THE YALE JOURNAL OF BIOLOGY AND MEDICINE 57 (1984), 777-785

Observations Related to Chronologic and Gynecologic Age in Pregnant Adolescents

MARIANNE E. FELICE, M.D., MICHELLE JAMES, M.D.,
PAUL SHRAGG, M.A., AND DOROTHY R. HOLLINGSWORTH, M.D.

Departments of Pediatrics and Reproductive Medicine, UCSD School of Medicine and Medical Center, San Diego, California

Received March 26, 1984

A low chronologic age (≤ 15 years) and low gynecologic age (≤ 2 years) have been considered factors that increase medical complications among adolescent pregnant women. Gynecologic age (GA) is defined in this study as age in years at conception minus age at menarche. Two hundred twelve consecutive pregnant teenagers were followed prospectively in the Teen OB Clinic at the University of California, San Diego Medical Center, between August 1978 and July 1981. The clinic population consisted of 37.3 percent Whites, 35.8 percent Hispanics, 20.8 percent Blacks, and 6.1 percent other (mostly Indochinese). Sixty-eight percent of the patients were funded by MediCal. The patient population was divided by chronological age (CA) at conception into those 15 years or less or 16 years or older. A low chronological age was found to be a significant risk factor for premature rupture of membranes. Teenagers with a low gynecologic age (≤ 2) had a lower mean pre-pregnancy weight and body mass index (Kg/M^2) than teenagers with a higher gynecologic age. In this study, we did not find that a low CA or GA was correlated with a higher frequency of pregnancy-induced hypertension, prenatal medical problems, obstetrical problems at labor or delivery, or an excessive number of low-birthweight infants.

INTRODUCTION

The effect of chronological age (CA) on outcome of teenage pregnancy has been examined by many groups of investigators in the last half century. It is now generally accepted that for the older adolescent (16 years of age or more) who receives appropriate prenatal care, a good pregnancy outcome may be expected for mother and infant, particularly if the teenager's psychosocial needs are addressed [1-3]. However, studies involving the young adolescent (15 years of age or less) are less clear and are confounded by differences in racial characteristics, socioeconomic factors, and provision or lack of prenatal care. Reports range from very few complications [4-6] to a high prevalence of one or more of the following problems: pregnancy-induced hypertension [7-14], anemia [7,8], uterine dysfunction [7,9], cephalopelvic disproportion [10,11,15], prematurity [9,10,14,16,17], and perinatal mortality [14,17].

Some investigators [18,19] have speculated that physiologic maturity rather than

Supported in part by the UCSD General Clinical Research Center NIH/Division of Research Resources Grant RR 0827 and in part by Robert Wood Johnson Foundation High Risk Youth Grant 6-444845-58711

Address reprint requests to: Marianne E. Felice, M.D., Dept. of Pediatrics (H-814F), UCSD Medical Center, 225 Dickinson Street, San Diego, CA 92103

chronologic age may be a better predictor of outcome of teenage pregnancies. Erkan et al. [18] described physiologic maturity as the postmenarchal age of the mother until the last menstrual period before pregnancy. Zlatnik and Burmeister [19] coined the term "gynecologic age" (GA) which they defined as the chronological age at delivery minus the age of menarche. In both reports a higher percentage of low-birthweight infants was noted in mothers with a GA of $\leq$ 2 years, but there was no correlation with toxemia or other complications of pregnancy. Lawrence and Merritt [20] reviewed the records of all teenage mothers delivered in one year at the University of Rochester and found no relationship between GA at delivery and birthweight in White adolescents, but noticed a trend for smaller babies in Black mothers with a lower GA. Because previous reports on the role of CA and GA in adolescent pregnancy have been inconclusive and contradictory, this study was undertaken to assess the relative importance of these factors on medical complications in a racially diverse group of pregnant adolescents.

METHODS

The study population consisted of 212 consecutive pregnant adolescents aged 11–19 years from San Diego County who were followed at the UCSD Medical Center Teen OB Clinic between August 1978 and July 1981. The Teen OB Clinic is a collaborative effort between the Department of Reproductive Medicine and the Division of Adolescent Medicine in the Department of Pediatrics to provide special services to pregnant teenagers. The clinic is staffed by members of both departments.

Information from each pregnancy and delivery was recorded into a data base using the CLINFO computer program at the General Clinical Research Center of the University of California, San Diego Medical Center. The study population, as indicated in Fig. 1, was divided into two groups by CA at conception: those $\leq$ 15 years of age, and those 16 years or more. GA, defined as chronological age at conception minus the age of menarche [18], was calculated for 193 patients. Nineteen subjects were excluded from the analysis of GA because of missing or conflicting data. Girls who conceived within two years of menarche comprised the low GA group; those who conceived more than two years beyond menarche comprised the high GA group. Two patients with twin gestations, one patient with an intrauterine death, and those who did not deliver at UCSD Medical Center were excluded from data analysis related to weight gain during pregnancy, labor and delivery, and infant outcome. All data analyses were computed as a two-group analysis, using *t*-tests for numerical data or chi-square tests for ordinal or categorical data.

RESULTS

Pre-Pregnancy Data

The racial composition, parity, and source of funding of the four study groups are listed in Table 1. The racial composition of the total clinic population was White (37.3 percent), Hispanic (35.8 percent), Black (20.8 percent), and other (6.1 percent). The racial composition of the chronologically and gynecologically younger patients was different from the older population. Patients with GA $\leq$ 2 years were more likely to be White than Hispanic ($p < 0.006$). Although more patients with a young chronologic age were White than Hispanic, the difference was not statistically significant.

Most patients were from low socioeconomic families and funded by MediCal

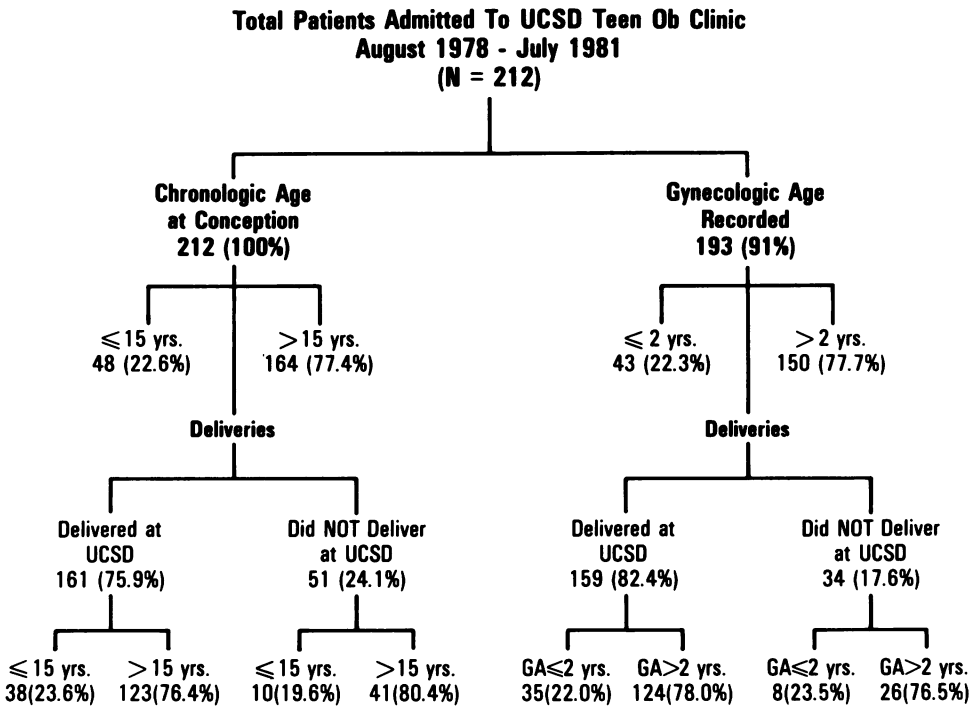

FIG. 1. Flow diagram of 212 consecutive patients admitted to UCSD Medical Center Teen OB Clinic from August 1978 to July 1981. The patient population is subdivided by chronologic and gynecologic ages.

TABLE 1
Racial Composition, Parity, and Hospital Funding Status, of 212 Patients Admitted to the UCSD Teen OB Clinic

	Chronologic Age (years)				Gynecologic Age (years)			
	≤15 48(100%)		>15 164(100%)		≤2 43(100%)		>2 150(100%)	
Race	*N*	%	*N*	%	*N*	%	*N*	%
White	23	48	56	34	21	49	47	31
Black	9	19	35	21	8	19	32	21
Hispanic	11	23	65	40	8	19	64	43
Other[a]	5	10	8	5	6	14	7	5
Parity								
Gravida 1	44	92	118	72	39	91	108	72
Gravida 2	3	6	39	24	4	9	34	23
Gravida 3	1	2	5	3	0	0	6	4
Gravida 4	0	0	1	0.6	0	0	1	0.7
Gravida 5	0	0	1	0.6	0	0	1	0.7
Funding								
MCAL	40	83	105	64	32	74	99	66
TMCP[b]	4	8	41	25	6	14	38	25
Insurance	2	4	10	6	2	5	9	6
Other	2	4	8	5	3	7	4	3

[a] Southeast Asian, Filipino, and Oriental
[b] Prepaid delivery package, UCSD Medical Center

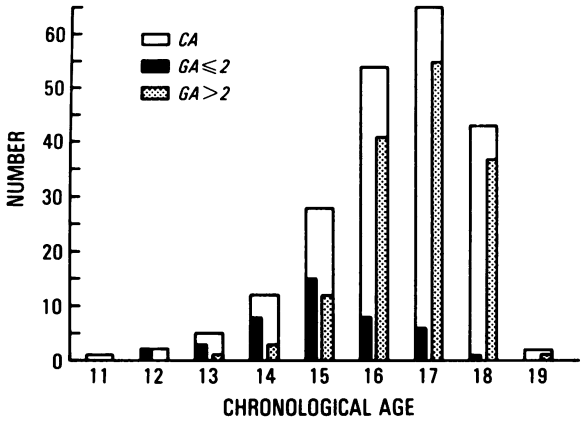

FIG. 2. Frequency distribution of a population of 212 pregnant adolescents aged 11–19 years. The clear bars indicate the number of subjects for each year of chronologic age. Patients with a gynecologic age (GA) of ≤2 years are indicated by black bars and those with a GA >2 years by stippled bars.

(68.4 percent). Prenatal care was purchased through a low-cost UCSD Medical Center prepaid plan in 22.8 percent or by third party or other means in 9 percent (Table 1).

Chronologically younger adolescents were more likely to be funded by MediCal and less likely to be funded by the prepaid plan than older adolescents ($p < 0.03$). There was no association found between gynecologic age and source of funding.

Seventy-six percent of the study group were primigravidas (Table 1). Although more previous pregnancies occurred in chronologically and gynecologically older teens, 9 percent of the younger girls in both groups had had previous pregnancies.

Figure 2 shows the frequency distribution of the patient population by CA and GA. Basic pre-pregnancy information concerning the study populations is listed in Table 2. The mean chronological age of the entire group was 16.4 (± SD 1.4 years) with a range of 11 to 19 years. The mean age at conception of those 15 years or less was 14.3 (± SD 0.9 year); while that of those > 15 years was 16.9 (± SD 0.8 year).

TABLE 2
Age at Menarche, Pre-Pregnancy Weight, Body Mass Index, Chronologic and Gynecologic Ages at Conception in 212 Consecutive Pregnant Adolescents

	Chronologic Age		Gynecologic Age	
	≤15 (years) (48)	>15 (years) (164)	≤2 (years) (43)	>2 (years) (150)
Age at menarche (years)	12.0 ± 1.1[a]	12.4 ± 1.4	13.3 ± 1.3	12.1 ± 1.3[b]
Pre-pregnancy weight (lb)	118.6 ± 17.3	122.6 ± 20.9	113.8 ± 16.3	123.8 ± 20.6[c]
Pre-pregnancy BMI (kg/M²)	21.1 ± 3.0	21.9 ± 3.4	20.4 ± 2.6	22.1 ± 3.4[b]
CA at conception (years)	14.3 ± 0.9	16.9 ± 0.8[b]	15.1 ± 1.4	16.7 ± 1.0[b]
GA at conception (years)	2.4 ± 1.0	4.5 ± 1.6[b]	1.8 ± 0.4	4.6 ± 1.4[b]

[a] All values represent mean ± SD.
[b] $p < 0.001$
[c] $p < 0.002$

The mean age of adolescents with GA ≤ 2 years was 15.1 (± SD 1.4 years) with a range of 12 to 18 years; while that of adolescents with GA > 2 years was 16.7 (± SD 1.0 year) with a range of 13 to 19 years. Sixty-five percent of patients with a GA of ≤ 2 were age 15 years or younger.

Patients with a low GA were significantly older at menarche than those with a GA > 2 ($p < 0.001$). The difference in age at menarche between chronologically younger and older patients was not statistically significant. Chronologically younger adolescents had a significantly lower GA than the older adolescents ($p < 0.001$).

Adolescents with GA ≤ 2 had a lower pre-pregnancy weight and a lower body mass index (BMI: Kg/M^2) than those with a higher GA ($p < 0.001$). In contrast, there was no significant difference in pre-pregnancy weight or BMI between patients ≤ 15 years and those > 15 years. Neither the chronologically nor the gynecologically younger patients differed in pre-pregnancy height from the older patients.

Course of Pregnancy

Not all patients completed their pregnancies with live births. Five adolescents (2.4 percent) had spontaneous abortions; six (2.8 percent) requested a therapeutic abortion; and one teenager (0.5 percent), a 17-year-old with labile insulin-dependent diabetes, had an intrauterine fetal death at 25 weeks' gestation. Twenty-six pregnant girls (12.3 percent) moved out of town or transferred to a different health care facility before delivery, and fourteen patients (6.7 percent) were lost to follow-up. There were no significant differences between study groups in reasons for not completing the pregnancy at UCSD Medical Center.

Table 3 lists the medical problems during pregnancy of 159 young women who delivered single births. Compared to older adolescents, chronologically younger adolescents had more frequent premature rupture of membranes (rupture of mem-

TABLE 3
Problems During Pregnancy of 159 Teenagers Who Delivered Singlet Births at UCSD Medical Center

	Chronologic Age (years)				Gynecologic Age (years)			
	≤15 (38)		>15 (121)		≤2 (35)		>2 (122)	
Complications[a]	*N*	%	*N*	%	*N*	%	*N*	%
Anemia	13	34	41	34	12	34	40	33
Hyperemesis gravidarum	0	0	6	5	0	0	6	5
Urinary tract infection	5	13	21	17	4	11	23	19
Goiter	2	5	5	4	1	3	6	5
Hypertension	9	24	25	21	8	23	26	21
Pre-eclampsia	5	13	18	15	6	17	17	14
Premature labor	5	13	11	9	3	9	13	11
Premature rupture of membranes	6	16	3	2[b]	4	11	4	3
Deep vein thrombosis	1	3	1	0.8	1	3	1	0.8
Glycosuria	1	3	13	11	3	9	11	9
Smoking	6	16	14	12	6	17	12	10
Drugs	0	0	6	5	1	3	5	4
Depression	4	11	24	20	5	14	24	20

[a] Numbers are not mutually exclusive.
[b] $p < 0.005$ by chi-square analysis

branes prior to the onset of labor). This study did not show any differences between groups in the frequency of anemia (hematocrit < 35 percent), hyperemesis gravidarum (causing ten-pound or more weight loss), urinary tract infections, goiter, pregnancy-induced hypertension (blood pressure > 140/90 or an increase in systolic pressure by 20 mm Hg or an increase in diastolic pressure by 15 mm Hg), pre-eclampsia (hypertension, edema, proteinuria), premature labor (the onset of regular, intense, uterine contractions associated with cervical dilatation at 37 weeks' gestation or less), deep vein thrombosis, glycosuria, smoking cigarettes, the use of drugs, clinically observed depression, or low incidence of venereal disease. It should be noted that in this multiracial population of mostly poor patients, approximately one-third of all the teenagers were anemic, more than 20 percent had pregnancy-induced hypertension, and 15 percent met the criteria for pre-eclampsia. The frequency of these problems, however, was not significantly higher in chronologically or gynecologically younger women.

Although there was no difference in amount of weight gained during pregnancy between the different groups, chronologically younger patients gained a higher percentage of their pre-pregnancy weight than did older patients ($p < 0.05$). No such difference was found between the gynecologic age groups (Table 4).

Labor and Delivery

A higher percentage of young women ≤ 15 years had caesarean sections (21 percent vs. 11 percent) but the difference was not statistically significant. There were no differences among the various groups in the frequency of forceps-assisted or vacuum-extraction deliveries, endometritis, postpartum hemorrhage (Hct < 25 or requiring a transfusion), third- or fourth-degree vaginal tears, placenta abruptio, or placenta praevia.

It was of special interest that there were no significant differences in mean infant birthweight, mean placental weight, or gestational age by Dubowitz criteria in the chronologically or gynecologically younger women.

Table 5 shows the number of low- and high-birthweight infants in each group. We failed to demonstrate significant differences between groups by chi-square analysis; this could be a result of the small sample size. However, there was a trend toward more low-birthweight infants in adolescents with a low CA or GA.

Sixteen patients had premature onset of labor. As shown in Table 6, six of the 16 patients were treated with a tocolytic agent (Vasodilan). This treatment was suc-

TABLE 4
Weight Gain During Pregnancy of 159 Adolescents Who Delivered Live Singlet Births at UCSD Medical Center[a]

	Chronologic Age		Gynecologic Age	
	≤15 $N = 38$	>15 $N = 113$[b]	≤2 $N = 35$	>2 $N = 114$[b]
Weight gain (lb)	38.3 ± 12.9	29.6 ± 13.8	30.4 ± 12.7	30.6 ± 14.0
Percentage weight gain $\left(\frac{\text{Weight Gain}}{\text{Pre-pregnancy Weight}} \times 100\right)$	28.8 ± 12.3	24.4 ± 11.2[c]	27.2 ± 12.7	24.9 ± 11.3

[a] All values represent mean ± SD.
[b] Not all patients had pre-pregnancy weights recorded.
[c] $p < 0.05$

TABLE 5
Numbers of Low Birthweight (<2,500 g) and High Birthweight Infants (>4,000 g) Born to Adolescent Mothers at UCSD Medical Center[a,b]

	Chronologic Age				Gynecologic Age			
	≤15 N = 38		>15 N = 120		≤2 N = 35		>2 N = 121	
	n	%	n	%	n	%	n	%
Infant birth weight:								
<2,500 g	5	13.2	6	5.0	5	14.3	6	5.0
>4,000 g	2	5.3	10	8.3	3	8.6	9	7.4

[a] Data from two twin births and one intrauterine fetal demise at 25 weeks' gestation were excluded.
[b] There were no significant differences between groups by chi-square analysis of data.

cessful in delaying labor in five of six patients until gestation reached term. This intervention may have favorably influenced the outcome of pregnancy in these patients and decreased the number of low-birthweight infants.

DISCUSSION

In this study of a group of multiracial pregnant teenagers, chronologically younger adolescents differed from older adolescents in few areas. Teenagers ≤ 15

TABLE 6
Chronological Age, Gynecologic Age, and Delivery Outcome of 16 Pregnant Adolescents Who Experienced Pre-Term Labor[a] with Singlet Deliveries

Study Code Number	CA (years)	GA (years)	Gest. Age at Onset of Labor (weeks)	Intervention	Gest. Age at Delivery by Dubowitz (weeks)	Infant Birthweight (g)	Infant Size (AGA, SGA LGA)[b]
40	15	2	37	None	unk	3,140	unk
88	15	2	35	None	35	2,807	AGA
127	15	3	37	None	37	2,200	SGA
157a	15	4	37	None	37	2,820	AGA
111	15	4	36	None	36	2,010	AGA
39	16	1	35	None	35	2,240	AGA
116	16	4	37	None	37	2,700	AGA
28	16	4	35	Tocolytic agent	39	2,840	AGA
128	16	4	33	Unsuccessful use of tocolytic agent	33	2,150	AGA
44	17	4	32	Tocolytic agent	40	3,289	AGA
164	17	4	30	Tocolytic agent	39	2,523	SGA
95	17	5	37	None	37	2,779	AGA
50	17	5	34	None	34	1,860	AGA
135	17	5	37	None	37	2,679	AGA
152	18	6	24 and 34	Tocolytic agent and McDonald cerclage	39	3,352	AGA
29	18	7	30 and 33	Tocolytic agent	39	3,203	AGA

[a] Premature (or pre-term) labor is defined as regular, intense, uterine contractions associated with cervical dilatation at 37 weeks' gestation or less.
[b] AGA = Appropriate for gestational age; SGA = Small for gestational age, and LGA = Large for gestational age

years of age had a lower gynecologic age, gained a higher percentage of pre-pregnancy weight during pregnancy, and were more likely to have premature rupture of membranes than those > 15 years of age. A young age at conception did not result in significantly higher rates of other prenatal medical or obstetrical problems, including pre-eclampsia and low-birthweight infants. The number of low-birthweight infants in the group as a whole may have been positively influenced by the use of a tocolytic agent by an aggressive perinatal service at UCSD Medical Center which strives to maintain pregnancies long enough to result in heavier, older, newborn infants.

Gynecologically younger patients were older at menarche and chronologically younger at conception than patients with a higher GA. Their mean pre-pregnancy weights and body mass indexes were lower, but they did not differ significantly in height from teenagers with a higher GA. A lower GA did not result in a higher frequency of prenatal medical problems, complications related to labor and delivery, or the postpartum period. Infants of these mothers did not weigh less. The lower pre-pregnancy weight in this study group was compatible with the expected pattern of physical development in adolescent girls. Although a weight spurt typically occurs prior to menarche, some weight gain may continue for a few post-menarchal years [21]. In addition, because pre-pregnancy weight is ascertained by history, the value is subject to error. In this study, 15 percent of all the pre-pregnancy weights were known to be accurate measurements which were confirmed from clinic visits which antedated the pregnancy.

In contrast to previous reports [18,19] we did not find that a low GA was a significant variable for the prediction of outcome of teenage pregnancy. Adolescents in the UCSD Teen OB Clinic had a wide range of gynecologic ages (0.5–8.5 years). About two-thirds (65 percent) of the adolescents with a GA of ≤ 2 years were also ≤ 15 years of age. However, 35 percent were 16 years or older.

The different racial composition of the younger populations found in our study was unexpected. In girls ≤ 15 years of age, or with a GA of ≤ 2 years, half were in the White group. This is in contrast to findings in other urban clinics which have a predominance of Black adolescents [2,7,9,10,16]. All of the various groups in this study had approximately the same proportion of Blacks.

A larger epidemiologic study will be necessary to assess CA and GA as independent variables. This will be especially important in the assessment of frequency of caesarean section rates and number of low-birthweight infants where a trend toward higher numbers was noted in young women with a low CA and/or GA. The data from this study suggest that CA is a better indicator for premature rupture of membranes than GA. In all other respects, neither a low CA nor a low GA resulted in higher medical risks for pregnant adolescents. These findings support the observation by Felice et al. [22] that a low chronological age may not necessarily result in a high rate of low-birthweight infants if young women are given comprehensive prenatal care. This study also supports the data of Perkins et al. [23], who found that neonatal outcome was not adversely affected by a low GA when good prenatal care and a regional perinatal center were available.

We conclude from this study of a multiracial, low-income population of pregnant teenagers who received comprehensive care in a university hospital perinatal center:

1. A low CA is a significant risk factor for premature rupture of membranes.
2. Neither a young CA nor a low GA increases the frequency of pre-eclampsia, anemia, problems at labor and delivery, or low-birthweight infants.

3. A low GA is associated with an older age of menarche.
4. Adolescents with a low GA have a significantly lower pre-pregnancy weight than adolescents with a higher GA.

ACKNOWLEDGEMENT

The authors are grateful to Drs. William L. Nyhan, Robert Resnik, and Allen Lein for their critical review of this manuscript; to Ms. Willie Stallsworth for assistance in medical chart retrieval; and to Paula Holder for careful manuscript preparation.

REFERENCES

1. Kreutner AKK, Hollingsworth DR: Adolescent Obstetrics and Gynecology. Chicago, Year Book Publishers, 1978
2. McAnarney ER, Roghmann KJ, Adams BN, et al: Obstetrical, neonatal and psychosocial outcome of pregnant adolescents. Pediatrics 61:199–205, 1978
3. Lawrence RA, Merritt TA: Infants of adolescent mothers: Perinatal, neonatal and infancy outcome. In Premature Adolescent Pregnancy and Parenthood. Edited by ER McAnarney. New York, Grune & Stratton, 1983
4. Williams JW: Textbook of Obstetrics. New York, Appleton-Century-Crofts, 1971
5. Harris JW: Pregnancy and labor in young primiparae. Johns Hopkins Hosp Bull 33:12–21, 1922
6. Briggs RM, Herren RR, Thompson WB: Pregnancy in the young adolescent. Am J Obstet Gynecol 84:436–441, 1962
7. Mussio TJ: Primagravidas under age 14. Am J Obstet Gynecol 84:442–444, 1962
8. Osofsky HJ, Hagen JH, Wood PW: A program for pregnant school girls. Am J Obstet Gynecol 100:1020–1027, 1968
9. Coates JB: Obstetrics in the very young adolescent. Am J Obstet Gynecol 108:68–72, 1970
10. Duenhoelter JH, Himenez JM, Baumann G: Pregnancy performance of patients under fifteen years of age. Obstet Gynecol 46:49–52, 1975
11. Mellor S, Wright JD: Adolescent pregnancy. The Practitioner 215:77–82, 1975
12. Spellacy WN, Mahan CS, Cruz AC: The adolescent's first pregnancy: A controlled study. South Med J 71:768–771, 1978
13. Claman A, Bell HM: Pregnancy in the very young teenager. Am J Obstet Gynecol 90:350–354, 1964
14. Poliakoff SR: Pregnancy in the young primigravida. Am J Obstet Gynecol 76:746–753, 1958
15. Battaglia FC, Frazier TM, Hellegers AE: Obstetric and pediatric complications of juvenile pregnancy. Pediatrics 32:902–910, 1963
16. Hulka JF, Schaaf JT: Obstetrics in adolescents: A controlled study of deliveries by mothers 15 years of age or under. Obstet Gynecol 23:678–685, 1964
17. Dott AB, Fort AT: Medical and social factors affecting early teen-age pregnancy. Am J Obstet Gynecol 125:532–536, 1976
18. Erkan KA, Rimer BA, Stine OC: Juvenile pregnancy—Role of physiologic maturity. Md State Med J 20:50–52, 1971
19. Zlatnik FJ, Burmeister LF: Low "gynecologic age": An obstetric risk factor. Am J Obstet Gynecol 128:183–186, 1977
20. Lawrence RA, Merritt TA: Infants of adolescent mothers. Sem in Perinatol 5:19–32, 1981
21. Tanner JM: Growth at Adolescence. London, Blackwell, 1962
22. Felice ME, Granados JL, Ances IG, et al: The young pregnant teen-ager: Impact of comprehensive prenatal care. J Adol Health Care 1:193–197, 1981
23. Perkins RP, Nakashima II, Mullin M, et al: Intensive care in adolescent pregnancy. Obstet Gynecol 52:179–188, 1978