Title

Early puberty and adolescent pregnancy: The influence of alcohol use

Authors

Deardorff, Julianna
Gonzales, Nancy A
Christopher, F Scott
et al.

Early Puberty and Adolescent Pregnancy: The Influence of Alcohol Use

Julianna Deardorff, PhD*; Nancy A. Gonzales, PhD‡; F. Scott Christopher, PhD§;
Mark W. Roosa, PhD§; and Roger E. Millsap, PhD‡

ABSTRACT. *Objective.* Early pubertal timing predicts deleterious outcomes for young girls, including substance use, risky sexual behavior, and pregnancy. In turn, adolescent pregnancy predicts long-term negative consequences such as reduced educational attainment and income-earning potential. Despite evidence of the direct links between early puberty and negative outcomes, this study is the first to examine the role that alcohol plays in the timing of sexual intercourse and pregnancy among early-maturing females.

Design. Participants were 666 females, aged 18 to 22 years, from 4 major ethnic groups in Arizona (non-Hispanic white, black, Latino, and Native American). All women included in the sample had experienced a pregnancy in their teens or early 20s. Participants completed a self-administered questionnaire that inquired about their timing of menarche, sexual initiation, first alcohol use, and age at first pregnancy. A mediating model predicting age at pregnancy was tested by using path modeling.

Results. Early puberty was found to be associated with earlier age of alcohol use and sexual initiation, which in turn predicted early pregnancy. Age at first sexual intercourse and age at first substance use significantly mediated the relation between age at menarche and age at first pregnancy. The results did not vary by ethnic group.

Conclusions. Girls who mature early are more likely to engage in early substance use and sexual intercourse, which in turn puts them at greater risk for adolescent pregnancy. It is important that health care providers are sensitive to the risks associated with early maturation among young girls and provide preventive screening, education, and counseling related to alcohol use and sexual initiation for this group. *Pediatrics* 2005;116:1451–1456; *adolescent pregnancy, adolescent sexual behavior, early-onset puberty, age at onset, adolescent health.*

ABBREVIATIONS. RMSEA, root-mean-square error of approximation; SRMR, standardized root-mean-square residual; CFI, comparative fit index.

The United States has the highest rate of teenage pregnancy among developed nations, with ~822 000 pregnancies occurring among women aged 15 to 19 years in 2000.[1] Early onset of pubertal development consistently has been identified as a significant risk factor for early pregnancy as well as a host of other negative outcomes such as conduct problems,[2] depression,[3] early substance use,[4] poor body image,[5] and early sexual initiation.[6] This study focuses on early initiation of alcohol use, sexual intercourse, and pregnancy. These outcomes are troublesome, because they may lead to longer-term trajectories that impede an early-maturing girl's success over her lifetime. In particular, a combination of alcohol use and sexual initiation at early ages may increase the risk for pregnancy, which in turn affects a girl's opportunities for attaining higher educational goals, decreases income-earning potential, and limits future options.[7,8]

Approximately 10% to 15% of young girls currently mature earlier than their peers and potentially suffer negative consequences as a result.[9] Moreover, in the United States today, girls are entering puberty earlier than in the past; breast and pubic hair development occur up to 1 year earlier among preadolescent females than in the 1950s, and recent evidence suggests that the average age of menarche has decreased as well.[10,11]

EARLY PUBERTY AS A RISK FACTOR

The early-timing hypothesis posits that early entrance into puberty may be daunting for a young girl, particularly if others in her peer group have not experienced this transition yet.[12,13] An early-maturing girl is less likely to be prepared for this transition, either cognitively or emotionally,[14,15] and her coping resources may be too immature to effectively deal with the expectations of others associated with maturation.[16] Evidence suggests that, compared with on-time or late maturers, early-maturing girls are more likely to have older friends[17] and are more likely to attract attention from the opposite gender,[18] which subsequently increases their risk for engaging in behaviors typical of older adolescents such as alcohol use and sexual activity.

Despite evidence of the direct links between early puberty and early substance-use initiation,[4,19,20] early sexual intercourse,[6,21,22] and early pregnancy,[23,24] no studies have looked at the role that alcohol may play in terms of the timing of sexual intercourse and pregnancy among early maturers.

EARLY INITIATION OF ALCOHOL USE

Girls who experience menarche early are more likely to use alcohol,[4,25] initiate alcohol and cigarette use earlier,[4,26] use more substances at earlier ages,[4,26] be drunk more often,[17,27,28] and meet diagnostic criteria for alcohol abuse more often[19] than on-time or late maturers. Although a certain amount of substance-use experimentation is considered normative during middle to late adolescence,[29] early initiation of substance use and heavier use at early ages seem particularly problematic and lead to increased long-term negative outcomes including alcohol dependence.[20,30,31]

EARLY INITIATION OF SEXUAL INTERCOURSE

Although some sexual experimentation in adolescence is considered normative as well,[32] very early sexual initiation puts girls at risk for a variety of negative outcomes such as having more sexual partners, more frequent intercourse, and older sexual partners throughout their teen years.[8] Young girls who engage in intercourse have been found to use contraception less consistently than older teens[8] and are at greater risk for pregnancy and sexually transmitted diseases.[33,34] Compared with their older counterparts, they hesitate to admit that they are sexually active until they are in a relationship that they consider stable[35,36] and therefore delay family planning up to 1½ years after their first sexual intercourse.[37] Young girls often suspect a pregnancy by the time of their first clinic visit.[37] In turn, girls who experience early childbearing subsequently complete less schooling, are at greater risk for single parenthood, and experience more economic disadvantage later in life.[7]

THE COMBINATION OF EARLY ALCOHOL USE AND SEXUAL INITIATION

Research suggests that alcohol use leads to an increased likelihood of sexual intercourse among adolescents,[38] and a significant portion of female adolescents report some alcohol use before intercourse.[39] A widely held theory known as the "disinhibition effect" posits that the disinhibiting effect of alcohol causes people to engage in riskier sexual behaviors than they would otherwise.[40] However, the disinhibition effect may lead to decreased condom use only when sex is unplanned or occurring for the first time.[41] In fact, unplanned sexual intercourse under the influence of alcohol or drugs has been found to uniquely relate to risky sexual behaviors, including inconsistent condom use.[42] Because younger girls are more likely to engage in unplanned sex, they are presumably at heightened risk for unprotected intercourse and pregnancy. In addition, younger girls are more likely to rely on birth control methods that are affected by alcohol use, such as condoms, in comparison to older females, who tend to use the birth control pill.[8]

COMBINED RISK AMONG EARLY MATURERS

The combined risk associated with alcohol initiation and risky sexual behavior among young girls may help explain the consistent direct relationship between early puberty and adolescent pregnancy noted in the literature. Although numerous studies have confirmed that early maturation is linked to early alcohol use, sexual behavior, and pregnancy, no study to date has examined the potential role of alcohol initiation in predicting sexual behavior and pregnancy among early-maturing girls. The examination of the role of alcohol use in these processes is critical to build better explanatory models of teenage pregnancy and illuminate targets for preventive interventions.

OUR STUDY

Our study provides a test of whether early puberty is linked to both early alcohol use and early sexuality and examines the relations between these potential mediating factors and pregnancy (see Fig 1). Age at menarche was hypothesized to show positive and direct paths to age at first alcohol use and age at first intercourse. Intercourse was hypothesized to exhibit a positive, direct path to pregnancy. Based on speculations about the disinhibiting effect of alcohol among young girls, it also was hypothesized that early alcohol use would relate directly to age at intercourse and subsequent risk for pregnancy.

Research with early-maturing girls has exhibited limited diversity and typically focuses on non-Hispanic white girls in urban or suburban contexts. Our
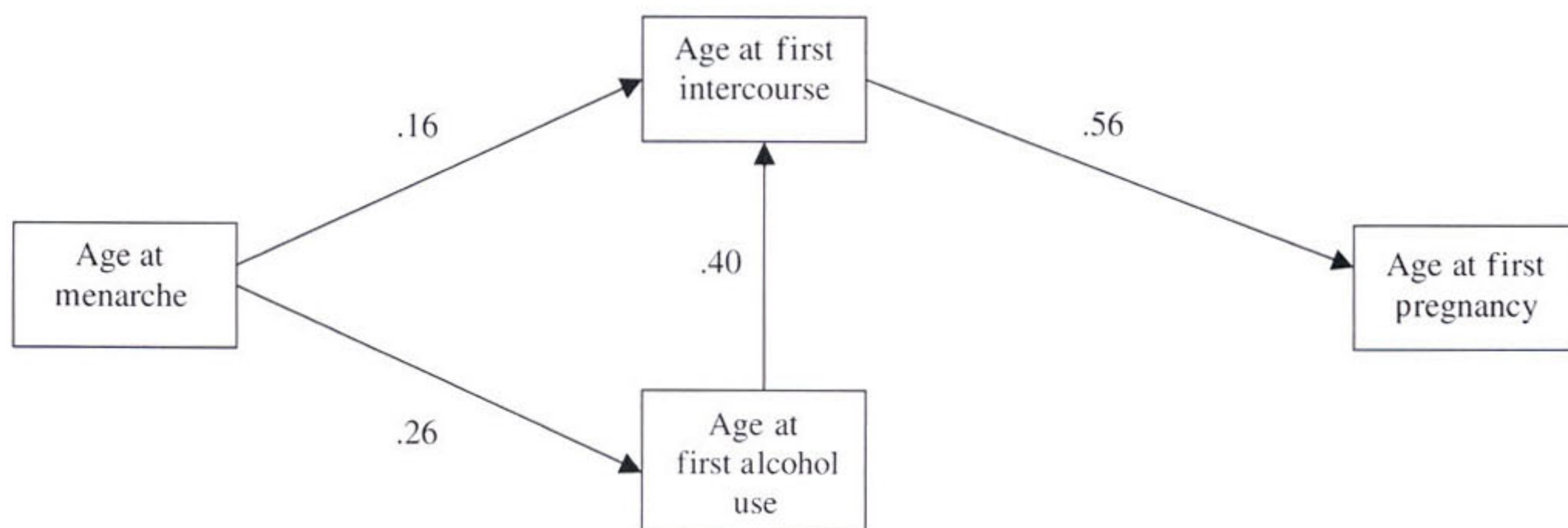

Fig 1. Test of the mediational model in the total sample. $N = 666$.

study represents an attempt to address this gap in the literature by examining relationships between early puberty, sexual initiation, alcohol use, and pregnancy in an ethnically and geographically diverse sample. As such, analyses were conducted to determine if the mediating model held constant across ethnicities.

METHODS

Participants

This study originated from a larger public health study focusing on the sexual and reproductive histories of women living in Arizona.[43] The original sample included 2003 women, 18 to 22 years of age (mean: 19.92 years; SD: 1.48), who represented the 4 major ethnic groups found in the state (non-Hispanic white, black, Latino, and Native American). Participants were generally representative of women in Arizona in terms of demographics.[43]

The study was based initially on a select subsample of 791 women who had experienced a pregnancy. However, preliminary analyses revealed that 125 women had experienced at least 1 of the proposed mediators (ie, initiation of sexual intercourse and/or alcohol use) before menarche. These women were eliminated from analyses. In addition to raising an issue of temporal precedence, these participants were qualitatively different. Two thirds of the women who experienced sexual intercourse before menarche reported that this sexual experience was unwanted (compared with 26% of those who experience sex after menarche), and 60% reported having been raped in their lifetime (compared with 26% of those who experienced sex after menarche).

Biases that may have emerged as a result of eliminating these participants were examined by comparing the 125 who were excluded to the 666 women who were included. Comparisons of demographic data indicated that there were no significant differences in terms of demographics. However, there were significant differences between the groups for the primary study variables: age at menarche [$t(789) = -5.17; P < .001$], age at first sexual intercourse [$t(789) = 13.77; P < .001$], and age at first alcohol use [$t(789) = 12.20; P < .001$]. On average, women who were included in the sample experienced these events earlier than those who were excluded. These differences were expected given the selection criteria for this sample.

The final sample for the study included 666 women whose ages ranged from 18 to 22 years (mean: 20.22; SD: 1.46). The ethnic breakdown of the sample was 13.8% black ($N = 92$), 28.7% non-Hispanic white ($N = 191$), 31.4% Latino ($N = 209$), 23.9% Native American ($N = 159$), and 2.0% other ($N = 13$). Two women (0.3%) were missing ethnicity data. Of the women, 57% lived in urban areas and 43% lived in rural areas. Nineteen percent were married, 31% were not married but were cohabitating, 7% were divorced or separated, 42% had never married, and <1% were widowed. Forty percent reported less than a high school education, 25% graduated from high school, and 35% had a college education. Ten percent of the sample had never worked, 62% were currently employed, and 28% were unemployed.

Procedure

Women were recruited at 44 different sites (eg, health clinics, colleges, private providers, shelters) in urban and rural areas throughout Arizona as well as on reservations. At each site, women in the target age group were approached by a female affiliated with the project who explained the purposes of the study, the anonymity of responses, and participants' rights. Participants subsequently completed an anonymous questionnaire, which was available in English or Spanish.

Measures

Age at Menarche

Age at menarche was assessed by using 1 question: "How old were you when you had your first menstrual period?" Response choices ranged from "8 years old or younger" to "17 or older," with each answer choice between these values representing a single year (9, 10, 11, etc). Although menarche occurs relatively late in the pubertal process, it is often used as a proxy for the onset of puberty. Self-reports of age at menarche have proven to be accurate across ages and birth cohorts, and retrospective reports of menarche are reliable up to several decades later.[44,45]

Age at First Pregnancy

Age at first pregnancy was assessed by using 1 question: "How old were you the *FIRST* time you became pregnant?" Note that this question refers to first pregnancy rather than first live childbirth. This item was followed up with questions about the result of the first pregnancy (eg, delivered, abortion), which further clarified the intent of the question. Response choices ranged from "13 or younger" to "22 years old," with each choice between these values representing a single year.

Age at First Sexual Intercourse

Age at first sexual intercourse was assessed by using 1 question: "How old were you when you first had sex?" Response choices ranged from "8 or younger" to "22 years old," with each value in between representing a single year.

Age at First Alcohol Use

Age at first alcohol use was assessed by using 1 question: "How old were you when you first began to drink alcoholic beverages (not including religious ceremonies)?" Responses ranged from "9 or younger" to "18 years old."

Ethnicity

Ethnicity was measured by using a 1-item self-report measure: "Which of the following best describes you?" Answer choices included (1) Anglo or non-Hispanic white, (2) African American or black, (3) Hispanic, Latino, or Chicano, (4) Native American or American Indian, and (5) other.

RESULTS

Preliminary Analyses

Descriptive statistics for the study variables are presented in Table 1. The average age at menarche for girls in the United States is between 12.1 and 12.7 years, varying by ethnicity.[11,46] As expected on the basis of the sampling strategy, the average for the current sample is lower at 11.94 years old. It is notable that studies to date typically define early menarche as occurring before age 12,[12,13,17] with ex-

TABLE 1. Descriptive Statistics for the Study Variables ($N = 666$)

Measures	N	Mean, y	SD	Range, y
Age at menarche	666	11.94	1.48	8.0–17.0
Non-Hispanic white	191	12.08	1.41	8.0–17.0
Black	92	12.34*	1.25	8.0–15.0
Latina	209	11.80	1.53	8.0–16.0
Native American	159	11.77	1.60	8.0–16.0
Age at first intercourse	666	15.27	1.92	8.0–22.0
Non-Hispanic white	191	15.07	1.88	11.0–22.0
Black	92	15.26	1.76	11.0–20.0
Latina	209	15.11	1.96	8.0–22.0
Native American	159	15.82†	1.89	9.0–21.0
Age at first alcohol use	666	15.21	1.94	9.0–18.0
Non-Hispanic white	191	14.91	1.86	9.0–18.0
Black	92	15.90†	1.80	11.0–18.0
Latina	209	15.23	1.98	10.0–18.0
Native American	159	15.18	1.98	10.0–18.0
Age at first pregnancy	666	17.31	1.97	13.0–22.0
Non-Hispanic white	191	17.39	1.85	13.0–22.0
Black	92	17.20	2.00	13.0–22.0
Latina	209	16.97	2.03	13.0–22.0
Native American	159	17.72‡	1.96	13.0–22.0

Two participants were missing ethnicity data, and 13 participants responded with "other." Means that are statistically different by ethnic group are connoted at the following levels: * $P < .01$; † $P < .001$; and ‡ $P < .05$.

tremely early menarche occurring before age 10[4] or 11.[17] Based on these criteria, 66% of the current sample experienced menarche before age 12, 32% before age 11, and 15% before age 10.

Intercorrelations between the predictor, mediators, and the outcome are presented in Table 2. As expected, age at menarche significantly and positively related to age at first intercourse, age at first alcohol use, and age at first pregnancy. The proposed mediators (alcohol use and age at first intercourse) also exhibited significant positive relations to age at first pregnancy. Age at first intercourse was positively correlated with age at first substance use and age at pregnancy.

Primary Analyses

Test of Model Fit in the Total Sample

Path modeling in Lisrel[47] yields fit indices for the proposed model, including the χ^2 test of fit, the root-mean-square error of approximation (RMSEA), the standardized root-mean-square residual (SRMR), and the comparative fit index (CFI). Based on these indices, results from our analyses indicate that the overall fit of the model was good [$\chi^2(2)$ ($N = 666$) = 3.12; $P = .21$; RMSEA = .03; SRMR = .02; CFI = 1.00]. As shown in Fig 1, standardized path coefficients, which are equivalent to β weights in multiple regression, were significant (at $P < .001$) and in the expected directions. Age at menarche related to both age at first alcohol use ($\beta = .26$; $z = 6.91$) and age at first sex ($\beta = .16$; $z = 4.63$). Age at first alcohol use directly and positively related to age at first sex ($\beta = .40$; $z = 11.14$), which in turn had a significant path to age at first pregnancy ($\beta = .56$; $z = 17.59$). On the basis of Sobel's test of mediation,[48] the mediated (or indirect) effects for menarche on age at first sex ($z = 5.87$) and age at first pregnancy ($z = 6.62$) were also significant, supporting the inclusion of the mediators. In addition, the squared multiple correlation for age at first pregnancy was .32, which represents the proportion of variance accounted for in age at first pregnancy and is reflective of the indirect effect of menarche on pregnancy through the proposed mediators.

Testing Across Ethnic Subgroups

The path model was examined across the 4 ethnic groups for configural invariance, which tests whether the model form varies across groups (ie, without constraining the path coefficients to be invariant). The proposed mediational model provided a good overall fit across ethnic groups [$\chi^2(8) = 11.85$; $P = .16$; RMSEA = .05; CFI = .99]. The model then was tested for pattern invariance, whereby the path parameters were constrained across groups, which

provides a test of whether the model form and the values of the path coefficients are equivalent across groups. Overall fit indices suggested that when path values were constrained, the model continued to provide a good fit across groups [$\chi^2(20) = 22.74$; $P = .30$; RMSEA = .03; CFI = .99], indicating that the relations seem to operate similarly regardless of ethnicity.

Secondary Analyses

Because menarche serves as a proxy measure of pubertal timing (and occurs rather late in the pubertal process), secondary analyses were conducted that included the 125 women who experienced intercourse and/or alcohol use before menarche. These women had experienced significantly earlier sexual intercourse and alcohol use than their counterparts. The results were consistent with primary findings. The mediating model provided a good overall fit [$\chi^2(2)$ ($N = 761$) = 7.72; $P = .02$; RMSEA = .06; SRMR = .03; CFI = .98], and all paths were significant (at $P < .001$) and in the expected directions: menarche to alcohol use ($\beta = .13$; $z = 3.79$); menarche to sex ($\beta = .20$; $z = 6.02$); alcohol use to sex ($\beta = .33$; $z = 10.09$); sex to pregnancy ($\beta = .46$; $z = 14.46$).

DISCUSSION

Results of this investigation suggest that, among women who experience an early pregnancy, alcohol use and age of sexual initiation play an important role in determining the timing of first pregnancy, particularly as it relates to early maturation. The findings lend support for the "early-timing hypothesis," which upholds that early pubertal development is associated with a series of problem behaviors, which may set girls on long-term negative trajectories. Ultimately, such trajectories can potentially lead to multiple poor outcomes including but not limited to early pregnancy. As such, this study yields important implications for preventive intervention. Early puberty acts as a risk factor that provides a clear focal point to help guide preventive efforts, particularly efforts targeted to prevent early sexual behavior and adolescent pregnancy.

Early sexual initiation has been found to relate to multiple sexual partners before adulthood, higher rates of sexually transmitted disease, increased emotional distress, and higher rates of pregnancy termination, pregnancy complications, and preterm delivery.[8,34,35] Moreover, it is conceivable that risk for these outcomes is further enhanced when sexual behavior is initiated in combination with early alcohol use. Pregnancy at a young age also predicts a host of more distal problem outcomes including increased high school drop-out rates, poorer employment rates, and emotional distress/depression.[7] Thus, early identification of girls who are more likely to engage in high-risk behaviors, including early sex and early alcohol use, is critical to better focus teen pregnancy-prevention efforts.

Clinical Implications

Results from our study have strong implications for clinical practice. Early maturation serves as a

TABLE 2. Intercorrelations Between Study Variables ($N = 666$)

Variable	1	2	3	4
Age at menarche	1.00			
Age at first intercourse	.27*	1.00		
Age at first alcohol use	.26*	.44*	1.00	
Age at first pregnancy	.14*	.56*	.29*	1.00

* Intercorrelations are significant at the $P < .001$ level.

significant stressor for young girls and puts them at risk for multiple problems during adolescence and, potentially, into adulthood. These findings underscore the importance of informing clinical providers of the risks associated with early pubertal development. Because pediatricians are typically the first to identify signs of early maturation, they are in the best position to provide early intervention by informing and educating young girls about their changing bodies and talking with parents about related health and behavioral risks. In addition, providers should consider screening for alcohol use among early-maturing girls as a means to better focus preventive efforts.

In terms of sexual behavior, it is important to note that early maturers are unlikely to receive effective or timely intervention in the school setting, which makes pediatrician intervention even more critical. Schools tend to begin sexual education in senior high school, potentially long after early maturers have initiated problem behaviors. Moreover, the models of abstinence (for substances and sex) typically presented in schools as effective intervention tools have not been validated empirically by recent research. Intervention efforts tend to intervene in 1 domain (eg, DARE for drugs, abstinence programs for sex) rather than comprehensively addressing multiple problem behaviors that are clearly linked. Pregnancy-prevention efforts among clinicians should include a focus on alcohol use in an effort to help young girls and their parents understand how related behaviors, in combination with early sexual activity, increase risk for early pregnancy. Clinicians should inform parents also about the problems of relying on school-based intervention when it comes to informing their early-maturing daughters about sexual development, safe sex, and the consequences of early sexual behavior. Moreover, it is important to consider the cognitive developmental level of young adolescents when intervening.

Limitations

Only women who experienced a first pregnancy by their late teens or early 20s were included in this study; therefore, there are likely to be characteristics or patterns that are specific to this group of females. Caution should be used when generalizing these findings to a broader population of adolescents. All measures in this study were self-reported, retrospective, and subject to social desirability; however, past studies have found that women report the age at first menarche with relative accuracy.[44,45] Finally, these data are cross-sectional and provide no way of establishing either the temporal proximity or order of the behaviors studied.

Future Research Directions

In terms of prevention science and social policy, it is important to promote research that investigates empirically sound prevention methods for early sexual behavior and alcohol use among early-maturing youth. Additional theory development is necessary to better understand the complex sequence of events initiated when girls experience early puberty. There is a strong need for prospective studies to assess more rigorously the sequence of events initiated by early puberty. Through the use of daily diaries, one might elucidate how these events unfold and their respective timing. The adolescent population presents an interesting challenge in terms of obtaining accurate and consistent reporting of problem behaviors. Perhaps by using handheld electronic devices, our technically savvy generation of teens would be more likely to self-record daily behaviors, providing closer estimates of the timing of events.

In future studies, it also will be crucial to incorporate multiple measures of pubertal timing to better understand which pubertal changes trigger certain emotions and behaviors. Measurement batteries should include subjective (eg, self-report of Tanner stages) and objective (eg, hormonal assays) reports as well as measures from significant others (eg, clinical providers, parents). In addition, a more complex exploration of psychological mediators is warranted. Of particular interest for future studies are the individual psychological processes (eg, self-esteem, reactions to menarche) and interpersonal processes (eg, peers, family) that may influence these relations. Also of interest are the potentially variable effects across specific contexts (eg, all-girls' schools versus mixed-gender schools, ethnic homogeneity in schools).

Our study lays a foundation for future studies to explore targeted points of intervention for diverse ethnic groups. Although findings indicated that relations between the variables hold across ethnic groups, "1-size-fits-all" interventions will not necessarily be uniformly effective for girls from all backgrounds. The need for cultural sensitivity and cultural relevance when developing interventions is already recognized at a national level. Toward this aim, we need to step back and explore processes that are most salient for teenage girls and attempt to decipher common sequences or patterns across ethnic/social groups and contexts. Results from this study are significant in confirming the link between early menarche and a cluster of problem behaviors that can potentially put girls at risk for negative long-term outcomes. Focus groups with early-developing females would help us better understand these processes and how they may vary. In particular, with careful sampling across ethnic, geographic, and socioeconomic backgrounds, potential group differences in girls' experiences may emerge.

REFERENCES

1. Alan Guttmacher Institute. U.S. teenage pregnancy statistics: overall trends, trends by race and ethnicity, and state by state information. 2004. Available at: www.agi-usa.org/pubs/state_pregnancy_trends.pdf. Accessed February 2, 2005

2. Caspi A, Lynam D, Moffitt TE, Silva, PA. Unraveling girls' delinquency: biological, dispositional, and contextual contributions to adolescent misbehavior. *Dev Psychol.* 1993;29:19–30

3. Hayward C, Killen JD, Wilson DM, et al. Psychiatric risk associated with early puberty in adolescent girls. *J Am Acad Child Adolesc Psychiatry.* 1997;36:255–262

4. Dick DM, Rose RJ, Viken RJ, Kaprio J. Pubertal timing and substance use: associations between and within families across late adolescence. *Dev Psychol.* 2000;36:180–189

5. Siegel JM, Yancey AK, Aneshensel CS, Schuler R. Body image, perceived pubertal timing, and adolescent mental health. *J Adolesc Health.* 1999;25:155–165

6. Kim K, Smith PK. Family relations in early childhood and reproductive development. *J Reprod Infant Psychol.* 1999;17:133–149

7. Berry EH, Shillington AM, Peak T, Hohman MM. Multi-ethnic comparisons of risk and protective factors for adolescent pregnancy. *Child Adolesc Social Work J.* 2000;17:79–96

8. Moore KA, Miller BC, Glei D, Morrison DR. *Adolescent Sex, Contraception, and Childbearing: A Review of Recent Research.* Washington, DC: Child Trends; 1995

9. Alsaker FD. Annotation: the impact of puberty. *J Child Psychol Psychiatry.* 1996;37:249–258

10. Herman-Giddens ME, Kaplowitz PB, Wasserman RC. Navigating the recent articles on girls' puberty in *Pediatrics*: what do we know and where do we go from here? *Pediatrics.* 2004;113:911–917

11. Herman-Giddens ME, Slora EJ, Wasserman RC, et al. Secondary sexual characteristics and menses in young girls seen in office practice: a study from the Pediatric Research in Office Settings network. *Pediatrics.* 1997; 99:505–512

12. Caspi A, Moffitt TE. Individual differences are accentuated during periods of social change: the sample case of girls at puberty. *J Pers Soc Psychol.* 1991;61:157–168

13. Stattin H, Magnusson D. *Pubertal Maturation in Female Development.* Hillsdale, New Jersey: Lawrence Erlbaum; 1990

14. Ge X, Conger RD, Elder GH Jr. Coming of age too early: pubertal influences on girls' vulnerability to psychological distress. *Child Dev.* 1996;67:3386–3400

15. Ruble DN, Brooks-Gunn J. The experience of menarche. *Child Dev.* 1982;53:1557–1566

16. Siegel JM, Aneshensel CS, Taub B, Cantwell DP, Driscoll AK. Adolescent depressed mood in a multiethnic sample. *J Youth Adolesc.* 1998;27: 413–427

17. Magnusson D, Stattin H, Allen VL. Differential maturation among girls and its relation to social adjustment: a longitudinal perspective. Reports from the Department of Psychology, University of Stockholm. Stockholm, Sweden: University of Stockholm; 1985:62

18. Simmons RG, Blyth DA, McKinney K. The social and psychological effects of puberty on white females. In: Brooks-Gunn J, Petersen AC, eds. *Girls at Puberty: Biological and Psychosocial Perspectives.* New York, NY: Plenum Press; 1983

19. Stice E, Presnell K, Bearman SK. Relation of early menarche to depression, eating disorders, substance abuse, and comorbid psychopathology among adolescent girls. *Dev Psychol.* 2001;37:608–619

20. Tschann JM, Adler NE, Irwin CE, et al. Initiation of substance use in early adolescence: the roles of pubertal timing and emotional distress. *Health Psychol.* 1994;13:326–333

21. Billy JOG, Brewster KL, Grady WR. Contextual effects on the sexual behavior of adolescent women. *J Marriage Fam.* 1994;56:387–404

22. Miller BC, Norton MC, Curtis T, Hill EJ, Schvaneveldt P, Young MH. The timing of sexual intercourse among adolescents: family, peer, and other antecedents. *Youth Soc.* 1997;29:54–83

23. Udry JR. Age at menarche, at first intercourse, and at first pregnancy. *J Biosoc Sci.* 1979;11:433–441

24. Udry JR, Cliquet RL. A cross-cultural examination of the relationship between ages at menarche, marriage, and first birth. *Demography.* 1982; 19:53–63

25. Aro H, Taipale V. The impact of timing of puberty on psychosomatic symptoms among fourteen- to sixteen-year-old Finnish girls. *Child Dev.* 1987;58:261–268

26. Wilson DM, Killen JD, Hayward C, et al. Timing and rate of sexual maturation and the onset of cigarette and alcohol use among teenage girls. *Arch Pediatr Adolesc Med.* 1994;148:789–795

27. Prokopcakova A. Drug experimenting and pubertal maturation in girls. *Stud Psychol (Bratisl).* 1998;40:287–290

28. Ruiselova Z. Relationships with parents and teachers in connection with pubertal maturation timing in girls. *Stud Psychol (Bratisl).* 1998;40: 277–281

29. Baumrind D. The influence of parenting style on adolescent competence and substance use. *J Early Adolesc.* 1991;11:56–95

30. Chassin L, Flora DB, King KM. Trajectories of alcohol and drug use and dependence from adolescence to adulthood: the effects of familial alcoholism and personality. *J Abnorm Psychol.* 2004;113:483–498

31. Chassin L, Presson CC, Sherman SJ, Edwards DA. The natural history of cigarette smoking: predicting young-adult smoking outcomes from smoking patterns. *Health Psychol.* 1990;9:701–716

32. Christopher FS. *To Dance the Dance: A Symbolic Interactional Exploration of Premarital Sexuality.* Mahway, NJ: Lawrence Erlbaum; 2001

33. Alan Guttmacher Institute. Facts in brief: teen sex and pregnancy. Available at: www.agi-usa.org/pubs/fb_teen_sex.pdf. Accessed February 2, 2005

34. Zabin LS, Kanter JF, Zelnick MB. The risk of adolescent pregnancy in the first months of intercourse. *Fam Plann Perspect.* 1979;11:215–222

35. Zabin LS. Adolescent pregnancy and early sexual onset. In: Lahey BB, Kazdin AE, eds. *Clinical Child Psychology.* New York, NY: Plenum Press; 1990

36. Zabin LS, Smith EA, Hirsch MB, Hardy JB. Ages of physical maturation and first intercourse in black teenage males and females. *Demography.* 1986;23:595–605

37. Zabin LS, Clark SD. Why they delay: a study of teenage family planning clinic patients. *Fam Plann Perspect.* 1981;13:205–217

38. Strunin L, Hingson R. Alcohol, drugs, and adolescent sexual behavior. *Int J Addict.* 1992;27:129–146

39. Fortenberry JD. Adolescent substance use and sexually transmitted diseases risk: a review. *J Adolesc Health.* 1995;16:304–308

40. Kellogg ND, Hoffman TJ, Taylor ER. Early sexual experiences among pregnant and parenting adolescents. *Adolescence.* 1999;34:293–303

41. Halpern-Felsher BL, Millstein SG, Ellen JM. Relationship of alcohol use and risky sexual behavior: a review and analysis of findings. *J Adolesc Health.* 1996;19:331–336

42. Poulin C, Graham L. The association between substance use, unplanned sexual intercourse and other sexual behaviors among adolescent students. *Addiction.* 2001;96:607–621

43. Roosa MW, Tein J, Reinholtz C, Angelini PJ. Relationship of childhood sexual abuse to teenage pregnancy. *J Marriage Fam.* 1997;59:119–130

44. Brooks-Gunn J, Warren MP, Rosso JT, Gargiulo J. Validity of self-report measures of girls' pubertal status. *Child Dev.* 1987;58:829–841

45. Damon A, Bajema CJ. Age at menarche: accuracy of recall after thirty-nine years. *Hum Biol.* 1974;46:381–384

46. Wu T, Mendola P, Buck GM. Ethnic differences in the presence of secondary sex characteristics and menarche among US girls: the third National Health and Nutrition Examination Study, 1998–1994. *Pediatrics.* 2002;110:752–757

47. Joreskog KG, Sorbom D. *LISREL VI: Analysis of Linear Structural Relationships by the Method of Maximum Likelihood.* Mooresville, IN: Scientific Software, Inc; 1985

48. Sobel ME. Asymptotic confidence intervals for indirect effects in structural equation models. In: Leinhart S, ed. *Sociological Methodology.* San Francisco, CA: Jossey-Bass; 1982:290–312