 to 0.89)* |

Notes: Unweighted $n = 848$. Data collected in the USA between 1994 and 2008. Models 2–4 adjust for current age, age at first pregnancy, months passed since first pregnancy, receipt of public assistance by a household member before age 18, race/ethnicity, current educational attainment, and relationship to partner at the time of pregnancy.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ⁺ $p < 0.10$.

Table 4. Unadjusted and adjusted population-average logistic and linear regression analysis results for unwanted first pregnancies occurring between Waves 3 and 4

| | Logistic regression results OR (95% CI) | Linear regression results β (95% CI) |
|--|--|---|
| Model 1: Unadjusted | | |
| First unwanted pregnancy ended in abortion | 1.02 (0.51 to 2.04) | 0.44 (−0.65 to 1.52) |
| Model 2: Adjusted for prior depressive symptoms and covariates | | |
| First unwanted pregnancy ended in abortion | 1.34 (0.52 to 3.45) | 0.70 (−0.23 to 1.63) |
| Prior depression | | |
| Wave 1 | 2.96 (1.09 to 8.03)* | 0.08 (−0.04 to 0.20) |
| Wave 2 | 1.83 (0.66 to 5.05) | 0.11 (−0.02 to 0.24) |
| Wave 3 | 9.00 (3.55 to 22.79)*** | 0.44 (0.32 to 0.56)*** |
| Model 3: Adjusted for trauma and covariates | | |
| First unwanted pregnancy ended in abortion | 1.07 (0.49 to 2.35) | 0.45 (−0.60 to 1.50) |
| Trauma index | 1.63 (1.13 to 2.35)** | 0.97 (0.54 to 1.40)*** |
| Model 4: Adjusted for prior depressive symptoms, trauma and covariates | | |
| First unwanted pregnancy ended in abortion | 1.33 (0.52 to 3.46) | 0.65 (−0.27 to 1.57) |
| Prior depression | | |
| Wave 1 | 2.51 (0.95 to 6.68) ⁺ | 0.07 (−0.05 to 0.18) |
| Wave 2 | 1.84 (0.66 to 5.11) | 0.10 (−0.04 to 0.23) |
| Wave 3 | 8.26 (3.30 to 20.65)*** | 0.42 (0.30 to 0.54)*** |
| Trauma index | 1.39 (0.91 to 2.12) | 0.53 (0.11 to 0.94)* |

Notes: Unweighted $n = 438$. Data collected in the USA between 1994 and 2008. Models 2–4 adjust for current age, age at first pregnancy, months passed since first pregnancy, receipt of public assistance by a household member before age 18, race/ethnicity, current educational attainment, and relationship to partner at the time of pregnancy.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ⁺ $p < 0.10$.

This research, along with a prior analysis of Add Health data, indicates that women who experienced their first pregnancies in adolescence or young adulthood were not at increased risk of subsequent depressive symptoms (Warren *et al.* 2010). Both developmental periods are significant. Adolescents under age 18 may face restricted access to abortion, through the requirement of parental notification laws, while women under age 30 constitute the majority of people accessing abortion and experience the highest rates of unintended pregnancy (Finer & Zolna, 2016; Jerman *et al.* 2016; Guttmacher Institute, 2017b). Moreover, young women are in a precarious developmental period characterized by greater risk of adverse mental health outcomes (Kessler *et al.* 2005; Arnett *et al.* 2014). These results stand in contrast to a highly criticized meta-analysis that found an increased risk of depression after an abortion (Coleman, 2011; Goldacre & Lee, 2012; Kendall *et al.* 2012; Steinberg *et al.* 2012). These disparate findings are likely due to statistical, measurement, and design flaws that threaten the validity of many studies finding a link between abortion and subsequent depression (Major *et al.* 2009). Indeed, the present study's results are in line with findings from previous research with adult women and adolescents that do attend to these important methodological issues (Major *et al.* 2000; Pope *et al.* 2001; Schmiege & Russo, 2005; Warren *et al.* 2010; Steinberg *et al.* 2011; Biggs *et al.* 2017). Taken together, this body of work indicates that concerns about subsequent mental health do not provide support for policies to restrict abortion access.

Strengths of this analysis included use of a 15-year, nationally representative dataset, allowing for adjustment for prior depressive symptoms and utilization of an appropriate comparison group (i.e., women whose unwanted first pregnancy ended in live birth) (Major *et al.* 2009). By examining respondents' first pregnancies and using measures of depressive symptoms that captured the past 7 days, this analysis avoided the temporality issues present in previous research investigating the relationship between abortion and mental health (Charles *et al.* 2008; Major *et al.* 2009; Robinson *et al.* 2009; Steinberg & Finer, 2012). Additionally, this analysis extended the use of the common risk factors approach to more broadly consider trauma, which has been shown to be an important influence on adult mental health (Dube *et al.* 2001; Chapman *et al.* 2004; Herrenkohl *et al.* 2013).

This analysis is not without limitations. Underreporting of abortion is a well-established measurement issue in national surveys (Jones & Kost, 2007). The impact of abortion underreporting on the relationship

between abortion and subsequent mental health is unknown, though a few studies have suggested that women with better mental health may be less likely to disclose abortions in surveys (Jagannathan, 2001; Schmiege & Russo, 2005). At the same time, abortion is highly stigmatized in the USA, and individuals experiencing greater stigma may be less likely to self-report their abortions (Cockrill *et al.* 2013). Additionally, this analysis focused on pregnancies classified as unwanted using a retrospective and binary measure that may be sensitive to recall bias and oversimplify the complex nature of pregnancy intentions (Santelli *et al.* 2003). Because this analysis focused on first pregnancies, we were unable to account for the impact of multiple pregnancies on subsequent depressive symptoms. Future analyses utilizing longitudinal data analytic approaches would extend this work to holistically capture the diversity of women's reproductive experiences across the life course. Moreover, while women who chose to give birth after an unwanted first pregnancy are a more appropriate comparison group than all women who gave birth irrespective of wantedness, these two groups may be different in ways beyond the sociodemographic variables adjusted for in multivariable models (Major *et al.* 2009). Finally, the use of an abbreviated CES-D scale presents additional limitations. The abbreviated measures demonstrated high construct validity with the full set of items available in Waves 1, 2, and 4; nonetheless, the content of these nine items appears to more accurately capture general malaise or distress as opposed to depressive symptoms. One of the CES-D items refers to 'feeling blue', a concept that may not contemporarily convey the meaning intended when the scale was developed in the 1970s (Radloff, 1977).

Conclusion

Despite the lack of evidence demonstrating an association between having an abortion and subsequent depression and other mental health outcomes, policies in six states continue to require counseling of women about negative psychological consequences of abortion (Guttmacher Institute, 2017a). This analysis and the growing body of work that finds no link between having an abortion and subsequent mental health suggests that policy and clinical efforts that aim to improve women's mental health should focus elsewhere. In particular, intervention and policy efforts to promote positive mental health outcomes and reduce exposure to trauma among adolescent and young women—regardless of pregnancy status—may have the greatest impact throughout the life course.

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Declaration of Interest

None.

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