**Objective:** To examine whether depressive symptoms are a risk factor for a subsequent pregnancy in adolescent mothers.

**Design:** Secondary analysis from a longitudinal risk-reduction intervention.

**Setting:** Five community-based prenatal sites in Baltimore, Maryland.

**Participants:** Two hundred sixty-nine consenting teens, predominantly African American and with low income, who received prenatal care at any of the 5 community-based prenatal sites and completed follow-up questionnaires at 1 or 2 years post partum.

**Intervention:** Baseline depressive symptoms were measured with the Center for Epidemiological Studies Depression Scale.

**Outcome Measure:** Occurrence of and time to subsequent pregnancy by 2 years post partum.

**Results:** Among teens completing at least 1 follow-up questionnaire, baseline depressive symptoms were present in 46%. A subsequent pregnancy by 2 years post partum was experienced by 49%, with a mean (SD) time to first subsequent pregnancy of 11.4 (5.8) months. Depressive symptoms were associated with increased risk of subsequent pregnancy in both unadjusted models (hazard ratio, 1.44; 95% confidence interval, 1.01-2.03) and adjusted models (hazard ratio, 1.44; 95% confidence interval, 1.00-2.01).

**Conclusions:** Depressive symptoms may be an independent risk factor for subsequent pregnancy in African American adolescent mothers. Because depression is treatable, future studies should evaluate whether improved recognition and treatment of adolescent depression reduces the risk of rapid subsequent pregnancy.

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**National Studies Demonstrate** that adolescent mothers are twice as likely to experience depression compared with adult mothers; nearly twice as many African American compared with white teen mothers are affected (48% vs 28%, respectively). Rapid subsequent pregnancy, defined as pregnancy occurring within 24 months of a birth, is common in adolescent mothers. A recent meta-analysis found that 19% of teen mothers (range, 12%-49%) experienced a subsequent pregnancy within 12 months and 38% (range, 28%-63%) experienced a subsequent pregnancy within 24 months. The highest rates are among younger, economically disadvantaged African American adolescents.

Depression and rapid subsequent pregnancy have negative consequences for adolescent mothers. Maternal depression is associated with interpersonal conflict, risk of child abuse and neglect, and adverse effects on the child’s intellectual development and psychosocial functioning. Treatment of maternal depression has a positive effect on both mothers and children. Repeat adolescent pregnancy and birth are associated with poorer pregnancy outcomes, less educational attainment, lower future income, and greater dependence on public assistance. Children born into families with short interpregnancy intervals are exposed to increased parenting stress and negative parenting behaviors.

Studies that examined depression and subsequent pregnancy in adolescents have failed to find a consistent association. Most have been cross-sectional. A few have tried to integrate the study of depression and subsequent pregnancy with longitudinal data in an attempt to understand how...
these variables might relate to one another. One recent study examined risk factors for subsequent pregnancy in more than 500 adolescents in Texas and did not find an association between depressive symptoms at 3 months post partum and subsequent pregnancy within 24 months of the index birth. Data from adult women showed no significant association between depression and unintended subsequent pregnancy. However, such an association is plausible because depression can affect attitudes and behaviors (eg, condom use), may affect social and partner relationships, and has been associated with an increased risk of early parenthood in general. A better understanding of the relationship between depression and subsequent pregnancy is important for both clinicians and program planners. The objective of this study was to use longitudinal data from a cohort of pregnant and parenting teens to determine whether depressive symptoms at baseline independently and prospectively are associated with subsequent pregnancy.

**STUDY SETTING AND PARTICIPANTS**

This is a secondary analysis of data drawn from pregnant and parenting adolescents participating in 2 consecutive longitudinal risk-reduction interventions carried out in Baltimore, Maryland, a city with teen birth rates almost twice the national average. Subsequent pregnancy prevention was a primary intervention goal, but the intervention did not achieve this. Likewise, depressive symptoms were not affected, although the intervention was not specifically designed to do so. Enrollment was conducted between February 5, 2001, and April 29, 2005; intervention and study follow-up activities continued for 2 years. All pregnant adolescents between the ages of 12 and 18 years, in their third trimester (gestational age ≥ 24 weeks), and receiving prenatal care at any of 5 urban prenatal care sites, were eligible for recruitment. Teens living in foster care were excluded if no guardian consent could be obtained. The 5 clinics, staffed by family physicians or obstetrics and gynecology physicians and midwives, provide prenatal care to the surrounding predominantly African American and low-income community. Three-fourths of all eligible pregnant teens agreed to participate. Those who refused to participate were similar to participants but tended to be older. After informed consent was obtained from the teen and her parent or guardian, she was administered a baseline structured interview and was randomly assigned to the intervention or the usual-care control group. Structured follow-up questionnaires were administered by research staff at 1 and 2 years post partum.

**INTERVENTION**

Teens randomized to the intervention group received home visiting services that began during pregnancy and continued bimonthly or monthly until her child was 2 years old. Motivational interviewing was added to enhance the intervention when findings from the first 84 participants showed no effect on subsequent pregnancy. Trained paraprofessionals provided parenting instruction, case management, and motivational interviewing. Most of the intervention activities occurred in local community settings and in participants’ homes. We wanted to examine the effect of depression on repeat pregnancy and, therefore, controlled for intervention group assignment. The primary intervention and outcomes are described in more detail elsewhere.

**DATA COLLECTION AND MEASURES**

Study participants completed questionnaires administered by research staff at baseline (during pregnancy) and at 1 and 2 years post partum. Subsequent pregnancy by 2 years post partum was our primary dependent variable. Subsequent pregnancy was measured by asking, “Since your baby was born [1 or 2] year(s) ago, how many pregnancies have you had?” Those reporting any pregnancy were coded as experiencing a subsequent pregnancy. To assess the timing of each subsequent pregnancy in relation to the index birth, we asked the teen for the date(s) of her last menstrual period (LMP) or the date when she found out she was pregnant and, if she knew, the gestational age of the fetus. When possible (about 50% of the sample), we verified the LMP date with the medical record. To estimate the timing of the first subsequent pregnancy, we computed the number of months between the index child’s birth date and the date of the LMP before the first subsequent pregnancy.

We measured covariates that research has shown to be associated with both depressive symptoms and subsequent pregnancy, including demographic characteristics, living arrangements, whether the teen was in school or had dropped out, pregnancy history, future pregnancy intent (“Have their been times over the past year that you were trying to get pregnant?”), abuse history, violence exposure (Conflict Tactics Scale), substance use (tobacco, alcohol, and drugs) in the last 30 days, and relationship with her baby’s father. The teen mother’s relationship with her baby’s father was assessed at baseline and at each follow-up interview by asking whether they were married, living together, going together, friends, just seeing each other to care for the baby, or having no contact. The first 3 response choices were coded as “together” and the other 3 choices were coded as “not together.”

Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale, a well-validated instrument that comprises 20 questions about symptoms experienced in the last week. Scores range from 0 to 60, with higher scores indicating more depressive symptoms. We looked at depressive symptoms as a continuous variable and also used the standard cutoff of 16 or higher to define depressive symptoms.

**STATISTICAL ANALYSIS**

Baseline characteristics of our sample are reported as mean (SD) or as counts with percentages, as appropriate. Using χ², Fisher exact, and t tests, we examined bivariate associations between baseline characteristics and depressive symptoms and subsequent pregnancy. To check for effects of differential follow-up, we compared baseline characteristics of teens who failed to complete either follow-up interview with those completing at least 1 follow-up interview.

We used Cox proportional hazards regression models to calculate the hazard ratio (risk) of a subsequent pregnancy associated with baseline depressive symptoms. These analyses included the 245 teens with follow-up data at 2 years post partum. We calculated unadjusted risk and then adjusted for possible confounders. We controlled for covariates that previous research has shown to be associated with both depression and subsequent pregnancy and also variables that were significant in our bivariate analysis at P < .20. These included age of the adolescent mother, age of the index baby’s father, Medicaid receipt, parity, whether the teen mother was a school dropout, violence exposure, whether she was a victim of physical or sexual abuse, and substance use. We also tested the effect of the relationship between the adolescent mother and the baby’s father and whether the teen was trying to become pregnant at any point between the index child’s birth and 2 years post partum.

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RESULTS

Two hundred ninety-seven adolescents in the third trimester of pregnancy were recruited between February 5, 2001, and April 29, 2005, completed a baseline interview, and reached the 2-year post partum end point. Of these 297 teens, 269 (91%) completed a follow-up interview at either 1 or 2 years post partum and compose our sample; 28 teens (9%) with neither follow-up were excluded. Teens who completed only the 1-year (n = 24) or 2-year (n = 35) follow-up interview did not differ significantly on baseline characteristics from teens who completed at least 1 (n = 269) or neither (n = 28) follow-up interview.

Characteristics of the sample by baseline depressive symptoms are given in Table 1. The sample was predominantly African American. Their level of economic and social disadvantage is denoted by the high prevalence of Medicaid receipt (83%) and school dropout (38%). Almost half of the sample scored as depressed at baseline, and they were significantly more likely to use substances and have more exposure to abuse and violence.

Of the 245 teens followed up through 2 years post partum, 120 (49%) had at least 1 subsequent pregnancy (Table 2) and 28 (10%) had more than 1 subsequent pregnancy (data not shown). Among the 24 teens who completed only the 1-year follow-up interview, 8 had a subsequent pregnancy. For this cohort of 269 teens, the mean (SD) time between the index birth and first subsequent pregnancy (LMP) was 11.4 (5.8) months. Teens having a subsequent pregnancy were more likely to be school dropouts; not use condoms consistently at follow-up; and report a relationship with their baby’s father, who tended to be older (Table 2).

The hazard ratio of subsequent pregnancy was significantly greater among the 112 teens with baseline depressive symptoms. This increased risk of subsequent pregnancy in 62 teens with baseline depressive symptoms (55%) remained significant even after adjusting for possible confounders including age, parity, and Medicaid receipt (hazard ratio, 1.41; 95% confidence interval, 0.99-2.01; P = .06); age of teen mother; age of the baby’s father; whether the mother was in school or had dropped out; substance (tobacco, alcohol, or drug) use at baseline; whether the teen mother was physically or sexually abused or exposed to violence; and the relationship between the baby’s mother and father at baseline (hazard ratio, 1.46; 95% confidence interval, 1.00-2.14; P = .05).

The adjusted cumulative hazard of subsequent pregnancy by baseline depressive symptoms is shown in the Figure. Teens with depressive symptoms had a subsequent pregnancy significantly sooner after the index birth compared with those without depressive symptoms.

COMMENT

This study provides evidence that depression may be an important independent risk factor for rapid subsequent pregnancy in African American adolescent mothers. Even after adjusting for multiple potential confounders, the risk of having a subsequent pregnancy by 2 years post partum was about 40% greater among teen mothers having depressive symptoms during the index pregnancy compared with those who did not. To our knowledge, this is the first study of adolescent mothers that demonstrates with longitudinal data that depressive symptoms precede subsequent pregnancy and may be a determinant of this adverse outcome. These findings are concordant with a recent national study of 4000 teenagers that demonstrated with longitudinal data that depressive symptoms are predictive of high-risk sexual behaviors.

The prevalence of maternal depression varies widely, from 10% to 67%, depending on the timing, method of depression assessment, and the population studied. In general, adolescent samples exhibit among the highest rates of depression, but even within this group there is variation. Our results conflict with those of previous studies that investigated but did not find a similar temporal association between depression and subsequent pregnancy. In contrast to our study, previous investigations used cross-sectional data with largely white samples; did not examine specifically the association between depression and subsequent pregnancy; or focused on older, nonadolescent mothers.

Why might depression be a risk factor for subsequent pregnancy in adolescents? Depression is associ-
ated with nonadherence to medication to treat chronic conditions.39,40 Moderate to high levels of depressive symptoms predict reduced use of condoms and birth control.32 In our sample, depressive symptoms were associated with less condom use and increased subsequent pregnancy, although when specifically tested for, we did not find mediation effects. It is possible that fatigue and helplessness caused by depression may accentuate an adolescent’s perception of side effects or reduce self-efficacy, thereby serving as a barrier to condom or contraceptive adherence.41-43

Research suggests that factors recognized as common in adolescent depression, such as negative self-concept, loss of interest, passive coping style, cognitive distortions, and feeling of lack of control over events, may contribute to impaired functioning in reproductive health decision making.44-46 In addition, relationships between teen mothers and their babies’ fathers are notably fragile.47 Teen mothers who become emotionally distressed may seek out intimacy with additional sexual relationships, leading to changes in motivation to prevent another pregnancy.46 Similar to findings of previous studies,38 our findings show an increased subsequent pregnancy risk for an adolescent mother who reports a romantic relationship with her baby’s father. Contextual factors (eg, history of sexual abuse) likely influence partner relationships, which, in turn, affect childbearing motivation and intent.38,48

Numerous interventions have attempted to reduce adolescent subsequent pregnancy, with unsuccessful or disappointingly modest outcomes.49-51 These efforts have targeted hypothesized predictors including access to contraceptives,42,52 level of educational attainment,23,53 and social support23,53; however, to our knowledge, none have specifically addressed depression. Because depression is common, is associated with adverse outcomes, and is underrecognized and undertreated,54,55 our study findings support renewed focus by clinicians, investigators, and program planners aimed at depression identification and treatment for pregnant and mothering adolescents.

There are several limitations to our study. First, the Center for Epidemiological Studies Depression Scale, while a reliable and valid measure of depressive symptoms in adolescents and predictive of depression,1,29 is not the same Table 1. Characteristics of Teen Mothers by the Presence of Depressive Symptoms at Baseline (Third Trimester of Pregnancy)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Full Sample (N = 269)</th>
<th>Those With Depressive Symptoms at Baseline (n = 124 [46])</th>
<th>Those With No Depressive Symptoms at Baseline (n = 145 [54])</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic age 12-19, mean (SD), y</td>
<td>16.9 (1.3)</td>
<td>16.9 (1.2)</td>
<td>16.8 (1.4)</td>
<td>.52</td>
</tr>
<tr>
<td>African American race</td>
<td>259 (96)</td>
<td>120 (96)</td>
<td>139 (97)</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Medicaid insurance</td>
<td>222 (83)</td>
<td>96 (77)</td>
<td>126 (88)</td>
<td>.02</td>
</tr>
<tr>
<td>Received TANF in last month</td>
<td>57 (21)</td>
<td>30 (25)</td>
<td>27 (19)</td>
<td>.30</td>
</tr>
<tr>
<td>Lives with mother</td>
<td>169 (63)</td>
<td>76 (61)</td>
<td>93 (66)</td>
<td>.61</td>
</tr>
<tr>
<td>Not in school or dropped out</td>
<td>102 (38)</td>
<td>52 (42)</td>
<td>50 (35)</td>
<td>.26</td>
</tr>
<tr>
<td>Pregnancy history and intent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous pregnancy</td>
<td>80 (30)</td>
<td>39 (31)</td>
<td>41 (29)</td>
<td>.69</td>
</tr>
<tr>
<td>Previous birth</td>
<td>31 (12)</td>
<td>15 (12)</td>
<td>16 (11)</td>
<td>.85</td>
</tr>
<tr>
<td>Previous abortion</td>
<td>35 (13)</td>
<td>19 (15)</td>
<td>16 (11)</td>
<td>.37</td>
</tr>
<tr>
<td>Previous miscarriage or stillbirth</td>
<td>24 (9)</td>
<td>13 (11)</td>
<td>11 (8)</td>
<td>.52</td>
</tr>
<tr>
<td>Wants another pregnancy within 2 years</td>
<td>8 (3)</td>
<td>4 (3)</td>
<td>4 (3)</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Trying to become pregnant again c</td>
<td>18 (7)</td>
<td>11 (10)</td>
<td>7 (5)</td>
<td>.18</td>
</tr>
<tr>
<td>Condom use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At baseline</td>
<td>71 (26)</td>
<td>36 (29)</td>
<td>35 (24)</td>
<td>.41</td>
</tr>
<tr>
<td>At follow-up d</td>
<td>144 (54)</td>
<td>61 (49)</td>
<td>83 (58)</td>
<td>.18</td>
</tr>
<tr>
<td>Abuse history and violence exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent beat or physically harmed adolescent</td>
<td>23 (9)</td>
<td>16 (13)</td>
<td>7 (5)</td>
<td>.03</td>
</tr>
<tr>
<td>Sexually abused</td>
<td>14 (5)</td>
<td>11 (9)</td>
<td>3 (2)</td>
<td>.02</td>
</tr>
<tr>
<td>Conflict Tactics Scale score, mean (SD)</td>
<td>19.5 (14.6)</td>
<td>24.3 (15.4)</td>
<td>15.3 (12.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Substance use in last 30 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td>22 (8)</td>
<td>17 (14)</td>
<td>5 (4)</td>
<td>.003</td>
</tr>
<tr>
<td>Alcohol</td>
<td>9 (3)</td>
<td>4 (3)</td>
<td>5 (3)</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Drugs (eg, marijuana)</td>
<td>9 (3)</td>
<td>7 (6)</td>
<td>2 (1)</td>
<td>.09</td>
</tr>
<tr>
<td>Baby’s father</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 14-39, mean (SD), y</td>
<td>19.6 (3.2)</td>
<td>20.2 (4.0)</td>
<td>19.4 (2.8)</td>
<td>.06</td>
</tr>
<tr>
<td>Age difference between teen mother and baby’s father, mean (SD), y</td>
<td>2.8 (3.0)</td>
<td>3.1 (3.5)</td>
<td>2.6 (2.4)</td>
<td>.08</td>
</tr>
<tr>
<td>Married (n = 2), living together, or going with baby’s father</td>
<td>191 (71)</td>
<td>85 (68)</td>
<td>106 (74)</td>
<td>.28</td>
</tr>
</tbody>
</table>

Abbreviation: TANF, Temporary Assistance to Needy Families.

a All characteristics were measured at baseline unless otherwise noted.
b Two teens were 18 years old at recruitment but were 19 years old by baseline assessment.
c Measured at the 1- or 2-year follow-up by asking, “Since your baby was born, have there been times when you were trying to get pregnant?”
d Consistent condom use during the last 30 days, measured at either the 1- or 2-year follow-up interview.
as a clinical diagnosis of depression. Second, it is possible that a teen with depressive symptoms at baseline was no longer scoring as depressed by the time of her subsequent pregnancy. Because we lacked a measure of depressive symptoms in the first weeks after delivery, it is possible that the high rates of depressive symptoms we observed during pregnancy were confounded by normal somatic symptoms of pregnancy (eg, fatigue). However, baseline depressive symptoms were highly correlated with depressive symptoms at the 1-year follow-up. We considered using our measure of depressive symptoms at 1 year post partum and incorporating it as a time-dependent variable, but chose not to because of concerns about bias. Third, our sample was predominantly African American and of low income, limiting the generalizability of our findings.

Nevertheless, our findings that depressive symptoms in adolescent mothers may increase the risk of subsequent pregnancy reinforce a growing body of evidence that depression in this group needs to be identified and treated. Inasmuch as primary care settings are the major, and sometimes only, point of health care service contact for adolescents,59-61 primary care clinicians may be well-positioned to identify, manage, and coordinate care for depressed adolescents.62 Depression in primary care is underdetected and inadequately treated.63 Even if depression screening is universally implemented, as has been recommended,64 without evidence-based treatment, outcomes are unlikely to improve65 and high unmet need will persist.66

How, then, to address depression in adolescent mothers? We believe that effective mental health treatment for this group will come from primary care practice innovations that incorporate concepts of the medical home model and the implementation of new models of care that have proved effective in adult populations.67-69 These new models of care, developed and studied largely in adults, use multidisciplinary teams, collaborative care arrangements, and care coordination across clinic and community settings, and may be vital for successful pediatric behavioral health initiatives in primary care settings.59 Primary care teams that include nurses, health educators, social workers, and physicians (linked to community resources) can most effectively provide care across time to large numbers of patients with behavioral problems.70 Because depression is treatable, we believe it is imperative to enhance the capacity of primary care to provide and study effective methods to treat depression in adolescent mothers and other vulnerable groups.
Depression is unhealthy for mothers and their children.6-10 Treating maternal depression improves the health and well-being of both.11 This study demonstrates with longitudinal data an association between depressive symptoms at baseline and subsequent pregnancy by 2 years in adolescent mothers. Our findings do not tell us how depression might fit into a causal pathway to repeat adolescent childbearing,12,13 but they do suggest that depression may be an important modifiable risk factor. Whether treatment of adolescent depression decreases the risk of subsequent pregnancy is not known. However, depression is recognized as 1 of 5 priority areas important to the internal care of childbearing women.8 New treatment strategies that incorporate systematic practice changes, collaborative care models, and teams may benefit care delivery for teen mothers. Future studies should evaluate whether improved recognition and treatment of adolescent depression reduces the risk of subsequent pregnancy.

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Correspondence: Beth Barnet, MD, Department of Family and Community Medicine, University of Maryland School of Medicine, 29 S Paca St, Baltimore, MD 21201 (barnet@som.umaryland.edu).

Author Contributions: Dr Barnet had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Barnet. Acquisition of data: Barnet, Liu, and DeVoe. Analysis and interpretation of data: Barnet and Liu. Drafting of the manuscript: Barnet. Critical revision of the manuscript for important intellectual content: Barnet, Liu, and DeVoe. Statistical analysis: Barnet and Liu. Obtained funding: Barnet. Administrative, technical, and material support: DeVoe. Study supervision: Barnet and DeVoe.

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