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Predictors of high risk teenage pregnancies

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PREDICTORS OF HIGH RISK TEENAGE PREGNANCIES

by

Joy Walker Bonar

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APPROVAL PAGE

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To identify variables that predict birthweight among teenagers participating in a prenatal program, data were analyzed from 25,945 women, including 5,270 teenagers. Of black teenagers in the program, 8 to 17% had low birthweight births, compared to 8 to 10% of the white teenagers. The percentages were significantly different only at age 15. Whereas black teenage mothers more often were unmarried, had previous abortions, and used public prenatal care providers, white teenage mothers more often smoked and were employed. Birthweight was regressed on a number of variables selected from the medical histories of the pregnant women. To obtain a risk score, the standardized regression coefficients were used to calculate weights that could be summed for each woman. Women who scored 10 or more were considered at risk. Risk weights for teenagers and for young adult women (ages 20 and 21) were calculated and compared with the risk weights for women of all ages who were in the prenatal program.

For teenagers in the program, the variables most strongly predictive of low birthweight were black race, smoking, a previous preterm or low birthweight infant, one spontaneous second trimester abortion, repeat spontaneous or induced second trimester abortions, weight under 100 pounds,

being under five feet tall, prenatal care from a public care provider, age under 16, being employed, and having kidney or repeated urinary infections. Second trimester abortions and being employed were not significant predictors for all women in the program. Variables that were not significant predictors of low birthweight for the teenage mothers included education, marital status, uterine anomaly or DES exposure, cervical conization, performing heavy or stressful work, commuting more than 30 minutes to work, less than one year since a previous birth, and two or more previous stillbirths or neonatal deaths. The differences between predictors for teenagers and for all women were sufficient to warrant using different risk weights for the two groups.

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

This research was designed to identify the risk factors associated with low birthweight births among teenage mothers. The data set was part of an ongoing program designed to reduce high risk pregnancies in 20 counties in northwestern North Carolina. The program had identified factors associated with preterm low birthweight pregnancies among women of all ages who participated in the program before December 1, 1987. This study, however, will focus on the risk factors associated with low birthweight pregnancies specifically among teenage women age 19 and under. Those factors associated with low birthweight among teenagers were compared with factors predictive of low birthweight for two other groups: women age 20 and 21 and all women in the program.

Incidence of Teenage Pregnancy

Among industrialized nations, the United States is remarkable for its high rate of teenage pregnancy (Hanson, Myers, and Ginsburg, 1987; Institute of Medicine, 1985; Jones, Forrest, Goldman, Henshaw, Lincoln, Rosoff, Westoff and Wulf, 1985; Rodman, Lewis, and Griffith, 1984). Jones, et al. (1985, p. 55) reported pregnancy rates, which were "calculated as the sum of births and abortions experienced by women of a given age divided by the midyear estimate of the female population of that age." For women 15 to 19 years old these rates (per 1000 women) are: (a) U.S. total, 96; (b) U.S white, 83; (c) England, Wales, France, and Canada, 43-45; (d) Sweden, 35; and (e) Netherlands, 14. Despite these figures, teenage fertility in the United States, measured by the number of births to women aged 15 through 19, has reached the lowest level since 1940 (Ventura, 1984).

According to a report by the National Academy of Sciences in Family Planning Perspectives (Risking the future, 1987)

> More than one million teenage girls in the United States become pregnant each year, just over 400,000 teenagers obtain abortions, and nearly 470,000 give birth. The majority of these births are to unmarried mothers, nearly half of whom have not yet reached their 18th birthday. (p. 119)

The birth rate among black teenagers has dropped more steeply than the rate among white teenagers, though the rate among black teenagers remains almost twice that of white teenagers. In 1981, the birth rate per 1000 white teenagers was 44.6, compared to 97.1 for black teenagers ("Teenage births decline", 1986, p. 87).

Teenage Pregnancy as a Risk Factor

Teenage pregnancy is generally considered to be a high risk condition (Brown, 1985; Fedrick and Anderson, 1976; Institute of Medicine, 1985; Kaltreider and Kohl, 1980; Makinson, 1985; McCormick, Shapiro, and Starfield, 1984; Moore, Meis, Ernest, Michielutte, Sharp, Grover, and Hill, 1986; Rodman, Lewis, and Griffith, 1984) with several studies reporting that women under 18 more often deliver infants which are preterm (less than 38 weeks since the mother's last menstrual period) or low birthweight (under 2500 grams), or both. Within the teenage group, women under 16 are reported to be particularly at risk for preterm and/or low birthweight babies (Institute of Medicine, 1985; Moore, et al., 1986).

Although the association of high risk, particularly low birthweight (LBW) and/or preterm (PT) delivery, with teenage pregnancy has been reported in numerous studies, the causes of that association are not yet clear. In most studies, the incidence of low birth weight and/or preterm delivery among teenagers seems to be associated more with social or demographic variables than with clinical variables (Brown, 1985; Kleinman and Kessel, 1987; Makinson, 1985; McCormick, et al., 1984; Moore et al., 1986; Singh, Torres, and Forrest, 1985). These social or demographic variables appear to include race, single (unmarried) pregnancy, less than a high school education, and low economic status, defined in terms of the expectant female or of her father. The literature is not consistent, however, and some of the larger studies (Fedrick and Anderson, 1976; Kaltreider and Kohl, 1980) did not include variables, such as race, which other studies found to be highly significant predictors of preterm or low birthweight deliveries. In a Family Planning Perspectives (1987) review of an article by Geronimus (1986) it was concluded that

> Examination of neonatal mortality by maternal age alone makes it appear that teenagers giving birth, particularly those 18 and younger, are at a biological disadvantage that results in excessive risk to their infants . . . . However, socioeconomically advantaged teenagers rarely bear children, whereas blacks, rural residents and women who get inadequate prenatal care currently account for most teenage childbearing . . . . This suggests . . . that the association between teenage births and excessive rates of short gestation, low birthweight and neonatal mortality may result from environmental disadvantages rather than from inherent biological factors, since all of these risks are reduced after race and prenatal care are controlled for. Among mothers younger than 15, for example, inadequate prenatal care accounts for almost one-third of neonatal deaths. The finding that infants of black women aged 24-34 had higher neonatal mortality rates than infants of even younger white women, also contributes to the hypothesis that maternal age does not generally have an independent effect on neonatal mortality. (p. 83)

Geronimus (1986) noted "if none of the teenage pregnancies in this data set had occurred, the racial disparity in neonatal mortality rates would have dropped only trivially" (p. 1416). This suggests that high rates of neonatal mortality among blacks are not due to the higher incidence of teenage childbearing among blacks.

Kleinman and Kessel (1987, pp. 752-753) made the same point:

> Our findings also show that the contribution of childbearing by teenagers to adverse outcomes of pregnancy among blacks has been overemphasized. If all births to teenagers in 1983 had been prevented, the rate of very low birth weight would have decreased by 8% among whites and 3% among blacks. . . . The problem of "children having children" must be addressed on the basis of its social effects rather than its effect on the overall problem of low birth weight.

<u>Other Factors Associated with High Risk Pregnancy</u>

Given the evidence that black women in the United States experience relatively high rates of morbidity and mortality associated with pregnancy, and that their infants are at higher risk both prenatally and postnatally, one might speculate that genetic factors may be at work, perhaps in combination with socioeconomic disadvantage. For instance, it is known that many Americans of African ancestry carry genes for sickle cell trait. People carrying that trait are at risk for certain illnesses and the trait is associated with higher risk for pregnant women. However, a computer search of the clinical literature yielded no indication of increased incidence of preterm/low birth-weight infants among women with sickle cell disease. One study (Tuck, Studd, and White, 1983) reported on the

> complications and outcomes of 334 pregnancies in women with sickle cell trait. . . . Compared with a comparable group of women without sickle cell trait, the mean birthweight of the babies was not reduced. (pp. 108-111)

The clinical literature does emphasize, however, that the health of women with sickle cell trait is more at risk. Such women need good prenatal care.

In an effort "to identify the risk factors responsible for differences in birth weight between blacks and whites", Kleinman and Kessel (1987)

> investigated the effects of four maternal characteristics (age, parity, marital status, and education) on rates of very low birth weight (<1500 g) and moderately low birthweight (between 1500 and 2500g. (p. 749)

The study used 1983 national data. For both black and white women, less than 12 years of schooling was associated with moderately low birthweight and, for white women, with very low birthweight. Compared to married women, both black and white unmarried women were at higher risk for low birthweight or very low birthweight infants. There was an interaction between parity and age:

> Primiparas 30 years of age and over and multiparas under 18 years of age had the highest rates of very low birth weight and moderately low birth weight infants. The excess risk among teenagers was considerably higher among whites than among blacks and was higher for very low birth weight than for moderately low birth weight. (p. 751)

Lieberman, Ryan, Monson, and Schoenbaum (1987) "investigated medical and socioeconomic risk factors that may explain the known increase in premature births among black women" (p. 743). They found an association between maternal hematocrit level, age less than 20, single marital status, receiving welfare support, not having graduated from high school, and premature birth. "When the number of these factors pertaining to an individual woman was taken into account, race was no longer a significant predictor of premature birth" (p. 743). They concluded that "the racial difference in the rate of premature birth is attributable to specific medical and socioeconomic characteristics" (p. 743).

Physicians, nurses, and other clinicians responsible for the medical care of pregnant women are concerned with clinical variables and medical problems, before or during the pregnancy, that may be associated with high risk pregnancy. They are particularly eager to identify problems that may be altered or controlled during the course of an existing pregnancy or that may be altered or controlled before a future pregnancy. Family sociologists also tend to be interested in identifying demographic or sociological variables that may be predictive of high risk pregnancies. Often, clinicians and family sociologists hypothesize that adolescent pregnancy, sexual activity, and marriage are deviant or delinquent or undesirable behaviors (Newcomer and Udry, 1987; Hanson, Myers and Ginsburg, 1987; Teti, Lamb, and Elster, 1987). Thus they are interested in identifying ways of preventing such events. Others have pointed out that not everyone considers adolescent pregnancy or sexual activity to be delinquent or undesirable behavior.

In most situations, neither clinicians nor family sociologists can alter demographic or social variables such as race, economic status, or educational level. However, both clinicians and sociologists can attempt to identify risk factors of this sort so that policies may be suggested to alleviate socially determined risk factors. For instance, some have suggested that race or educational level may be intervening variables that are highly correlated with economic level. Economic level, therefore, would be the ultimate determinant of such factors as maternal nutritional state and physical development, which may be the true causes of preterm or low birthweight deliveries (Brown, 1985; Kleinman and Kessel, 1987; Lieberman et al., 1987; Makinson, 1985; McCormick et al., 1984).

In addition, when clinicians can identify sociological or clinical conditions that are associated with high risk pregnancy, they can attempt to provide extra care and close observation of women who are in a high risk group. Clinicians may also seek to educate girls and women, health care providers, and the general public, about situations which may cause a problem during pregnancy. Smoking, nutrition, use of drugs including aspirin, alcohol or thalidomide, and maternal susceptibility to cat scratch fever or rubella during early pregnancy, are examples of situations where education can reduce the incidence of high risk pregnancies.

Prenatal care has been found to be associated with better pregnancy outcomes (Brown, 1985; McCormick et al., 1984; Moore, et al., 1986). McCormick et al. (1984) noted that teenage mothers are less likely to obtain prenatal care than are other age groups, in part because very young mothers lack economic resources, knowledge, and experience. Brown (1985) noted six major reasons why some women do not obtain adequate prenatal care:

> financial constraints, including inadequate insurance or public funds such as Medicaid; inadequate availability of service providers, especially of providers who are willing to serve socially disadvantaged or high-risk women; insufficient prenatal services in facilities routinely used by high-risk populations, such as community health centers, hospital outpatient clinics and health departments; the experiences, attitudes and beliefs of women themselves; poor or absent child care and transportation services; and inadequate systems to recruit hard-to-reach women into care. (p. 116)

The Northwest North Carolina Regional Program

In the hope of reducing the incidence of high risk pregnancies, a regional program was developed for northwestern North Carolina. The program was multidisciplinary in approach, and included all public providers and a high percentage of all private providers of pregnancy care in a 20-county area (Moore et al., 1986). Based on the clinical literature and their own experience, the researchers developed an instrument for risk assessment and a packet of educational materials for the care providers and for the pregnant women. By pointing out the incidence of high risk pregnancies, and by emphasizing the importance of teamwork among providers and researchers in professional meetings and on-site consultations, the cooperation of more than 95% of all maternity care providers was obtained. In its first 18 months the program enrolled more than 11,000 pregnant women. Over 40% of the births in the area during that period were included in the study.

Births in this North Carolina study population closely resembled all births in the area with regard to the age and race of the mothers, marital status, and the percentage of public versus private patients. In an analysis of the total group, Ernest, Michielutte, Meis, Moore, and Sharp (in press) reported these results:

> Significant risk factors for preterm/low birth weight were identified and weights assigned for each factor. Application of the weighting system . . . for a specific patient identifies women at high risk for a preterm/low birth weight birth and assists in the decision concerning appropriate intervention.

Several other studies showed inadequate prenatal care to be a major factor in neonatal mortalilty and preterm/low birthweight births (Brown, 1985; Makinson, 1985; McCormick et al., 1984). In the program reported by Ernest, et al., (in press) all subjects received prenatal care and those subjects identified as high-risk, according to the protocol developed at the beginning of the program, received intensive observation and preventive care.

All women enrolled in the Northwestern North Carolina prenatal program from July, 1984 through November 30, 1987 were scored using the risk weights defined at the instigation of the program. On the basis of the statistical analysis described by Ernest et al. (in press), a revised risk scoring system has been developed and will be used for all women enrolled in the program after December 1, 1987.

Statistical analysis of the 11,623 cases enrolled in the first 18 months of the study (Ernest et al., (in press) included the "comparison of the percentage of women with and without each risk factor who had a PT/LBW child." Chi-square analysis of these data indicated that the risk factors most strongly related to preterm low birthweight for women of all ages ($p<.05$) included

> less than one year since last birth, previous preterm delivery or low birth weight delivery, two or more previous stillbirths or neonatal deaths, uterine anomaly or DES exposure, and history of placenta previa.

Other factors strongly related were black race, age less than 16, and mother's weight less than 100 pounds. Unexpectedly, age greater than 40, work outside the home, heavy physical or stressful work, and cyanotic heart disease or renal failure "did not yield the predicted increase in preterm/LBW births."

One or more second trimester induced abortions were not associated with increased risk of preterm low birthweight in the chi-square analysis by Ernest, et al. (in press). One abortion (spontaneous or induced) at less than 14 weeks was not associated with a significantly increased risk of preterm low birthweight births. However, two or more abortions (spontaneous or induced) at less than 14 weeks were associated with an increased risk of preterm low birthweight births (p=.056 for two abortions at less than 14 weeks and p=.079 for three or more abortions at less than 14 weeks). In taking the patient history, care providers did not distinguish between first trimester induced or spontaneous abortions. They did ask specifically about second trimester induced abortions, however. Repeated second trimester induced abortion did not have a significant effect.

Utilizing their preliminary risk analysis to choose significant variables, Ernest, et al. (in press) then employed multiple logistic regression analysis to obtain partial regression coefficients to estimate the net effect of each risk factor while controlling for all other risk factors. With this procedure, 16 variables were found to be important. Ernest, et al. calculated weights from the unstandardized regression coefficients by dividing each coefficient by the largest coefficient, multiplying the results by 10 and rounding off. The weights for the 16 variables for each woman were added to yield her risk score. Ernest, et al. reported that risk scores from their full regression model correctly identified about 55% of the preterm low birthweight pregnancies as true positives (i.e., correctly predicted 55% of the preterm low birthweight births) when the 30% of women with the highest risk scores (those above the 70th percentile) were considered high risk. When the 10% of women with the highest risk scores (those above the 90th percentile) were considered high risk, their full model correctly identified about 25% of the preterm low birthweight births. That is, if there were 100 women in the population and 10 of those could be expected to have low birth weight babies, then if the scoring system is so inclusive that 30 of the women were considered high risk, 5.5 of those low birth weight births would be in the group of 30, whereas, if the scoring system is so stringent that only 10 of the 100 women were considered high risk, then 2.5 of the low birth weight births would be in that group of 10. The R-square for the full regression model, that is, the proportion of variability in the incidence of preterm low birthweight births that could be attributed to variability in the independent variables included in the study, was not reported.

In a paper in preparation, Moore, et al. (personal communication, October 1, 1987) reported the impact of the North Carolina 20-county program on the rate of very low birthweight, low birthweight, and preterm low birthweight births. The rates dropped from 1984 to 1985 to 1986 as the project became established, and the rates are well below the rates of the region during the period 1980-1984. Adolescent mothers, however, continued to have higher rates of preterm low birthweight births than other ages, despite having prenatal care.

CHAPTER II

METHODS

Purpose

The purpose of this study was to find the predictors of low birthweight births for mothers 19 years old and younger. If these predictors could be determined, then mothers at high risk for having low birthweight babies might be identified early enough to intervene. Such intervention would be expected to lower the incidence of high risk babies. The predictors for teenage mothers were compared with the predictors for women 20 and 21 years old to understand whether the teen years are really a unique period. They were also compared with the risk scores for all women in the program to see if a different set of risk factors is needed to identify high risk pregnancies among teenagers as compared to the entire group including teenagers. The ultimate goal was to determine a risk score for predicting low birthweight in order to plan for intervention. The research plan was to find a regression equation that would give the significant predictors of low birthweight pregnancies among teenagers. A low birthweight birth is one in which the neonate weighs less than 2500 grams (about 5.5 pounds). Such infants are at high risk for serious developmental problems. In addition, the plan was to see if the regression equations differed by race. A third goal was to see if teenagers had a different set of predictor variables than the predictors appropriate for all women in the program..

The research questions were these: (a) What are the predictors of birth weight in teenage pregnancy? (b) In what respects do these predictors differ from the predictors for all women? (c) Are different sets of predictors needed for black teenagers and for white teenagers?

Sample

For this dissertation, the data collected in the ongoing program of Moore, et al., (1986) from July, 1984 through September, 1987, were examined. Nearly 27,000 cases were included in the available data. This study looked at the data for 5270 teenagers, compared with 3438 women aged 20 and 21, and with all the women in the program. About 1% of the subjects were classifed as "other" race. They were not included in the analyses. Mothers who had multiple births (twins, etc.) were excluded from the analyses, as were women whose infants were stillborn.

Operational Definitions

The risk assessment form developed by Ernest et al. (in press) included 51 items plus information such as age, race, date of confinement and length of gestation (see Appendix). Two risk assessments were made of each woman, one at the time of enrollment in the program, and one at 24-28 weeks of gestation. The predictor variables selected for analysis were from the items on the risk assessment form of Ernest et al.

Only 22 of these 51 predictor variables were used in the regression analyses for teenagers in this study for three reasons. (a) Several items scored at 28 weeks were not coded on to the computer at Bowman Gray. (b) Some items were scored after birth (Apgar scores, for instance). (c) Some items (abortion and education) had several mutually exclusive categories (see Table 1). The way in which items were coded affected the positive or negative signs of the regression coefficients. The meaning of a high or low number in the coding system is shown in Table 1.

The literature suggests that socioeconomic status may be a factor highly predictive of low birthweight births. It therefore seemed desirable to include an economic predictor variable while controlling for race and age. One socioeconomic indicator available from these data was private versus public care provider, although private versus public care is not a precise indicator of socioeconomic status.

A paper by Buescher, Meis, Ernest, Moore, Michielutte, and Sharp (in press) focused on comparisons of the women, in and out of the program, who were in private care. The paper included, however, the following figures: Of the program participants in private care, only 5%

received Medicaid and 9.5% were in the WIC program. In contrast, 30% of the women who were health department clients, and in the program, received Medicaid and 67.18% were in the WIC program. In a comparison group of private patients not in the project, 8.1% received Medicaid and 12.7% were in the WIC program. Among a comparison group of women out of the project who received no prenatal care, 23.6% received Medicaid and 15.4% were in the WIC program. Furthermore, on the basis of her observations of women in the program, Moore concluded that there were substantial differences in educational level and socioeconomic status between private and public patients (M. L. Moore, personal communication, December 9, 1987). A second variable, "more than 2 children under 18 in the home" was also included on the risk assessment sheet as a possible indicator of socioeconomic status.

The dependent variable used for this research was a continuous variable, birthweight in grams. This is different from the categorical dependent variable preterm/low birthweight (coded yes/no) used by Ernest, et al. (in press). A problem with this data set was that there was no indication of when, in her pregnancy, a woman entered the prenatal program. All women in the program received prenatal care. However, the date of entering prenatal care, and hence, the length of time that each woman

Table 1

List of Coded Variables

Variables Recorded at Initial Interview	Code	
County, Provider, patient #	Exact number	
Age in years	Exact number	
Race	1=white, 2=black	
	0	1
Married	No	Yes
8 years or less education	No	Yes
9-11 years of education	No	Yes
Under 18 years of age, not in school	No	Yes
Two or more children under 18 at home	No	Yes
Less than five feet tall	No	Yes
Less than 100 pounds	No	Yes
Work outside home	No	Yes
Heavy physical or stressful work	No	Yes
Greater than 30 minutes commute to work	No	Yes
Uses snuff or smokes more than 10 cigarettes/day	No	Yes
Only one induced or spontaneous abortion under 14 weeks	No	Yes
Two abortions under 14 weeks	No	Yes
Three or more abortions under 14 weeks	No	Yes
One spontaneous second trimester abortion	No	Yes
One induced second trimester abortion	No	Yes
Repeated second trimester abortions	No	Yes
Previous premature or <2500 gram delivery	No	Yes
Less than 1 year between last birth and last menstrual period	No	Yes
Cervical conization	No	Yes
Pyelonephritis or >3 urinary tract infections	No	Yes
Uterine anomaly (except myoma) or DES exposure	No	Yes
Two or more previous still births or neonatal deaths	No	Yes
History of placenta previa or abruptio	No	Yes
Cyanotic heart disease	No	Yes
Variables Recorded Shortly after Delivery		
Care provider (0=public health dept., 1=private physician)		
Birthweight	Grams	

received prenatal care, was not coded on the computer records. Therefore, although this study controlled for prenatal care, in the sense that all women received some prenatal care, it does not control for length of prenatal care.

The program directors met with each cooperating care provider in training sessions designed to insure that data collection was comparable from one provider to the next.

Analysis Procedures

A stepwise regression analysis was the procedure selected for this study. The criterion variable was birthweight, adjusted for sex differences since, on the average, boy babies weigh more than girl babies. Control variables were age and race.

As with the analysis reported by Ernest, et al. (in press) for the entire range of ages, this study sought to identify the linear combination of variables which best discriminates or predicts those adolescents at high risk for low birthweight births. Ernest, et al. (in press) used multiple logistic regression analysis to "establish an empirical weighting system for the risk factors based on the net relationship between each risk factor and preterm low birthweight birth." (p. 4) The regression analysis approach seems appropriate when one considers the needs of the clinical care providers. They need a simple way of scoring each woman, in the office or clinic, so that she may quickly be assigned to a normal risk or high risk group. The (nonstandardized) regression coefficients from the analysis were used to assign a weight to each predictor variable. When a woman has a total score of 10 or more she is considered high risk. This score of 10 was arrived at by

> dividing all regression coefficients by the largest coefficient, multiplying by 10, and rounding the result. This results in a simplified weighting system that maintains the relative importance of each risk factor as identified by the logistic regression analysis. The weights are additive, and the higher the score, the greater the risk of preterm LBW. (Ernest et al., in press, p. 6)

It should be noted that there are risks associated with using regression coefficients to define the "importance" of variables in predicting an outcome. Howell (1982) stated that

> when variables are highly intercorrelated the values of B are very unstable from sample to sample, although R may change very little. . . . We must be exceedingly careful about attaching practical significance to the regression coefficients. (p. 441)

As a measure of importance, Howell (1982) recommended the "squared semi-partial correlation between predictor and the criterion (with all other predictors partialled out)" (p. 442).

The SAS Reg procedure and the SAS Stepwise procedure (SAS User's Guide: Statistics, 1985) were used to develop regression equations by age and race. These procedures have an advantage over logistic regression analysis, in that the dependent variable birthweight, is a continuous variable, and less information is lost.

CHAPTER III

RESULTS

The predictors of birthweight for young mothers were identified through several multiple regression analyses. The results of the regression analyses are presented by age group: 17 and under, 18 and 19, 20 and 21, and all women in the prenatal program. Racial comparisons will be shown for each age group under age 22.

Description of the Teenage Mothers

First an overall description of the teenage mothers is presented (see Table 2). In order to understand the data, the sample was compared by age and race (black or white) on eight variables. This comparison utilized the chi-square statistic to find significant differences between black and white teenagers, by year, and for each variable.

In short, a white teenage mother was significantly more likely to be a high school dropout, to be employed, and to smoke. A black teenage mother was significantly more likely to be unmarried. In fact, from 68 to 85% of black teenage mothers were single. Black mothers at ages 16, 18, and 19 were significantly more likely to obtain prenatal care from a public, rather than private, health care provider. However, this was not true at ages 14, 15 and 17. Only at

Table 2

Characteristics of Teenage Mothers in the Northwest North Carolina Program, by Age and Race (N=5253)

Age	14	15	16	17	18	19
Total Number	109	282	630	1042	1483	1707
Black (%)	55	45	32	26	7	6
Low birth weight baby(%)[a]						
(black)	8	17**	12	11	11	9
(white)	10	8	8	10	9	7
High school dropout (%)						
(black)	10	10	18	21	51	27
(white)	35*	46*	46*	56*	57	50*
Employed(%)						
(black)	2	2	4	8	15	26
(white)	0	3	10**	19*	28*	39*
Smoke >10/day or uses snuff(%)						
(black)	0	0	2	4	5	5
(white)	10**	15*	20*	24*	25*	26*
Single parent(%)						
(black)	85*	83*	83*	78*	83*	74*
(white)	57	61	54	49	44	35
1st trimester abortion (spontaneous or induced)(%)						
(black)	3	3	6	10	15	17**
(white)	0	6	4	8	11	13
2nd trimester abortion, induced (%)						
(black)	0	0	0	1	0	2**
(white)	0	2	1	0	1	1
Care provider (% public)						
(black)	77	78	73*	67	77*	74*
(white)	73	72	63	61	58	51

Chi-square: **p<.05, *p<.01

[a] Percentages of all births within each race

age 19 were black women significantly more likely to have had a first or second trimester abortion.

Overall the mean birthweights increased with age (see Table 3). The mean birthweights for black infants were lower than for white infants at all but one age level. However, when the categorical variable, under 2500 grams or 2500 grams and over, was compared for the two races, black teenagers were significantly more likely to have a low birth weight birth only at age 15 (see Table 2). It is important to remember that a lower mean birthweight is not necessarily bad, unless it is in the high risk area of less than 2500 grams. A very high birth weight can also be an indication of problems. For instance, women who have infants weighing over 9 pounds (about 4100 grams) are considered at risk for diabetes.

Predictors of Birthweight

The regression analyses were run on two teenage groups, 17 and under and 18-19, because the coding procedure used for the education variables dictated that the subjects be divided that way. The 20-21 age group and all women in the program were used for comparison. For all of the regression analyses, the dependent variable was birthweight (in grams) adjusted for the sex of the infant.

Table 3

Mean Birthweight in Grams of Babies Born to Women in the Program, by Race and Age of the Woman

Age	White			Black		
	Mean	S.D.	N	Mean	S.D.	N
10	3005.0	-	1			
12	3401.9	-	1	3161.0	260.6	2
13	2466.4	793.8	4	2975.1	495.4	18
14	3253.2	705.3	49	3025.4	555.8	60
15	3262.7	655.1	156	3067.8	626.9	126
16	3235.9	617.9	424	3072.1	523.6	206
17	3259.0	578.7	756	3101.8	523.9	277
18	3257.4	572.4	1083	2939.4	530.1	400
19	3300.6	588.7	1266	3094.4	537.0	441
Total N, women under 20:			3740			1530
20	3333.7	558.6	1279	3034.5	648.8	399
21	3344.0	553.0	1348	3102.5	553.4	412
Total N, women 21 and 22:			2627			811
All Women	3425.1	570.3	20805	3187.7	588.7	5140

Mothers Age 17 and Under

For black women under 18, the variables associated with low birthweight birth ($p<.05$) were a previous premature or low birthweight baby, and being under 5 feet tall. (see Table 4). Having kidney or repeated urinary infections was associated with a higher birthweight birth ($p<.05$). However, less than 3% of the variability in birthweight could be attributed to these three variables. In fact, all 25 variables included in the analysis accounted for only 5.5% of the variability in birthweight (R-square cumulative).

For white women under 18 (see Table 5), the significant predictors of low birthweight were smoking, being under 5 feet tall, public care provider, weighing under 100 pounds, and having had a previous premature or low birthweight baby. These five variables accounted for about 4% of the variability in birthweight. All the variables included in the analysis accounted for only 5% of the variability in birthweight.

For both black and white women in this group of younger teenage mothers, having a previous premature or low birthweight birth and being under five feet tall were significant predictors of low birthweight. Since the absence of those conditions was coded 0 and the presence of those conditions was coded 1, the beta weights for these two variables were negative, i.e., being under five feet tall

Table 4

Predictors of Birthweight for Mothers
Ages 17 and under: Black (N=688)

Variable	b	Beta	Partial R-square	Cumu-lative R-square	F
Previous premature/ low birth-weight baby	-430.2	-0.10	0.0100	0.0100	6.91*
Under 5 ft	-215.3	-0.08	0.0070	0.0169	4.81**
Kidney or urinary in-fections	280.8	0.07	0.0056	0.0224	3.92**
Previous birth with-in a year	-163.3	-0.07	0.0051	0.0275	3.58
County	13.2	0.07	0.0036	0.0312	2.55
Single parent	-84.3	-0.06	0.0036	0.0348	2.55
High School dropout	75.9	0.05	0.0027	0.0375	1.91
Employed	-138.8	-0.07	0.0023	0.0398	1.62
Provider	61.2	0.05	0.0024	0.0421	1.68
Repeat 2nd trimester abortions	636.0	0.06	0.0022	0.0443	1.57
One spon-taneous 2nd trimester abortion	-277.5	-0.06	0.0018	0.0462	1.31
Placenta previa	918.2	0.65	0.0034	0.0496	2.42
More than one 1st trimes-ter abortion	226.5	0.04	0.0015	0.0511	1.08
Under 100 lbs	-141.8	-0.04	0.0017	0.0528	1.20
Cervical conization	521.3	0.04	0.0013	0.0541	0.92
One 1st trimester abortion	-64.0	-0.03	0.0009	0.0550	0.66

*p<.01 **p<.05 R-square=0.055

received the higher code (1) and was associated with low birthweight (refer to Table 1).

Previous kidney or repeated urinary infections were predictive of higher birthweight for these very young black women, but predictive of lower birthweight for the very young white women. Smoking, weighing less than 100 pounds, having had a previous preterm or low birth weight baby, and obtaining prenatal care from a public, rather than private, care provider were predictive of low birthweight for young white women, but not for young black women.

<u>Mothers Age 18 and 19</u>

For the older black teenagers (see Table 6), the significant predictors ($p<.05$) of low birthweight were previous premature or low birth weight birth, smoking, being under five feet tall or under 100 pounds, and being employed. Less than 4% of the variability in birthweight could be attributed to these four variables, and less than 5% of the variability in birthweight could be attributed to all of the variables included in the analysis.

For white women age 18 and 19 (see Table 7), significant predictors ($p<.05$) of a low birthweight birth were smoking, weighing under 100 pounds, having had one spontaneous second trimester abortion, i.e., miscarriage, repeated spontaneous or induced second trimester abortion, a history of previous preterm or low birthweight birth, and obtaining prenatal care from a public care provider. Being

Table 5

Predictors of Birthweight for Mothers Ages 17 and Under: White (N=1399)

Variable	b	Beta	Partial R-square	Cumulative R-square	F
Smoke	-181.9	-0.12	0.0166	0.0166	23.64*
Under 5 ft	-254.6	-0.08	0.0103	0.0269	14.73*
Provider	97.3	0.08	0.0065	0.0269	9.35**
Under 100 lb	-173.0	0.07	0.0039	0.0373	5.65***
Previous premature/ LBW baby	-280.6	-0.06	0.0031	0.0403	4.45***
County	-6.4	-0.05	0.0021	0.0429	3.68
Kidney or urinary infections	-153.5	-0.05	0.0020	0.0449	2.98
One spontaneous 2nd trimester abortion	-268.8	-0.02	0.0013	0.0462	1.86
Previous birth within a year	56.1	0.02	0.0008	0.0470	1.20
Placenta previa	-312.4	-0.03	0.0007	0.0477	1.06
High school dropout	36.9	0.03	0.0007	0.0485	1.08
Two or more children <18 in the home	-57.2	-0.02	0.0006	0.0490	0.83
One induced 2nd trimester abortion	234.5	0.03	0.0005	0.0500	0.66
One 1st trimester abortion	57.0	0.02	0.0005	0.0500	0.66
Single parent	-22.6	-0.02	0.0003	0.0503	0.49

*p<.001 **p<.01 ***p<.05 R-square=0.050

Table 6

Predictors of Birth Weight for Mothers
Ages 18-19: Black (N=840)

Variable	b	Beta	Partial R-square	Cumu-lative R-square	F
Previous premature or low birth-weight baby	-366.1	-0.12	0.0123	0.0123	10.44**
Under 5 feet	-281.9	-0.09	0.0092	0.0215	7.87**
Smoke >10/day or snuff	-207.9	-0.08	0.0058	0.0273	5.01*
Under 100 lbs.	-229.6	-0.07	0.0046	0.0319	4.00*
Employed	-71.6	-0.07	0.0045	0.0365	3.94*
Kidney or urinary infections	290.6	0.05	0.0025	0.0390	2.19
Commutes >30 minutes	233.8	0.05	0.0023	0.0413	2.00
County	-9.8	-0.05	0.0022	0.0435	1.94
High school dropout	43.1	0.04	0.0015	0.0450	1.27
Provider	45.8	0.04	0.0015	0.0464	1.27
Single parent	36.1	0.03	0.0010	0.0474	0.84
Heavy work	-71.6	-0.03	0.0008	0.0482	0.68

**p<.01 *p<.05 R-square=.048

a single parent was significant at $p<.07$. Having a cervical conization was associated with a higher birthweight. In this group of older teenage white women, the model accounted for about 7% of the variability in birthweight.

For older teenage women of both races, previous preterm or low birthweight birth, smoking, and weighing under 100 pounds were significant ($p<.05$) predictors of low birthweight births. Being employed was a significant ($p<.05$) predictor for black women at age 18 or 19, but not for white women in that age group. One spontaneous second trimester abortion, repeated second trimester abortion, and public care provider were significant ($p<.05$) predictors of low birthweight births for white, but not for black, women at age 18 or 19.

<u>Women 20 and 21 Years of Age</u>

In this comparison group of young adults, the significant predictors ($p<.05$) of low birthweight for black women (Table 8) were previous premature or low birthweight birth, smoking, cervical conization, and less than one year since a previous pregnancy. Having two or more children under 18 living in the home was associated with a higher birth weight birth. For white women (Table 9) in this comparison group, the significant predictors ($p<.05$) of low birthweight were smoking, previous premature or low birthweight baby, being under 100 pounds or under 5 feet tall, and public care provider.

Table 7

Predictors of Birthweight for Mothers
Ages 18-19: White (N=2348)

Variable	b	Beta	Partial R-square	Cumu-lative R-square	F
Smoke	-196.6	-0.15	0.0316	0.0316	75.57*
Under 100 lb.	-267.8	-0.11	0.0145	0.0461	35.57*
1 spontaneous 2nd trimester abortion	-442.8	-0.07	0.0053	0.0514	13.15*
Repeat 2nd tri-mester abor tion	-979.6	-0.07	0.0053	0.0567	13.28*
Previous pre-mature/LBW baby	-210.3	-0.06	0.0044	0.0612	11.10*
Provider	44.4	0.04	0.0023	0.0635	5.74**
Cervical coni-zation	1195.7	0.04	0.0017	0.0652	4.32**
Single parent	-43.0	-0.04	0.0013	0.0665	3.24
Under 5 ft.	-102.7	-0.03	0.0009	0.0674	2.22
High school dropout	-33.9	-0.03	0.0007	0.0681	1.75
Placenta previa	-267.3	-0.02	0.0004	0.0685	1.03
2 plus children over 18 in home	-55.7	-0.02	0.0003	0.0688	0.81
Heavy work	50.1	0.03	0.0004	0.0695	0.92
Employed	-22.7	-0.02	0.0002	0.0697	0.60

*p<.001 **p<.01 R-square=0.070

Table 8

Predictors of Birthweight
Women Ages 20-21: Black (N=1184)

Variable	b	Beta	Partial R-square	Cumulative R-square	F
Previous preterm/ LBW baby	-401.7	-0.18	0.0320	0.0320	39.09*
Smoke	-162.8	-0.08	0.0056	0.0376	6.84**
Two or more children over 18 in the home	153.4	0.09	0.0056	0.0432	6.95**
Cervical conization	-664.1	-0.07	0.0054	0.0485	6.64***
<1 year since last birth	-94.1	-0.05	0.0036	0.0522	4.54***
1 spontaneous 2nd trimester abortion	-157.9	-0.04	0.0027	0.0549	3.35
Kidney/ urinary infections	-181.6	-0.05	0.0026	0.0575	3.21
County	-11.4	-0.05	0.0026	0.0600	3.22
One induced 2nd trimester abortion	203.9	0.06	0.0025	0.0625	3.12
Provider	52.4	0.04	0.0021	0.0646	2.61
Under 5 ft	-141.6	-0.04	0.0017	0.0663	2.13
Commutes >30 minutes	73.6	0.02	0.0004	0.0667	0.56
High school dropout	36.7	0.03	0.0004	0.0675	0.49
One 1st trimester abortion	-32.8	-0.02	0.0004	0.0675	0.53
Heavy work	31.3	0.02	0.0004	0.0679	0.51

*p<.001 **p<.01 ***p<.05 R-square=0.068

County of residence was significantly associated with birthweight, in that counties coded with a higher number had higher birthweights. Since the counties were coded alphabetically, this meant that counties with a higher number were at the end of the alphabet. There does not seem to be a good theoretical explanation for a statistically significant relationship between low birthweight birth and alphabetical ranking by county. This finding, which is almost certainly specious, should serve as a warning that other variables, thought to be of theoretical significance, may also be correlated only by coincidence. With samples of the size available for this study, it is relatively easy to find statistical significance.

For black women in this age group, 5.2% of the variability in birthweight could be attributed to five significant ($p<.05$) variables. Almost 7% of the variability in birthweight could be attributed to the set of 25 predictor variables used in these regression models. For white women in this comparison group, 7.1% of the variability in birthweight could be attributed to five significant ($p<.05$) variables and 7.5% could be attributed to the entire set of variables in the model.

In this study, the set of predictors from Ernest, et al. (in press) and Moore, et al. (1986) accounted for a higher percentage of variability in birthweight for young

Table 9

Predictors of Birthweight
Women Ages 20 and 21: White (N=3927)

Variable	b	Beta	Partial R-square	Cumulative R-square	F
Smoke	-207.5	-0.17	0.0362	0.0362	147.38**
Previous premature/ LBW birth	-346.5	-0.13	0.0162	0.0524	67.10**
Under 100 lb.	-311.8	-0.11	0.0140	0.0663	58.67*
Under 5 ft.	-180.3	-0.05	0.0024	0.0687	10.11*
Provider	64.3	0.06	0.0019	0.0707	8.07*
County	4.9	0.04	0.0018	0.0724	7.42*
One spontaneous 2nd trimester abortion	-105.8	-0.02	0.0005	0.0729	2.01
More than 1 1st trimester abortion	-59.7	-0.02	0.0004	0.0733	1.83
Two or more children over 18 at home	41.2	0.02	0.0004	0.0738	1.85
One induced 2nd trimester abortion	134.2	0.02	0.0004	0.0741	1.66
Placenta praevia	164.1	0.02	0.0004	0.0745	1.66
Repeated kidney/ urinary infections	-39.2	-0.02	0.0003	0.0749	1.43
Employed	-27.0	-0.02	0.0003	0.0751	1.10
One 1st trimester abortion	-17.9	-0.01	0.0001	0.0753	0.60
Heart or kidney disease	-225.2	-0.01	0.0001	0.0754	0.54

**p<.001 *p<.01 Rsquare=.075

adults, especially those who were white, than for teenagers. Even for young white adults, however, almost 93% of the variability in birthweight could not be accounted for by this set of predictors. The model probably should be expanded to include variables not on the present risk assessment form. Identifying such variables is still a major problem.

Smoking was the strongest predictor of low birthweight births for young white women and was a strong predictor for black women of ages 17 to 21. Smoking was significantly less frequent among the younger black women than among the younger white women in this study. Having a previous premature or low birth weight baby was the strongest predictor of low birthweight for young black women and was a strong predictor for young white women.

Variables that did not meet the significance level for entry ($p<.50$) in any of the four adolescent groups were (a) a history of two or more stillbirths or neonatal deaths, (b) uterine anomaly or DES exposure, and (c) cyanotic heart disease or renal failure. Such events were quite rare among these young women. However, heart or kidney disease was of sufficient significance ($p<.50$) to be included in the models for white women ages 20 and 21.

All Women in the Program

Adjusted birthweight was regressed on the 16 variables from Ernest, et al. (in press), plus provider and more than one child in the home, using data from all women in the program. All variables except previous placenta previa, commuting more than 30 minutes, kidney or repeated urinary infections and two or more stillbirths or neonatal deaths were significant at $p<.05$ (See Table 10). Public provider and black race were associated with lower birthweight ($p<.0001$). Having more than one child under 18 in the home was associated with higher birthweight. The model explained 9.2% of the variability in birthweight, a higher percentage than was achieved by the models for the younger women.

Major Predictors of Birthweight

The purpose of this study was to find the best combination of weighted predictors of the criterion variable, birthweight, for the teenage mothers. Ten variables (a) previous premature or low birth weight baby, (b) smoking, (c) less than five feet tall, (d) less than one hundred pounds, (e) provider, (f) one spontaneous second trimester abortion (miscarriage), (g) repeat second trimester abortions, (h) being employed outside the home, (i) less than one year since last birth, and (j) kidney or repeated urinary infections) were significant ($p<.05$) predictors of low birthweight in the four regression

Table 10

<u>Predictors of Birthweight for All Women in the Program (N=25,945)</u>

Variable	t	Beta	Partial R-square	Cumulative R-square	F
Race	-231.0	-0.16	0.0265	0.0265	706.0*
Smoke	-216.4	-0.15	0.0289	0.0554	794.8*
Previous premature/low birthweight	-313.0	-0.12	0.0131	0.0686	365.8*
Under100	-304.3	-0.09	0.0091	0.0777	256.5*
Provider	63.8	0.05	0.0050	0.0827	142.0*
More than 1 child under 18 at home	110.6	0.07	0.0049	0.0876	140.4*
Age 16-19	-57.9	-0.03	0.0013	0.0889	37.1*
Uterine anomaly or DES exposure	-220.8	-0.03	0.0007	0.0896	19.9*
Under 16	-104.1	-0.03	0.0007	0.0903	20.1*
Dropout	-34.0	-0.03	0.0005	0.0909	14.6*
2nd trimester abortion(s)	-68.0	-0.02	0.0005	0.0913	14.0*
Cervical conization	-128.2	-0.02	0.0004	0.0918	12.5*
Last birth under 1 year	-33.4	-0.01	0.0002	0.0920	5.8**
Repeat abortion under 14 week	-29.4	-0.01	0.0001	0.0921	4.0**
Previous placenta previa	-50.3	-0.01	0.0000	0.0922	1.0
Commutes >30 mn	-13.6	-0.01	0.0000	0.0922	0.8
>2 stillbirths/ neonat deaths	-56.4	0	0.0000	0.0922	0.5
Kidney or urinary infections	-1.6	0			

*p<.0001 **p<.05 R-square=0.0922

analyses for teenage mothers (refer to Tables 4 through 9). After putting all of these significant predictors, plus race and age, in a final regression model, all but two remained significant at $p<.01$ (see Table 11). Not significant for these teenage mothers were (a) less than one year since last birth and (b) kidney or repeated urinary infections.

For use by clinicians, Ernest, et al. (1986) calculated risk scores from the data on all women. Unstandardized regression coefficients for variables predictive of preterm/low birthweight were divided by the largest coefficient for variables predictive of preterm/low birthweight. The results were multiplied by 10, and rounded off. Similarly, in this study, the variable with the largest regression coefficient was previous premature or low birthweight birth (refer to Table 11). The regression coefficient for that variable in the Final Model for teenagers was -283.0. To calculate risk weights, the regression coefficient for each of the other variables in the model was divided by 283.0. The result of that division was multiplied by 10 and rounded off, for each variable, yielding relative risk weights for assessing a woman's likelihood of having a low birthweight infant. The sum of the weights is the risk score.

The risk weights for teenagers, calculated from the Final Model of Table 11, are shown in the right hand column,

Table 11

Final Model of Predictors of Birthweight for Teenage Mothers

Variable	b	Beta	Partial R-square	Cumulative R-square	F
Smoke	-200.4	-0.13	0.0190	0.0335	103.90*
Race	-185.6	-0.15	0.0144	0.0144	77.22*
Under 100 lbs.	-225.8	-0.08	0.0102	0.0437	56.48*
Previous premature low birth wt. baby	-283.0	-0.08	0.0058	0.0495	32.28*
Under 5 ft.	-186.4	-0.06	0.0036	0.0531	20.05*
Provider	67.3	0.06	0.0030	0.0562	17.02*
Age	21.5	0.05	0.0018	0.0580	10.33**
1 spontaneous 2nd trimester abortion	-247.1	-0.04	0.0018	0.0598	10.00**
Repeat 2nd trimester abortion	-447.0	-0.03	0.0007	0.0605	3.87***
Employed	-31.5	-0.02	0.0004	0.0609	2.49
Variables Excluded by the Stepwise Procedure					
Less than one year since last birth	-0.3	-0.0	These variables did not meet the 0.5 significance level for entry into the Stepwise regression model		
Kidney or repeated urinary infections	-27.2	-0.01			

* p<.001   ** p<.01   *** p<.05   R-square=.060

Teenage Risk Weights (Final Model), of Table 12. Some variables in the model of Ernest, et al. (in press) did not appear in the Final Model because, for teenagers, they did not meet the criterion of $p<.5$ required for entry in the stepwise regression analysis.

The Final Model gives the highest weights to repeat second trimester abortion, one spontaneous second trimester abortion, previous preterm or low birthweight infant, weighing less than 100 pounds, race, provider, and smoking. All of the predictor variables used by Ernest, et al. (in press) in their full regression model were also used in the present research to do a regression analysis for the teenagers and for all women in the program, and to calculate risk weights. Those risk weights are shown in the second and third columns of Table 12 (labeled All Women Risk Weights and Teenage Risk Weights). The Final Model categorizes the abortion items differently, using two second trimester categories whereas Ernest used only second trimester abortion(s).

An interesting aspect of these comparisons is that several variables associated with low birthweight, using data from women of all ages, were actually associated with higher birthweight in this group of teenage mothers. These variables were uterine anomaly or DES exposure, more than

Table 12

Comparison of Risk Weights for Teenagers and All Women

Variable	All Women Risk Weights	Teenage Risk Weights	Teenage Risk Weights Final Model
Previous Preterm or LBW infant	10	10	6
Previous placenta previa	2	9	Excluded**
Less than 100 pounds	10	8	5
Smoke	7	7	4
Race (black)	7	7	4
Second trimester abortion(s)	2	4	10
Provider	2	2	2
Less than 16 years	3	1	0
Mt 1 child <18	+*	1	Excluded**
Kidney or repeat urinary infection	0	1	1
High school dropout	1	0	Excluded**
16-19 years old	2	0	0
Uterine Anomaly or DES exposure	7	+*	Excluded**
More than 2 Still-births or neonatal deaths	2	+*	Excluded**
More than two abortions at less than 14 weeks	1	+*	Excluded**
Less than 1 year since last birth	1	+*	Excluded**
Commute to work more than 30 minutes	0	+*	Excluded**
1 spontaneous 2nd trimester abortion	Not a category		6
Cervical conization	4	+*	+*

* For the teenagers, experiencing this variable was predictive of higher birthweight.

**Only variables significant ($p<.05$) in age <18 and age 18-19 analyses were included in this Final regression analysis two previous stillbirth or neonatal deaths, previous birth within one year, more than two abortions at less than 14 weeks, and cervical conization. A possible explanation is that risk assessment scores identified women in the program who had experienced these conditions. The women scored "at risk" due to these conditions were given intensive care and information designed to counteract the effects of the high risk condition. Perhaps for teenagers these measures were so intensive and effective that the variables became associated with higher, rather than lower, birthweights in the teenage group.

Another possible explanation is that teenagers who experience cervical conization or more than one birth within a year receive more and better health care after such an event. In the case of cervical conization, women who obtain Pap tests are more likely to have a condition diagnosed for which cervical conization is prescribed.

Perhaps women who have experienced cervical conization have also received more, and better, preventive medical care including Pap smears over an extended period of time. One reason women have Pap tests is that they are on oral contraceptive pills. It is conceivable that oral contraceptive use is associated with higher birthweight. Of course, the women in this study must not have been using oral contraception, or any effective contraception, at the time they became pregnant. In this study, for the control group of women of ages 20 and 21, cervical conization and less than one year since a previous birth were associated with low birthweight. The weights for previous placenta previa were 9 for the teenagers, 0 for young adults age 20 and 21, and 2 for all women.

It is difficult to explain why there should be these differences between women 19 and under and those ages 20 and 21. These clinical problems occurred rarely in young women. Perhaps the differences in significance reflect the rarity of occurrence, which may lead to the violation of assumptions of equal variance of the criterion variables and of uncorrelated errors, required by the regression procedures.

Rarely occurring conditions are of interest for clinical reasons as well. Ernest, et al. (in press) noted that a variable may not be a significant predictor statistically, due to the rarity of its occurrence, yet when a woman has that condition she is at very high risk and should receive extra care.

Risk weights for teenagers from Ernest's full regression model, using 18 variables (refer to Table 12, column labeled "Teenage Risk Weights,) and the risk scores calculated using the 12 variables of the Final Model are quite different. Variables from Ernest's model that were associated with a higher birth weight, when the regression analysis was done using teenage data and Ernest's regression model, were not included in the regression analysis for the Final Model because they were not significant at $p<.50$. When the regression analysis used teenage data only, but used Ernest's full model of 16 variables plus provider and more than one child under 18 in the home, the variable "previous placenta previa" had the high weight of 9 (refer to Table 12). However, when the Final Model was developed for the teenage data, using the 12 variables found to be significant in earlier regression equations by age and race (refer to Tables 4 through 9), previous placenta previa was not of sufficient significance to be included in the Final Model. The second trimester abortion variables had weights of 10 and 6 in the Teenage Final Model. In Ernest's full model, there was only one second trimester abortion category, one or more second trimester abortion(s), which had a weight of 4.

When the teenage risk weights, calculated with 18 variables (column 2) or with 12 variables (column 3), were compared with the risk weights for all women (column 1), the results were quite different (refer to Table 12). It appears that it is desirable to use a model for teenagers that differs from the model for women of all ages.

Therefore, a suggested scoring system for teenagers, combining the risk scores from the 18 variable teenage model and the 12 variable teenage model is shown in Table 13.

Ernest et al. (in press) noted that some conditions occur rarely, and therefore may not be statistically significant, but may be of importance in managing the patient's care. It is possible that the variables, DES exposure, previous stillbirths or neonatal deaths, more than two abortions at less than 14 weeks, commuting more than 30 minutes, less than one year since last birth and cervical conization fall into that category. Clinicians may want to flag those conditions by giving them the weights from the model for all women, while continuing to monitor the data from the teenagers in the ongoing program to see if these variables continue to be either not significant or associated with higher birthweight. It is probably better to be overly cautious than to ignore a condition which might indicate a serious problem. The variable, previous placenta previa, presents a similar problem. Since it had a weight of 9, using Ernest's model, but did not achieve the significance necessary to be included in the "Teenage Final Model" it seems prudent to heed the high risk score and include it in the scoring.

Table 13

Scoring System for Teenage Mothers, Calculated from Unstandardized Regression Coefficients

Variables	Weights
Previous Preterm or Low Birthweight Infant	10
Repeat second trimester abortions	9
Previous placenta previa	9
Weight less than 100 pounds	8
Smoking	7
Race (black)	7
Provider (public)	2
More than one child under 18 in the home	1
Kidney or repeat urinary infection	1
Age under 16	1

Risk weights for the control group in this study, that is the young adults ages 20 and 21, were between the weights for the teenagers and the weights for all women, but were more like the teenage scores. An exception was that a previous placenta previa had a weight of 9 for the teenagers, 2 for all women, and 0 for the young adults. Table 14 compares the risk weights for the three groups.

Partial R-square versus the Regression Coefficient as an Indicator of "Importance"

Howell (1982) considered the partial R-square to be a better indicator of importance than the regression coefficient. As a check, Table 15 compares the order of the 12 variables ranked by partial R-square and by the variable weights, using Ernest's weighting or scoring system (both calculated from the Teenage Final Model). The ranks are different when using the two measures of importance. However, if the ranks are split into a top and bottom half, with the variable "provider" in the middle in both, only the two second trimester abortion variables appear in different halves, using the two methods. If the regression analyses were obtained for a number of subsamples, it might be that the regression coefficients would show more variability than the partial R-squares. However, the results of the comparison between partial R-squares and the weights were much the same for the young adult (ages 20-21) group and for all women in the program.

The partial R-square is a direct indication of the variability in birthweight which can be attributed to a particular variable. The unstandardized beta weights, used by Ernest, et al. to obtain risk weights, are not adjusted for the standard deviation of the variables. It seems that

Table 14

Comparison of Risk Weights for Three Age Groups, Calculated from the 18 Variable Model: Ranked by Teenagers

Variables	Teen-Agers	Young Adults	All Women
Previous preterm/ LBW birth	10	10	10
Previous placenta previa	9	0	2
Under 100 pounds	8	10	10
Race	7	10	7
Smoke	7	7	7
Second trimester abortion(s)	4	2	2
Provider(public)	2	2	2
More than 1 child under 18 in the home	1	+	+
Kidney or Repeat urinary infections	1	2	0
Dropout	0		1
Repeat abortions under 14 weeks	+	2	1
Cervical conization	+	4	4
Previous stillbirths or neonatal deaths	+	1	2
Less than 1 year since last birth	+	1	1
Uterine anomaly or DES exposure	+	+	7

+Occurrence of these variables was associated with higher birthweights

Table 15

Comparison of Partial R-squares and Regression Coefficients as Measures of Importance, for Teenagers' Final Model: Ranked by Partial R-square

Variables	Rank by Partial R-square	Rank by Risk Weight
Race	1	5
Smoke	2	5
Under 100 lb.	3	4
Previous premature/ low birth weight baby	4	2
Under 5 ft.	5	5
Provider	6	8
Age under 16	7	11
1 spontaneous 2nd trimester abortion	8	2
Repeat 2nd trimester abortions	9	1
Employed	10	9
Kidney or repeated urinary infections	11	9
Other birth within a year	11	12

Note: 1=most important

the R-square ranks, or weights calculated by dividing each of the standardized betas by the largest standardized beta would be better indicators of relative risk. A good example is the Teenage Final Model, where repeat second trimester abortion had a regression coefficient of -447 and received the highest weight. The standardized beta for that variable would give a weight of 2 and rank ninth in importance. To make this study comparable to the work of Ernest, et al, risk scores have been calculated by Ernest's method. However, a reasonable recommendation appears to be to use the partial R-squares as an indication of importance, or to use the standardized betas divided by the largest standardized beta to yield risk weights. Such a method was used to obtain the set of risk weights shown in Table 16. These risk weights would be easy to use in the clinical setting and, statistically, are perhaps a better measure of importance.

Table 16

Recommended Risk Scores for Pregnant Teenagers Calculated from Standardized Beta Weights

Variable	Risk Score
Race (black)	10
Smoke	9
Under 100 pounds	6
Previous premature low birthweight baby	5
Under five feet	4
Provider (public)	4
Age under 16	3
One spontaneous second trimester abortion	3
Repeat second tri-mester abortion	2
Employed	2
Kidney or repeated urinary infections	1

CHAPTER IV

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary

Data for this research came from a prenatal program designed to reduce the incidence of low birthweight and preterm low birthweight births in 20 counties in western North Carolina. The program was administered through cooperating prenatal care providers. A protocol to assess risk of low birthweight and preterm low birthweight births was developed using a system of risk weights that permitted quick assessment in the medical office or clinic. Using the original clinical assessment, women who scored as high risk with regard to low birthweight and preterm low birthweight birth were given intensive observation and care as required. Women entered the prenatal care program voluntarily. The risk assessment protocol was administered when women first entered the program and at 28 weeks of gestation. Data such as birthweight, delivery method, infant's sex, and Apgar scores were recorded after the baby was born. During the three and a half years of operation, from July, 1984 through December, 1987, the program was successful in reducing the rates of low birthweight and preterm low birthweight births for women in the program, compared to the rates in the region before the program began.

However, the program has been less successful in reducing the rate of low birthweight and preterm low birthweight births among participating teenagers. This fact led the program administrators to ask if a different set of risk weights should be used to aid clinicians in providing appropriate care for the high risk group of teenage mothers.

Therefore, the purpose of this study was to identify the set of weights appropriate for use with adolescent mothers and to compare that set with the set used thus far to predict birthweight for women of all ages who participated in the program.

An advantage of this project was that it was possible to control for several important predictor variables, i.e., age, race, and prenatal care, although this study did not control for length of time in prenatal care. All women in the program received prenatal care. However, some women may have entered the program at six weeks since their last menstrual period and others may not have entered the program until their second or third trimester of pregnancy.

Data from the 5,270 women under age 20 who participated in the program were analyzed by age and by race and compared with data for women of ages 20 and 21 and with data from all 25,945 women in the program. Finally, a prediction model (the Final Model) was developed including age and race as predictors. Risk weights, calculated according to the method of Ernest et al. (in press) were developed for the teenage population. The continuous variable, birthweight, adjusted for baby's sex, was the dependent variable.

In the Final Model the variables with the highest partial R-squares were smoking, race, weight under 100 pounds, previous premature or low birthweight birth, height under five feet, care provider, age, one spontaneous second trimester abortion and repeat second trimester abortion (refer to Table 11). The variables weighted most strongly, using the method of Ernest et al. to calculate risk weights for the Final Model, were repeat second trimester abortions, previous premature or low birthweight infant, one spontaneous second trimester abortion, under 100 pounds, smoking, race, provider, age, more than one child under 18 in the home, and kidney or repeated urinary infections (refer to Table 12). The order of these lists was somewhat different. In particular, one spontaneous second trimester abortion achieved a more important rank using Ernest's scoring system than on the basis of the partial R-square (Refer to Table 15).

Using the teenage data, birthweight was regressed on the 16 variables from Ernest's full regression model plus the variables provider and more than 1 child under 18 in the home. With two exceptions the weights were the same using teenage data and either the 18 variable model or the 12 variable Final Model. Combining the results from the two models, a suggested scoring system for teenagers was developed (refer to Table 13). The highest risk weights were for previous low birthweight birth (10), previous placenta previa (9), second trimester abortion (9), weight under 100 pounds (8), smoking (7), and race (7).

Certain other conditions included in the Final Model analysis (uterine anomaly or DES exposure, more than two stillbirths or neonatal deaths, less then one year since last birth, more than two abortions at less than 14 weeks, commuting more than 30 minutes, and cervical conization) were associated with high birthweight, rather than low birthweight, in the teenage women. However, these problem conditions were important enough to have risk weights in the entire population of women participating in the prenatal program. It might be wise to include these variables in the model for now, using Ernest's weights for all women, while continuing to monitor the teenage data to see if these variables continue to be associated with high, rather than low, birthweights in the teenage population.

The purpose of this research was to compare the teenage mothers with the entire group of women in the program, to see if a different weighting system should be used for teenagers. The weighting system developed by Ernest, et al. was used to make that comparison. However, a better measure of importance might be the partial R-squares, or if a quick scoring system is desired for use in the clinical setting, the standardized beta weights could be used in a fashion analogous to the method of Ernest, et al. A scoring system for teenagers was developed, using standardized regression coefficients to calculate risk weights by dividing each standardized beta weight by the largest beta weight (Refer to Table 16). Using this scoring sytem, the variables weighted most highly were race, smoking, under 100 pounds, previous premature or low birthweight birth, under 5 feet tall, public provider, age under 16, one spontaneous second trimester abortion, being employed, and kidney or repeated urinary infections.

Discussion

A decision was made to include race as a predictor variable in the Final Model, rather than to develop separate scoring protocols for each race. Several variables were important for both races. When a variable was a significant predictor for one race but not for the other, it was included in the Final Model.

The frequency data for the teenagers in this study indicated that there were significantly higher rates of low birthweight births for black teenagers at age 15. There were no significant differences in birthweight, by race, in the other teen years.

When birthweight was regressed on predictor variables for two age groups, under 18, and 18 and 19, and by race, 10 predictors seemed to be important for teenagers. Birthweight was regressed on these 10 variables, plus race and age, in order to compare the risk factors for teenagers with the risk factors for all women in the study. Variables that were predictive of high risk, low birthweight births for both the teenagers and women of all ages (using the scoring system of Ernest et al.) were previous preterm or low birthweight baby, weighing less than 100 pounds, smoking, race, provider, and being under 16 years of age. Variables that were important for teenagers but did not appear in Ernest's 18 variable model were more than one child under 18 in the home, public provider, and one spontaneous second trimester abortion

Variables with high risk weights when calculated for all women in the study, but that did not have high weights when calculated for the teenagers were cervical conization and uterine anomaly or DES exposure.

Teen risk weights were also developed using Ernest's 18 variable model. These weights were similar to the Final Model, except that one spontaneous second trimester abortion was not a category. One or more second trimester abortion was a category, and received a weight of 4.

It is important to note, again, that partial R-squares or standardized beta coefficients are, statistically, better measures of the importance of variables than risk weights calculated from unstandardized regression coefficients. To develop a risk scoring system for clinical use, standardized regression coefficients for each variable in the model were divided by the largest standardized regression coefficient in the model for teenagers (refer to Table 16).

It was hypothesized that the variables provider and more than two children under 18 might be indicators of socioeconomic status and that these two variables would be significant predictors of low birthweight. Public care provider was a significant predictor of low birthweight for white teenagers but not for black teenagers in this study. However, nearly three-quarters of all black teenagers in the program obtained prenatal care from public providers.

The data available for this population do not permit us to probe more closely into the causal relationship between race, care provider, and birthweight. Do public patients receive less effective care? There is nothing here to indicate that is the case. In fact, public care providers were more apt to involve themselves in the prenatal care program. Do black teenagers in this study have lower income and is lower income the explanation for lower birthweights among blacks? Certainly, in the bivariate analysis, there was a higher percentage of black teenagers in public care, and black teenagers had significantly lower birthweights at age 15, but not at other ages. In the regression analyses, being black was a significant predictor of lower birthweight.

For black women ages 20 and 21, having two or more children under 18 in the home was predictive of higher birth weight ($p<.05$). However, the variable was not systematically related to birthweight for white women at that age, nor for teenagers of either race.

To shed light on the relation between economic status and birthweight, it would be desirable to include better indicators of socioeconomic status on the risk assessment form. However, it is difficult to ask patients about their income, unless they are in a public program available only to those under a certain income. Data about family education level might be helpful, and more easily obtained.

Kleinman and Kessel (1987) found being white, having less than 12 years of schooling, and being unmarried were associated with teenage low birthweight pregnancies. Being unmarried was not a significant predictor of birthweight in this study. That is, there was no systematic relationship between marital status and birthweight. The education variable was not a significant predictor in this study.

Lieberman, et al. (1987) found that being unmarried, being on welfare, being a high school dropout, and having had a previous premature or low birthweight birth were associated with low birthweight in their subjects. When several of these factors were considered together, race was not a factor. Of the variables which Lieberman, et al. found important, only a previous premature or low birthweight birth and receiving prenatal care from a public, rather than private, provider were predictive of low birthweight in the present study, after controlling for age, race, and prenatal care.

It should be noted that several variables included in the regression analyses were not predictive of low birthweight births in this group of teenagers. These variables were marital status, being a high school dropout, performing heavy or stressful work, commuting more than 30 minutes to work, less than 1 year between last birth and last menstrual period, and two or more previous still births or neonatal deaths.

Recommendations

A risk scoring system recommended for use with pregnant teenagers is shown in Table 16. From the present study, it can be concluded that the set of conditions most predictive of low birthweight birth for teenage mothers includes black race, smoking, weight under 100 pounds, previous premature or low birth weight baby, height under five feet, public care provider, being a younger teenager (under 16), and having had one or more spontaneous second trimester abortions.

A few of the predictors in the final set of teenage high risk factors may be subject to alteration or education. One such factor is smoking. Smoking was significantly associated with low birthweight births for women of all ages. Measures to educate women about the hazard that smoking presents to their infants should be strengthened.

Weighing under 100 pounds may also be an alterable variable. As a culture we tend to extol the value of being slender and teenagers seem to be especially receptive to that value. It has been shown that a critical weight is necessary for menarche, for continued menstruation, and for fertility (Frisch, 1988). As little as three pounds change in weight, at a certain weight/height ratio, can cause menstruation to cease or begin again. Underweight women have been shown to have later menarche, a smaller number of live births in a given age group, and a larger number of unsuccessful pregnancies (Frisch, 1988, p. 94). It is probably desirable to try to educate teenagers, pregnant or not, about good nutrition and healthy weight levels. Perhaps an attempt should be made to evaluate the nutritional status of women when they enter the program. Extra attention could then be given to women who are identified as undernourished or under 100 pounds. Women could also be urged to participate in the WIC program, if they qualify.

The proportion of the variablity in birth weight that could be explained by the variables in the models did not exceed 6% for any of the teenage models. The explained variance was only slightly better for women ages 20 and 21 and reached about 9% for all women in the study. This suggests that there is a need to identify and incorporate other variables that may be closely related to low birthweight into the assessment protocol. This study was confounded by the fact that women of all ages who scored at risk for low birthweight at their first prenatal visit received more intensive observation and care than did other women. When comparing teenage risk factors with risk factors for the entire group, there was not a confounding due to the extra care since intensive care was given to high risk women of all ages. However, the R-square, the proportion of variability explained by the model, may have been reduced to the extent that the extra medical attention received by women identified as high risk may have prevented some low birthweight births. Nevertheless, despite the extra care provided to high risk women, the rate of low birthweight births has not declined for teenagers in the program to the extent that the rate has declined for other women.

BIBLIOGRAPHY

Brown, S. S. (1985). Can low birth weight be prevented? Family Planning Perspectives, 17, 112-117.

Buescher, P. A., Meis, P. J., Ernest, J. M., Moore, M. L., Michielutte, R., & Sharp, P. (in press). A comparison of women in and out of a prematurity prevention project in a North Carolina perinatal care region. American Journal of Public Health.

Ernest, J. M., Michielutte, R., Meis, P. M., Moore, M. L., & Sharp, P. (in press). Identification of women at high risk for preterm-low birthweight births. Preventive Medicine.

Fedrick, J., & Anderson, A. B. (1976). Factors associated with spontaneous pre-term birth. British Journal of Obstetrics and Gynaecology. 83, 342-350.

Frisch, R. A. (1988). Fatness and Fertility. Scientific American. 258, 88-95.

Geronimus, A. T. (1986). The effects of race, residence, and prenatal care on the relationship of maternal age to neonatal mortality. American Journal of Public Health, 76, 1416.

Hanson, S. L., Myers, D. E., & Ginsburg, A. (1987). Reducing teenage out-of-wedlock childbearing. Journal of Marriage and the Family, 49, 241-256.

Higher neonatal mortality among blacks is not attributable to their higher rate of teenage births. (1987). Family Planning Perspectives, 19, 80-81.

Howell, D. C. (1982). Statistical methods for psychology. Boston: PWS Publishers.

Institute of Medicine. (1985). Preventing low birthweight. Washington, D. C.: National Academy Press.

Jones, E. F., Forrest, J. D., Goldman, N., Henshaw, S. K., Lincoln, R., Rosoff, J. L., Westoff C. F., & Wulf, D. (1985). Teenage pregnancy in developed countries: Determinants and policy implications. Family Planning Perspectives, 17, 53-63.

Kaltreider, D. F., & Kohl, S. (1980). Epidemiology of preterm delivery. Clinical Obstetrics and Gynecology, 140, 17-31.

Kleinman, J. C., & Kessel, S. S. (1987). Racial differences in low birth weight. The New England Journal of Medicine, 317, 749-754.

Lieberman, E., Ryan, K. J., Monson, R. R., & Schoenbaum, S. C. (1987). Risk factors accounting for racial differences in the rate of premature birth. The New England Journal of Medicine, 317, 743-748.

Makinson, C. (1985). The health consequences of teenage fertility. Family Planning Perspectives, 17, 132-139.

McCormick, M. C., Shapiro, S., & Starfield, B. (1984). High-risk young mothers: Infant mortality and morbidity in four areas in the United States, 1973-1978. American Journal of Public Health, 74, 18-23.

Moore, M. L., Meis, P. J., Ernest, J. M., Michielutte, R., Sharp, P., Grover, C., and Hill, C. (1986). A regional program to reduce the incidence of preterm birth. Journal of Perinatology, VI, 216-220.

Newcomer, S. and Udry, J. R. (1987). Parental marital status effects on adolescent sexual behavior. Journal of Marriage and the Family, 49, 235-240.

Risking the Future: A symposium on the National Academy of Sciences report on teenage pregnancy. (1987). Family Planning Perspectives, 19, 119-121.

Rodman, H., Lewis, C., and Griffith, S. L. (1984). The sexual rights of adolescents. New York: Columbia University Press.

SAS Institute Inc. (1985). SAS user's guide: Statistics, (Version 5 Ed.) Cary, N.C: SAS Institute Inc.

Singh, S., Torres, A., and Forrest, J. D. (1985). The need for prenatal care in the United States: evidence from the 1980 national natality survey. Family Planning Perspectives, 17, 118-119.

Teenage births decline. (1986, March/April). Family Planning Perspectives, 18, 87-88.

Teti, D. M., Lamb, M. E., and Elster, A. R. (1987). Socioeconomic and marital consequences of adolescent marriage. Journal of Marriage and the Family, 49, 499-506.

Tuck, S. M., Studd, J. W., and White, J. M. (1983). Pregnancy in women with sickle cell trait. British Journal of Obstetrics and Gynaecology, 90, 108-111.

Ventura, S. J. (1984). Trends in teenage childbearing, United States, 1970-1981. Vital and Health Statistics, Series 21, No. 41. Natality Survey. Cited in Family Planning Perspectives, 17, 118-120.

APPENDIX

RISK ASSESSMENT OF PRETERM DELIVERY

ID ______________________

INITIAL SCREEN

SOCIOECONOMIC CONDITIONS

Score	
1	2 or more children at home
3	8 years or less completed education
1	9-11 years high school, no degree
1	Less than 18 years old, not in school
4	Less than 16 years old
2	16-19 years old
2	Greater than 40 years old
2	Single gravida (unmarried) gravida
3	Less than 5 feet tall
3	Less than 100 pounds
1	Work outside home
3	Heavy physical or stressful work (patient's perception)
3	Greater than 30 minutes commute to work
2	Smokes > 10 cigarettes a day or uses snuff

PAST HISTORY

Score	
1	Only one abortion < 14 weeks
2	Two abortions < 14 weeks
3	Three or more abortions < 14 weeks
5	One second trimester abortion (spontaneous)
5	One second trimester abortion (induced)
10	Repeated second trimester abortions
10	Premature delivery or birth weight < 2500 g
5	Two or more previous still births/neonatal deaths
1	Less than one year since last birth to LMP
3	Cervical conization
4	Pyelonephritis or > 3 urinary tract infections
5	Uterine anomaly (except myoma) or DES exposure
3	History of placenta previa or abruptio
5	Cyanotic heart disease or renal failure
___	Preterm labor in previous pregnancy

_____ Total Score (A) _______ Initial

Risk of preterm delivery (circle one)

3 High (≥ 10) 2 Medium (6-9) 1 Low (≤ 5)

Date of Scoring _____ Month _____ Day _____ Year

REPEAT SCREEN (24-28 WEEKS)

CURRENT PREGNANCY

Score	
1	≥ 2 lb weight loss/month in 2nd trimester
3	Total weight loss of 5 lb by 26 weeks
2	Total weight gain ≤ 8 lb by 26 weeks
2	Persistent albuminuria > trace
2	Bacteriuria
5	Pyelonephritis in this pregnancy
3	Febrile illness
2	Hypertension ≥ 120/80 in 2nd trimester
10	Hemoglobinopathies (SS, SC, other)
3	Anemia < 9 g Hbc of < 28% hct
2	First trimester bleeding
4	Second trimester bleeding
4	Engaged head at 26 weeks
4	Effacement > 20% at 26 weeks
4	Dilution of internal os
4	Uterine irritability
5	Placenta previa (after 22 weeks with bleeding)
10	Polyhydramnios (confirmed by ultrasound)
5	Oligohydramnios (confirmed by ultrasound)
3	Large uterine fibroids (> 5 cm)
10	Multiple gestation
10	Abdominal surgery in this pregnancy
___	Total Score (B)

_______ Total Score (A + B) _______ Initial

Risk of preterm delivery (circle one)

3 High (≥ 10) 2 Medium (6-9) 1 Low (≤ 5)

Date of Scoring _____ Month _____ Day _____ Year

Special Instruction Given to High-Risk Mother _____ Initial Date _____

Patient Instruction Sheet Given _____ Initial Date _____

___ Please check here if woman hospitalized for preterm labor in this pregnancy

---

Patient Name ______________________ Date of Birth ______________ Race: White 1 Black 2 Other 3

County of Residence ______________________

Estimated Date of Confinement: Original ______________ Revised ______________

Physician/Health Department Name/Address: ______________________

For Gestations less than 20 weeks (this pregnancy):
Elective abortion _____ weeks gestation
Spontaneous miscarriage _____ weeks gestation

Delivery Information: Birth Weight ______________ Apgar Score (1) ________ (2) ________ Sex: Male 1 Female 2

Date of Birth _____ Month _____ Day _____ Year Method of Delivery: Cesarean 1 Vaginal 2

COMMENTS: ____

COPY 1 Please Send to Bowman Gray School of Medicine After Initial Screen

COPY 2 Please Send to Bowman Gray School of Medicine After Baby is Born

COPY 3 For Patient Record