Seasonal Variation in Adolescent Conceptions, Induced Abortions, and Late Initiation of Prenatal Care

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Synopsis

The monthly distribution of conceptions among adolescents and the proportion of adolescent pregnancies that are voluntarily terminated by induced abortion by month of conception are the objects of this study. Additionally, seasonal variations in the timing of initiation of prenatal care services by adolescents are investigated. Vital records files of single live births, fetal deaths, and induced terminations of pregnancy to residents in the State of South Carolina, 1979–86, were aggregated to estimate conceptions.

There was a significant difference between adolescents and adults in the monthly distribution of conceptions. The peak month of adolescent conceptions coincided with the end of the school year. Pregnancies of adolescents occurring at this time further demonstrated later access of prenatal care services than conceptions occurring at other times of the year, most notably during the school term.

These findings suggest that there is considerable opportunity for improving the availability of reproductive health care services for adolescents. The results specifically suggest the potential benefit of increasing adolescent pregnancy prevention efforts prior to high-risk events and increasing the availability of and access to health care and counseling services to adolescents during the school recess months of the summer.

SEASONAL VARIATION in the distribution of births by month of delivery has been observed in every human population investigated (*1,2*). Live births in the United States display a characteristic seasonal pattern, peaking during September with a trough in April (*3*). While monthly variations in live births have been a consistent research finding, differing patterns of seasonal variation have been noted geographically, temporally, and among population subgroups (*1,2,4–1*).

Various theories have been advanced to explain these seasonal birth patterns and to explore the factors underlying their appearance. Biological, sociocultural, environmental, and meteorological determinants have been suggested (*9–14*). Specifically, seasonal variations in birth rates have been hypothesized to reflect the independent or interactive influences of seasonal variations in a broad array of factors including temperature, rainfall, length of daylight, food availability, sex hormone production, infections, sociodemographic characteristics, economic conditions, household climate control, and marital, religious, agricultural, employment, contraceptive, holiday, and vacation practices (*2,4,13,15–23*). The season of birth has been associated with a number of negative pregnancy outcomes and adverse health conditions, including preterm delivery, fetal death, perinatal mortality, congenital malformations, birth defects, and schizophrenia (*24–32*).

Compared with the season of delivery, seasonal variation in the month of conception has received less research attention. This is due, in part, to inadequacies in the reporting of all end products of conception (live births, fetal deaths, spontaneous abortions, and induced abortions) and to the difficulty in estimating the precise time when conception occurs (*33,34*). In some studies, the attempt has been made to estimate the point of conception by subtracting a constant—9 months for live

Table 1. Sociodemographic characteristics of 41,741 pregnant adolescents, South Carolina, 1979–86

Variable	Number	Percent
Race:		
White	19,700	47.23
Nonwhite	22,014	52.77
Marital status:		
Married	8,905	21.35
Unmarried	32,795	78.65
Gravidity:		
Nulligravid	34,952	84.00
Multigravid	6,656	16.00
Age of mother:		
Younger than 14	3,107	7.45
15-17	38,607	92.55
Educational status (grade for age):		
Below (2 or more grades behind)	14,274	34.47
Appropriate (within 2 grades)	26,826	64.79
Advanced (2 or more grades ahead)	305	0.74
Residence:		
Urban	21,345	51.17
Rural	20,368	48.83

births, for example—from the date of delivery (*12,31,35,36*). For population subgroups with higher percentages of preterm births and shorter mean gestational ages, such as adolescents and nonwhites, the accuracy of these estimates of the month of conception may vary.

While seasonal patterns in birth distributions have been investigated for their relationship to a variety of socio-demographic characteristics, variations among maternal age groups have not been previously explored with a specific focus on adolescents. Adolescents are an important subpopulation for investigations into reproductive health behavior. Compared with adults, adolescent mothers experience a disproportionate number of adverse pregnancy outcomes (*37,38*). Further, the potential long-term negative sequelae of adolescent parenthood for both mother and child warrants continuing efforts toward the prevention of unplanned pregnancies within this age group (*38–42*). A monthly conception distribution departing from that observed among adults would suggest the influence of a different set of factors on adolescent conception.

Increased knowledge of the circumstances surrounding adolescent pregnancy would be advantageous to prevention efforts as well as to those designed to improve and expand reproductive health care services for adolescents. Specifically, since approximately 40 percent of pregnancies of U.S. adolescents are terminated voluntarily (*37*), any seasonal variation in pregnancy resolution decisions could affect the service delivery system. Further, delays in seeking and receiving prenatal care services may also reflect the influence of seasonal barriers to care that may be alterable by modifying availability and accessibility of services.

In this study, we investigated the monthly distribution of conceptions among adolescents, the proportion of adolescent pregnancies that are voluntarily terminated by induced abortion, by month of conception, and seasonal variations in the initiation of prenatal care services among adolescent mothers.

Methods

Vital records files of single live births, fetal deaths, and induced terminations of pregnancy by residents of South Carolina for the years 1979–86 were aggregated to estimate conceptions. For live births and fetal deaths, the month of conception was based on the reported month of last normal menses (LNM). Month of conception for induced abortions was calculated using the date of termination and the physician's estimate of gestational age. For these terminated pregnancies, the estimated weeks of gestational age were subtracted from the date of termination and the resulting month was considered the month of conception. Previous research has indicated that among induced terminations of pregnancy, the physician's estimate of gestational age is comparable to the gestational age value derived from the date of LNM (*43*).

Cases with inconsistent conception and delivery or termination dates or with implausible gestational ages (less than 20 and more than 50 weeks) were excluded, leaving 477,997 total pregnancies (436,283 adults and 41,714 adolescents) for analysis. Total conceptions will be underestimated because of the lack of data on early spontaneous abortions.

Adolescents are defined as those women younger than age 18, in recognition of their status as minors. Late or delayed initiation of prenatal care is defined as no care or prenatal care initiated any time after the first trimester. Month of termination of pregnancy is derived from the date of termination indicated on the vital record report of induced termination of pregnancy. Gestational age at termination is reported as the physician's estimate in completed weeks (*44*). Gravidity includes all reported previous pregnancies. Urban-rural status was based on county level data. Counties deemed urban are contained within a standard metropolitan statistical area, had a greater proportion of urban than rural residents in the 1980 census, and had a

population of more than 100,000 in the 1980 census.

Seasonal data are described as those distributed in a non-random, cyclic, sinusoidal pattern with a 12-month periodicity. The amplitude of observed patterns is calculated as the percentage deviation from maxima and minima and tested for significance with the chi-square test of homogeneity. The effects of varying lengths of calendar months were eliminated by using percentages adjusted for the varying number of days per month. Multiple logistic regression was employed to calculate odds ratios for the independent effects of season of conception and maternal characteristics on the risk of late initiation of prenatal care and voluntary termination of pregnancy.

Results

Pregnancies occurring to women younger than age 18 represented 8.73 percent of the total study population. Figure 1 displays the percent distribution of pregnancies by month of conception for adults and adolescents. Significant differences (χ^2, $P < .001$) in the monthly patterns of conception were found between the two groups. While a primary December peak in conceptions was evident for both age groups, only the adolescent group exhibited a secondary peak in May and June.

The monthly distribution of conceptions for the adolescent group was further examined by sociodemographic subgroups (table 1). Among adolescent pregnancies, no significant differences in seasonal conception patterns were detected by race, marital status, gravidity, or urban-rural residence. Although they represent less than 1 percent of the population, adolescent mothers who were 2 years above grade level for age showed a different seasonal conception pattern. For this group, the primary peak in conceptions was found during July and August.

Nearly 34 percent of the adolescent pregnancies investigated were voluntarily terminated by induced abortion. This proportion is less than the national rate of 42 percent noted over a comparable period (*37*). The mean gestational age at termination for adolescent pregnancies was approximately 9.1 weeks, and the age was observed to vary by month of conception (fig. 2). Relatively higher mean gestational ages at induced abortion for adolescent pregnancies were evident in April, October, and November. Figure 3 displays the percentage distribution by month of conception of pregnancies terminated by induced abortion. A marked reduction in pregnancy resolution by induced abortion was evident during the fall conception months of September through November.

Figure 1. Pregnancies by month of conception of South Carolina residents younger than 18 years and 18 years and older, 1979-86

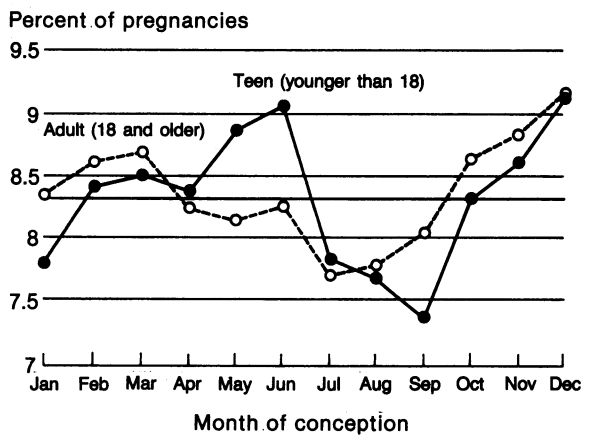
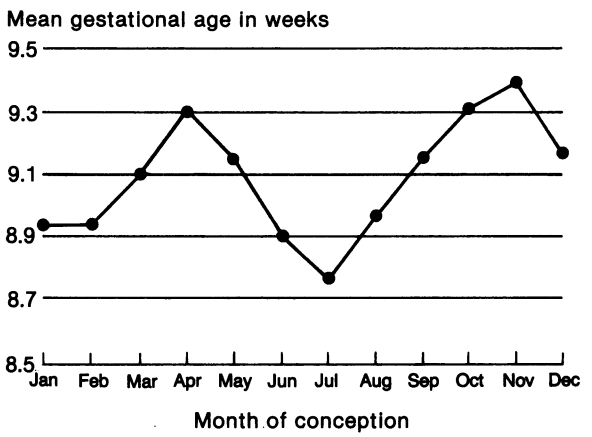


Figure 2. Mean gestational age at induced abortion of pregnant South Carolina adolescents, by month of conception, 1979-86



The results of logistic regression analysis for the risk of terminating pregnancy by induced abortion among adolescents are provided in table 2. A significantly increased risk of terminating pregnancy by abortion was found for adolescents who were unmarried, ages 10 to 14, multigravid, or educationally advanced. Adolescents who were nonwhite, lived in rural areas, or were below average educationally demonstrated relatively lower risks of induced abortion. There was a lower risk of pregnancy termination by induced abortion when conception occurred during the fall months, compared with other seasons of the year.

Figure 3. Percent of pregnancies of adolescent South Carolina residents resolved by induced abortion, by month of conception, 1979-86

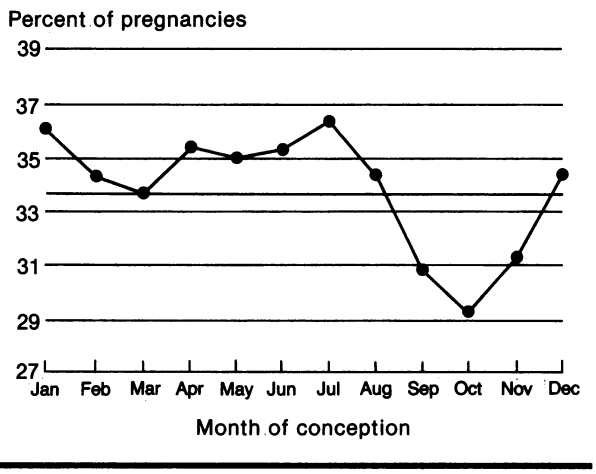
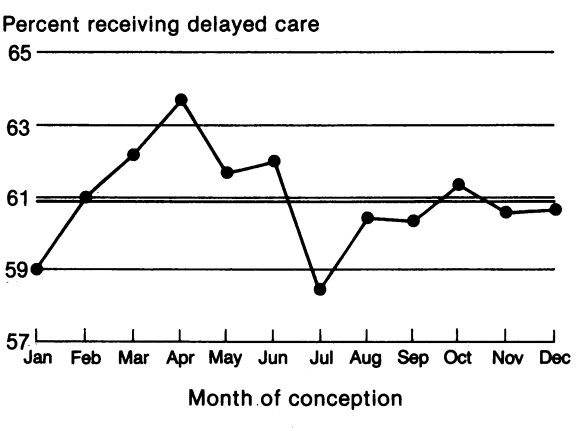


Figure 4. Percent of live births to South Carolina adolescents who initiated prenatal care after the first trimester, by month of conception, 1979-86



Among adolescents who delivered a live baby, 60.9 percent delayed initiation of prenatal care until after the first trimester of pregnancy. Figure 4 displays the proportion of live births to adolescents by month of conception when the mother initiated prenatal care late. A seasonal peak in delay of prenatal care is evident among conceptions occurring in April. Table 3 shows the results of the logistic regression analysis for the risk of late initiation of prenatal care among adolescents. While the risk of late prenatal care was lower for educationally delayed adolescent mothers, an increased risk of late prenatal care was found for adolescents who were ages 10 to 14, unmarried, and multigravid. A significant, though modest, increased risk of delayed prenatal care was also observed for adolescents who conceived during the spring months of March through June.

Discussion

In this study, a significant difference in the monthly distribution of conceptions was evident between adolescents and adults. Although meteorologic, biologic, and sociocultural factors, among others, continue to be discussed as possible determinants of the seasonal distributions of births, the potential influence of climate and environmental factors on the observed differences in this study can be considered negligible, given the use of a geographically and temporally defined population. These data are insufficient to explore the possible role of biological differences.

It is noteworthy that the peak month of adolescent conceptions coincides with the traditional end of the school year. In the United States, the end of the school year for adolescents is typically marked by formal and informal celebrations, including a ball or formal dance colloquially referred to as 'Prom (promenade) Night.' While adults typically celebrate during December at the end of the calendar year, adolescents celebrate and have increased vacation and leisure time both at the end of the calendar year and at the end of the school year. This may explain partly the twin peaks observed in adolescent conceptions in contrast to the single peak evident among adults. To the extent that both peak periods of adolescent conception are a function of sociocultural events, these findings have implications for efforts to prevent adolescent pregnancies. This is particularly important, since many of these same events can be occasioned by the use of alcohol and other drugs, perhaps precipitating sexual activity.

The trough in use of abortion services among adolescents who conceive in October also coincides with the end-of-the-year holiday season. Allowing 6 to 8 weeks after the date of the last normal menses for a pregnancy to be recognized, adolescents conceiving in October would be faced with pregnancy termination decisions during the December holiday season, when this predominantly Christian population would be celebrating Christmas. Social and cultural events during this period may result in delays in confirming pregnancy, delays in accessing and scheduling abortion services, less willingness to terminate the pregnancy during a time of increased emphasis on religious events, and less availability of financial resources to pay for abortion services. Of those adolescents in this population who did

terminate their pregnancies, the higher mean gestational age at termination observed for October and November conceptions further suggests the presence of barriers to abortion services during this season of the year.

The primary peak in delayed access to prenatal care services observed among April conceptions coincides with a recognition of pregnancy near the end of the school year. For adolescents, the end of the school year may signal the beginning of a period characterized by reduced availability of counseling and health care service throughout the summer months. Further, the myriad activities accompanying the end of the school year may result in a delay in seeking confirmation of pregnancy. It is noteworthy that the secondary peak in mean gestational age at termination for adolescent induced abortions also occurs among April conceptions.

The lowest monthly mean gestational age for induced abortion and the lowest monthly percentage of delayed prenatal care were both observed in the month of July. For adolescents conceiving during this month, recognition of pregnancy would coincide with the beginning of the school year when the adolescent would again have access to school health and counseling services and may be given a physical examination. The combination of these findings suggests that during the summer months deficits in the access to and availability of health care and counseling services may result in delays in seeking or obtaining such services that in turn could adversely influence reproductive outcomes.

Although there has been a paucity of research on the seasonal patterns of conception among adolescents, we do not believe these findings to be unexpected. The observed increased risk of conception among adolescents at the end of the calendar year and the end of the school year confirms conventional wisdom and experience. In spite of this, these findings suggest that there may be opportunity for improvement in the reduction of adolescent pregnancy and the availability of adolescent reproductive health care services. Recognizing that sociocultural events may increase the risk of adolescent pregnancy and decrease access to services, these data suggest the potential benefit of increasing efforts to prevent adolescent pregnancy prior to high-risk events, restructuring adolescent-specific celebrations to reduce the risk of conception, and increasing the availability of and access to health care and counseling services to adolescents during the summer months when school is in recess. Since our findings were similar among racial and urban-rural groups, the uniform need for these efforts among all adolescents should be emphasized.

Table 2. Logistic regression analysis of the risk of terminating pregnancy by induced abortion among 41,591 adolescents, South Carolina, 1979–86

Variable[1]	Odds ratio	95 percent CI	P value
Race of mother	0.12	0.12–0.13	<.001
Age of mother	1.47	1.35–1.61	<.001
Marital status	40.71	36.30–45.66	<.001
Gravidity	1.63	1.52–1.75	<.001
Low educational attainment	0.17	0.16–0.18	<.001
High educational attainment	8.23	5.62–12.04	<.001
Rural residence	0.79	0.75–0.83	<.001
Fall season	0.77	0.73–0.82	<.001

[1] Variable definitions: race, 0 = white, 1 = nonwhite; age, 0 = 15–17 years, 1 = 10–14 years; marital status, 0 = married, 1 = not married; gravidity, 0 = nulligravida, 1 = multigravida; low educational attainment, 0 = all other, 1 = 2 years below grade for age; high educational attainment, 0 = all other, 1 = 2 years above grade for age; residence, 0 = urban, 1 = rural; fall season, 0 = all other, 1 = September-November.
NOTE: CI = confidence interval.

Table 3. Logistic regression analysis of the risk of late initiation of prenatal care among 27,094 live births to South Carolina adolescents, 1979–86

Variable[1]	Odds ratio	95 percent CI	P value
Age of mother	1.32	1.19–1.47	<.001
Marital status	2.16	2.04–2.27	<.001
Gravidity	1.36	1.26–1.45	<.001
Low educational attainment	0.91	0.87–0.95	<.001
Spring season	1.09	1.04–1.15	<.001

[1] Variable definitions: age, 0 = 15–17 years, 1 = 10–14 years; marital status, 0 = married, 1 = not married; gravidity, 0 = nulligravida, 1 = multigravida; low educational attainment, 0 = all other, 1 = 2 yrs below grade for age; spring season, 0 = all other, 1 = March-June.
NOTE: CI = confidence interval.

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