WIC Prenatal Participation and Its Relation to Pregnancy Outcomes in Missouri: A Second Look

JOSEPH W. STOCKBAUER, MA

Abstract: We studied the association of WIC prenatal supplementation with pregnancy outcome using Missouri WIC participants who delivered in 1982 linked with their offspring's birth/fetal death certificates. A 93 per cent match rate resulted in a final study population of 9,411 pregnancies. A control population of like number was acquired by matching on key demographic characteristics.

The majority of the results generally confirm the results of a 1980 Missouri study; WIC participation was associated with decreases in low birthweight (7.8 vs 9.2 per cent), prematurity (9.7 vs 12.0 per cent) and inadequate prenatal care (30.5 vs 31.7 per cent), and an increase in mean gestational age (39.9 vs 39.6 weeks). Low birthweight rates were lower for infants of WIC participants in each of the risk categories reviewed. As noted in the 1980 study, duration of WIC of at least seven months was needed before improvements in birthweight outcomes measures were noted. (*Am J Public Health* 1987; 77:813–818.)

Introduction

The primary purpose of the Special Supplemental Food Program for Women, Infants and Children (WIC) is to enhance the health of expectant and lactating women, along with newborns and young children who are nutritionally at risk. The program attempts to achieve this objective by providing nutritional education, and supplemental foods which are rich in protein, iron, and vitamins A, C, and D.

The US General Accounting Office[1] (GAO) analyzed the evaluations of the WIC Program and found some favorable but no conclusive evidence on its overall effects, noting that six studies "are of high or medium quality" and "give some support, but not conclusive evidence, for the claims that WIC increases infant birthweights."[2]

The study presented here of 1982 Missouri WIC participants is a replication of an earlier study[2] which used 1980 Missouri resident WIC prenatals. The basic differences between this and the previous study are:

- The present study uses WIC prenatal population delivering in 1982; whereas, the previous study used WIC prenatal delivering in 1980.
- This study has approximately a 40 per cent larger population of WIC prenatals: 9,411 vs 6,732 for 1980.
- In 1982, WIC covered 112 Missouri countries, whereas in 1980 WIC covered 93 of Missouri's 114 countries; the city of St. Louis was included in both years. We estimate that 27 per cent of the eligible population was covered by the prenatal component of WIC in 1980 and 39 per cent in 1982.
- The methods employed to adjust for confounding variables are somewhat different in the two studies.
- For 1980, WIC used 195 per cent of poverty as a cutoff for participation whereas, for 1982, 175 per cent of poverty was used.

The administration of the WIC program was essentially the same in both years.

The major questions that this paper will focus on are:

- Is the outcome of pregnancy associated with WIC participation?
- Is the outcome of pregnancy associated with WIC enrollment different depending on length of participation?
- Are certain WIC risk categories more apt to be associated with prenatal nutrition supplementation than others?
- Do the results of this study coincide with those of the 1980 Missouri WIC evaluation?
- Does WIC participation during pregnancy overcome the negative effects of smoking during pregnancy?

Methods

Study Population

The study population (Missouri resident WIC participants delivering in 1982) represents 13.0 per cent of all Missouri resident births for 1982; those linked to birth/fetal death certificates represented 12.2 per cent (9,411 cases). Missouri had 98 WIC agencies located in 112 of its 115 counties in 1982. The three counties without a WIC program were very rural and sparsely populated, representing less than 1.3 per cent of Missouri births for the study year.

Data Sources and Linkage Procedures

A WIC-extracted master data set provided information on all program participants from November 1981 through April 1983. From this data set, a new one was created, consisting of those participants with estimated dates of delivery between November 1981 and April 1983. All WIC participants are included in the study regardless of the number of vouchers they received.

The WIC prenatal data set was linked with the birth/fetal death and the match birth/death data sets as outlined in a previous paper.[2]

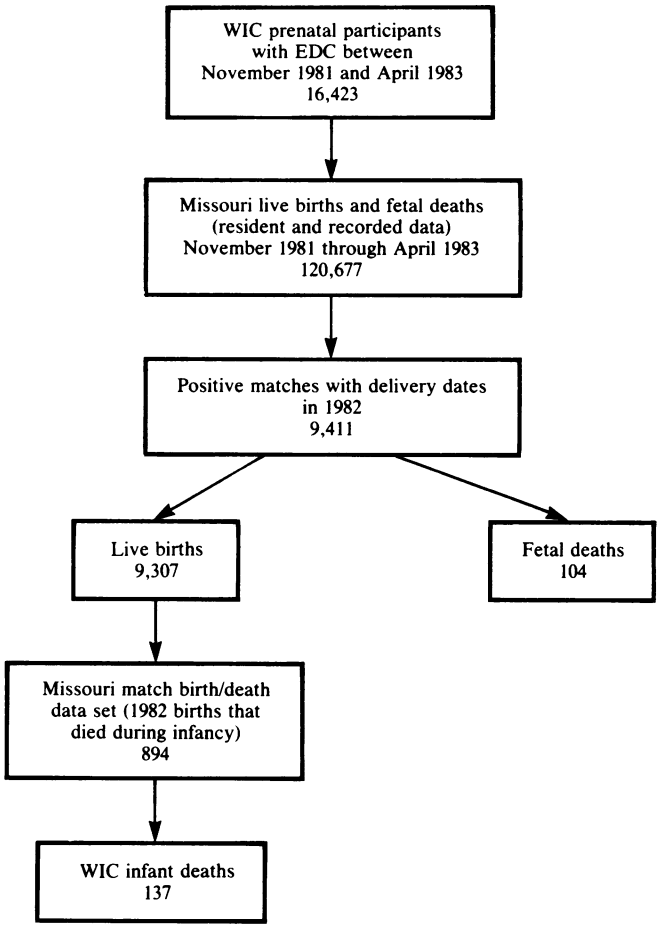
Figure 1 provides a summary of the matching procedure used. Approximately 93 per cent of the WIC records were linked to their respective birth/fetal death certificates. Through this process, 9,411 matches were found including 104 fetal deaths and 238 multiple fetuses. Table 1 provides a breakdown of the non-matches.

Control Population

A multivariate stratified matching technique was used to develop the control group from the remainder of 1982 Missouri resident births. The control group was developed using the mother's age, education, marital status, gravidity, number born this pregnancy, and child's race (Appendix A). A one-to-one match on all categories was found for 99.1 per cent of the WIC study group. Matches were found for the remaining 89 cases by relaxing the matching criteria for the

Address reprint requests to Joseph W. Stockbauer, MA, Research Analyst, Bureau of Health Data Analysis, State Center for Health Statistics, Missouri Department of Health, P.O. Box 570, Jefferson City, MO 65102. This paper, submitted to the Journal January 2, 1986, was revised and accepted for publication November 26, 1986.

FIGURE 1—Matching Process to Identify WIC Prenatal Participants in Missouri Who Delivered in 1982



EDC = Estimated Date of Confinement

TABLE 1—Breakdown of Missouri WIC Study Non-matches

WIC Prenatal Participants	10,405
Non-matches	994
1. Spontaneous Abortions	93
2. Birth occurred late 1981 or early 1983	66
3. Maternal death	2
4. Not pregnant	4
5. Induced abortion	5
6. Moved outside Missouri	67
7. Duplicate records	68
Subtotal	305
Non-matches because of inadequate information	689

Potential matches 10,405 − 305 = 10,100
Per cent matched (9,411/10,100) × 100 = 93.2%

weakest variables associated with the outcome measures by allowing matching using neighboring levels of up to two matching variables. No more than two variables for any given match were allowed to vary from one-to-one match. Fetal deaths were included as an outcome measure to allow matching for a live birth or fetal death.

Analysis

Table 2 shows that differences still prevailed for key confounding variables after matching. The greatest differences between the WIC and non-WIC groups were pre-pregnancy weight, smoking behavior during pregnancy and geographic region of residency (i.e., major metropolitan, minor metropolitan, and rural counties). In order to control for those confounders, analysis of covariance was used. Different analysis of covariance models were developed, and it was found that the results did not change with the addition of variables beyond the five with the greatest association (i.e., medical complication of pregnancy, pre-pregnancy weight, smoking behavior, race, and geographic region). Adding adequacy of prenatal care to the model did not change the results, nor did adding the mother's age, parity, education, legitimacy status, number born, or sex of child—singularly or in any combination (data available on request to author).

Length of WIC participation was calculated using dollar amount of redeemed food vouchers. Cost data were unavailable for approximately 8 per cent of the WIC prenatal participants and, for these, the difference between original certification date and date of birth was used to estimate cost.

TABLE 2—Per cent Distributions of WIC and Non-WIC Prenatal Populations by Selected Variables Available on Missouri Birth Certificates

Variables	Per Cent WIC	Per Cent Non-WIC
Pre-pregnancy weight*		
Greater or equal to 20 per cent overweight for height	18.1	13.5
Greater or equal to 10 per cent underweight for height	11.3	10.6
Smoking during pregnancy		
Less than a pack	26.0	23.9
One pack plus	18.9	16.8
Spacing between pregnancies less than 18 months	19.1	18.0
Medical complications of pregnancy associated with birthweight and length of pregnancy	15.5	14.7
Geographic Region of State		
Major Metro	53.5	60.4
Minor Metro	14.5	14.5
Rural	32.0	25.1
WIC risk identifiable from birth certificate**	55.5	51.3
WIC Medical risk conditions**	5.1	4.5
Sex of child—Male	50.6	51.3
N	9,411	9,411

*According to 1959 Metropolitan Life Insurance weight for height tables, also adjusting for age.

**Age of mother 17 or less or over 34 or previous pregnancies 4+ or birth spacing less than 18 months or mother more than 19 per cent overweight or more than 9 per cent underweight or previous infant death or previous stillbirth or at least three spontaneous abortions or a multiple birth or a WIC medical complication.

***Diseases and conditions complicating present pregnancy such as diabetes, hypertension, renal disease, sickle cell diseases, tuberculosis, and heart disease.

Results

Pregnancy Outcome Results

Table 3 provides the overall and racial WIC vs non-WIC comparisons on selected pregnancy outcome measures. Participation in WIC is associated with a 16 per cent decrease in the percentage of infants born weighing less than 2,500 grams (22 per cent for Blacks* vs 10 per cent for Whites) and a 27

*"Black" is comprised of 97 per cent Black, 2 per cent Asian and Pacific Islanders, and 1 per cent American Indian.

TABLE 3—WIC/Non-WIC Comparisons on Selected Adjusted† Pregnancy Outcome Measures by Race

	Total				White				Black			
	WIC	Non-WIC	Difference	95% CI	WIC	Non-WIC	Difference	95% CI	WIC	Non-WIC	Difference	95% CI
Mean Birthweight (g)	3,252	3,252	0	(−15, +15)	3,318	3,337	−19	(−38, 0)	3,127	3,091	+36	(+10, +62)
Per cent Low Birthweight	7.7	9.2	−1.5	(−2.3, −0.7)	6.6	7.3	−0.7	(−1.6, +0.2)	10.0	12.8	−2.8	(−4.3, −1.3)
Per cent Very Low Birthweight	1.01	1.38	−0.37	(−0.68, −0.06)	0.87	0.93	−0.06	(−0.40, +0.28)	1.33	2.17	−0.84	(−1.47, −0.21)
Per cent over 4,499 grams	1.2	1.4	−0.2	(−0.5, +0.1)	1.5	1.7	−0.2	(−0.7, +0.3)	0.6	0.8	−0.2	(−0.6, +0.2)
Per cent Small for Gestational Age*	6.0	5.6	+0.4	(−0.3, +1.1)	5.3	4.4	+0.9	(+0.1, +1.7)	7.5	7.7	−0.2	(−1.5, +1.1)
Mean Gestational Age (weeks)	39.9	39.6	+0.3	(+0.1, +0.5)	40.2	40.0	+0.2	(0, +0.4)	39.3	38.9	+0.4	(+0.6, +0.2)
Per cent Premature (<37 weeks)	9.5	12.2	−2.7	(−3.6, −1.8)	7.5	9.4	−1.9	(−2.9, −0.9)	13.5	17.3	−3.8	(−5.6, −2.0)
Per cent Extremely Immature (<28 weeks)	0.56	0.91	−0.35	(−0.60, −0.10)	4.7	5.4	−0.7	(−0.96, −0.44)	0.77	1.55	−0.78	(−1.31, −0.25)
One-Minute Apgar <6	6.9	6.9	0	(−0.7, +0.7)	6.9	6.7	+0.2	(−0.7, +1.1)	7.0	7.1	−0.1	(−1.4, +1.2)
Five-Minute Apgar <6	1.3	1.5	−0.2	(−0.4, +0.1)	1.2	1.3	−0.1	(−0.5, +0.3)	1.6	1.9	−0.3	(−1.0, +0.4)
Fetal Mortality (≥20 weeks gestation)	17.3	17.7	−0.4	(+3.5, −4.3)	13.7	14.3	−0.6	(−4.9, +3.7)	24.6	23.8	+0.8	(+8.5, +6.9)
Neonatal Mortality (<28 days)	7.2	8.5	−1.3	(+1.3, −3.9)	6.7	6.7	0	(−3.0, +3.0)	8.5	11.4	−2.9	(−7.9, +2.1)
Per cent Inadequate Prenatal Care**	30.4	31.7	−1.3	(0, −2.6)	29.5	28.4	+1.1	(−0.5, +2.7)	32.1	37.9	−5.8	(−8.1, −3.5)
N***	9,411	9,411			6,095	6,095			3,316	3,316		

CI = Confidence Interval

†Covariates for all birthweight, gestational age, and Apgar scores and mortality outcome measures were pre-pregnancy weight, age, education, smoking, medical complications of pregnancy, adequacy of prenatal care, sex, geographic region, purality, parity and race for total. For each race group race was dropped and legitimacy status added. The inadequate prenatal care model was the same as for the other outcome models except adequacy of prenatal care was taken out.

*Small for gestational age was defined as those below the 10th percentile for any given gestational age using Brenner series.[3]

**Inadequate prenatal care defined as: fewer than five prenatal visits for pregnancies less than 37 weeks, fewer than eight visits for pregnancies 37 weeks or longer or care beginning after the first four months of pregnancy.

***Ns vary a little because of differences in number of unknown for each outcome measure.

TABLE 4—WIC/Non-WIC Comparisons for Adjusted† Mean Birthweight and Low Birthweight Rates by WIC Cost* by Race

	N	Mean Birth Weight (grams)	Difference WIC-Non-WIC	95% CI of Difference	Low Birth-weight Rate (%)	Difference WIC-Non-WIC	95% CI of Difference
(Total Non-WIC)		(3,264)			(8.7)		
WIC Food Cost							
<$110	3,050	3,224	−40	(−60, −20)	8.8	+0.1	(−0.9, +1.1)
$110–$219	4,552	3,238	−26	(−44, −8)	7.9	−0.8	(−1.7, +0.1)
$220+	1,259	3,314	+50	(+80, +20)	7.1	−1.6	(−3.1, −0.1)
(White Non-WIC)		(3,349)			(6.7)		
WIC Food Cost							
<$110	1,997	3,301	−48	(−73, −23)	7.2	+0.5	(−0.7, +1.7)
$110–$219	2,845	3,300	−49	(−71, −27)	6.7	0.0	(−1.0, +1.0)
$220+	903	3,382	+33	(+68, −2)	6.0	−0.7	(−2.3, +0.9)
(Black Non-WIC)		(3,109)			(12.1)		
WIC Food Cost							
<$110	1,053	3,087	−22	(−56, +12)	11.9	−0.2	(−1.8, +2.2)
$110–$219	1,707	3,119	+10	(+39, −19)	10.2	−1.9	(−3.6, −0.2)
$220+	356	3,190	+81	(+135, +27)	8.5	−3.6	(−6.7, −0.5)

CI = Confidence Interval

†Covariates in model were length of pregnancy, medical pregnancy complications, smoking behavior during pregnancy, pre-pregnancy weight, and geographic area.

*WIC cost used as an indicator of duration of WIC participation during pregnancy (see text).

per cent decrease in the per cent of infants born weighing less than 1,500 grams. Overall, no difference was noted for mean birthweight and a very small difference was noted for per cent small for gestational age (as defined by Brenner, *et al* [3]). Per cent premature (< 37 weeks) and extremely immature (< 28 weeks) were lower by 22 and 38 per cent, respectively, for WIC participants. Again effects were most pronounced in Blacks as is true for virtually all other outcomes measured.

Duration of WIC Participation and Pregnancy Outcome

A mean duration of 4.3 months is noted for prenatal participants in WIC who delivered in 1982. The average

TABLE 5—WIC/Non-WIC Comparisons for Adjusted† Low Birthweight Rates for WIC Risk Categories Available on the Missouri Birth Certificate

	Total			White			Black		
	N	Difference WIC-Non-WIC	95% CI	N	Difference WIC-Non-WIC	95% CI	N	Difference WIC-Non-WIC	95% CI
Total with any WIC Risk category from birth certificate	8,426	−2.2	(−3.5, −0.9)	5,308	−1.2	(−2.7, +0.3)	3,118	−4.3	(−6.7, −1.9)
Having more than one risk category from birth certificate	2,118	−2.7	(−6.8, +0.4)	1,275	−1.1	(−4.9, +2.7)	843	−5.5	(−10.7, −0.3)
Spacing <18 months	1,707	−1.3	(−3.8, +1.2)	1,066	+0.2	(−2.7, +3.1)	641	−4.0	(−8.7, +0.7)
Mother age <18 years	2,335	−1.9	(−4.2, +0.4)	1,384	−2.1	(−4.8, +0.6)	951	−1.5	(−5.5, +2.5)
Mother age >34 years	434	−5.1	(−10.0, −0.2)	280	−0.8	(−6.8, +5.2)	154	−11.8	(−20.7, −2.9)
Previous pregnancies 4+	1,402	−2.4	(−5.4, +0.6)	812	−2.0	(−5.8, +1.8)	590	−2.5	(−7.4, +2.4)
Previous bad outcome*	968	−4.8	(−8.8, −0.8)	574	−1.9	(−6.9, +3.1)	394	−8.8	(−15.5, −2.1)
WIC Medical risk**	898	−2.1	(−6.9, +2.7)	540	+1.1	(−4.7, +6.9)	358	−5.4	(−13.7, +2.9)
Multiple pregnancy	426	−11.1	(−19.4, −2.8)	268	−8.2	(−18.4, +2.0)	158	−19.3	(−33.4, −5.2)
10%+ underweight	1,880	−0.3	(−2.9, +2.3)	1,307	+0.2	(−2.8, +3.2)	573	−1.0	(−6.3, +4.3)
20%+ overweight	2,719	−2.0	(−3.6, −0.4)	1,701	−0.9	(−2.7, +0.9)	1,018	−4.1	(−7.2, −1.0)

CI = Confidence Interval
*Previous bad outcome includes neonatal deaths, spontaneous abortions 3+ and stillbirths.
**Medical complication (e.g., diabetes mellitus, renal disease
†Covariates for above model were pre-pregnancy weight, smoking behavior during pregnancy, medical complications of pregnancy, adequacy of prenatal care, mother's age and geographic area of residency.

monthly cost for women who redeemed vouchers for 1982 was about $37; we assumed that less than $110 is the cost for less than three months, $110 to $219.99 for three to six months, and $220 or more for longer than six months participation.

Table 4 shows that duration in WIC needs to be at least seven months before there is a gain in mean birthweight (+50 grams) and a reduction in low birthweight (LBW) of 18 per cent. Again, the overall gain in birthweight and reduction in LBW is greater for Blacks.

WIC Risk Categories and Pregnancy Outcomes

Table 5 shows LBW rates for different WIC risk categories. A lower LBW rate was noted for all of the WIC risk categories for WIC prenatals. Overall, the largest reductions in LBW rates were recorded for the WIC risk categories of mothers age 35 or older (5.2 vs 10.3 per cent), mothers 20 per cent or more overweight for height (4.9 vs 6.9 per cent), and previous bad outcomes (12.4 vs 17.2 per cent). For White WIC prenatals, the largest reductions in LBW rates were recorded for the WIC risk category of mothers age 17 and younger (6.6 vs 8.7 per cent).

WIC Participation: Smoking and Pregnancy Outcome

Smoking is a risk category not covered by the WIC program but strongly related to birthweight. Smoking during pregnancy was recorded on the birth certificate for 44.9 per cent of the WIC prenatals and 40.7 per cent of the non-WIC group. This compares to an overall smoking rate of 30 per cent for Missouri resident women who delivered in 1982.

Table 6 suggests that for Black WIC participants there was an incremental increase over Black non-WIC participants in mean birthweight associated with the amount the mother smoked during her pregnancy but that was not manifest for White WIC participants.

Table 6 also shows that WIC participants, regardless of

TABLE 6—WIC/Non-WIC for Adjusted† Birth Outcome Measures by Race and Smoking Status

	Number		Mean Birthweight				Low Birthweight			
Race/Smoking	WIC	Non-WIC	WIC (grams)	Non-WIC (grams)	Difference	95% CI	WIC (%)	Non-WIC (%)	Difference	95% CI
White										
Nonsmokers	2,893	3,261	3,426	3,445	−19	(−45, +7)	4.5	5.4	−0.9	(−2.1, +0.3)
<1 pack per day	1,398	1,227	3,246	3,246	0	(−40, +40)	7.9	8.9	−1.0	(−2.8, +0.8)
≥1 pack per day	1,455	1,196	3,138	3,173	−35	(−75, +5)	9.9	10.0	−0.1	(−1.9, +1.7)
Black										
Nonsmokers	1,933	1,893	3,185	3,163	+22	(−11, +55)	8.2	10.7	−2.5	(−4.4, −0.6)
<1 pack per day	867	837	3,044	2,984	+60	(+10, +110)	11.9	15.8	−3.9	(−6.7, −1.1)
≥1 pack per day	213	269	2,969	2,893	+76	(−19, +171)	16.6	18.8	−2.2	(−7.5, +3.1)
Total										
Nonsmokers	4,826	5,154	3,344	3,347	−3	(−24, +18)	5.7	7.3	−1.6	(−2.6, −0.6)
<1 pack per day	2,265	2,064	3,179	3,155	+24	(−7, +55)	9.2	11.4	−2.2	(−3.7, −0.7)
≥1 pack per day	1,668	1,465	3,062	3,080	−18	(−55, +19)	11.9	12.5	−0.6	(−2.4, +1.2)

CI = Confidence Interval
†Covariates in models were pre-pregnancy weight, medical complications of pregnancy, adequacy of prenatal care, geographic area of residency, age, education, parity, purality, sex and race for total. For each race group race was dropped and legitimacy status was added.

race and smoking status, had lower low birthweight rates than their non-WIC counterparts. However, the differences between the WIC and non-WIC groups in low birthweight rates did not increase with increasing amount smoked.

Discussion

The majority of the results confirm previous WIC evaluation results showing WIC participation to be associated with certain pregnancy outcome measures and to be most advantageous for the Black WIC population. Also, as noted in the previous study,[2] duration of participation in WIC is solidly related to an increase in mean birthweight and a reduction in low birthweight.

As with other studies, there may be other key variables that are strongly related to the outcome measures but were not available for control. Weight gain during pregnancy and birthweight of previous live born infants are two potential confounding variables that were not available for inclusion.

Ninety-three per cent of the infants of the WIC participants were matched with their corresponding infants' birth certificates. It is possible that part of the remaining 7 per cent could have been in the non-WIC group. Some of the remaining non-matches may have been due to: spontaneous or induced abortions, birth/fetal death occurring in 1981 or 1983, moving out of Missouri, or not being pregnant. There was no difference between the WIC non-matched and matched records with respect to age, education, race, WIC agency, and WIC risk factors.

This study, as well as all previous WIC studies, is retrospective in design by necessity. The confounding of self-selection is present and therefore the motivation of the two groups could be entirely different. As others have noted, the WIC group could be comprised of individuals who are more highly motivated to have a healthy baby than the non-WIC group.

Another potential source of error is the lack of accuracy for the data items used from the Missouri certificate of live birth. Missouri has an extensive editing and querying program with its vital records system. The number of missing records is less than 2 per cent for the demographic variable (including smoking, prepregnancy weight and height) on the birth certificate. Month of last normal menses is noted as unknown for 1.7 per cent of births; however, exact day of the month is noted as unknown for 20 per cent, with the fifteenth being imputed for these cases.

A comparison of the 1980 National Natality Survey data set with the 1980 Missouri live birth data set showed very similar distributions for smoking behavior and pre-pregnancy weight. Smoking status was self-reported in both cases. Medical complications of pregnancy are grossly underreported on birth records. However, in our comparison of hospital discharge obstetrical records resulting in a delivery with birth records, it was found that the underreporting does not vary by geographic region for Missouri. From what is known at this time, there is no reason to assume that the amount of misinformation and underreporting differ for the WIC and the non-WIC group.

This study shows, as did our previous study[2] and those of Schramm,[3] Kotelchuck,[4] and Edozien,[5] small differences in mean birthweight, but larger reduction in low birthweight and increase in mean gestational age.

Length of time on WIC is strongly tied to length of pregnancy and, because of that, length of pregnancy was added into the covariate model. That the mean birthweight for WIC participants of less than seven months is less than the non-WIC group could be due to several factors. First, the observed gestational age as computed using last normal menses (LNM) from the birth certificate could be a poor reflection of the true gestational age. However, there is no reason to assume that the error in reporting of LNM is different for the WIC than the non-WIC groups.

Another potential reason for the mean birthweight being lower for WIC participants of less than seven months is that the effects of nutritional supplementation on fetal growth varies with when it started and how long it lasted. That all WIC participants were included in the study means that some became certified for WIC but never returned due to early delivery, because they were not motivated enough to continue, or because they entered WIC late in their pregnancy. If the matching worked one might expect little differences between the non-WIC and the WIC group with little or no duration of participation (less than $110) as is the case for Blacks; however, for Whites, mean birthweight is lower for both WIC groups participating less than seven months (Table 3).

As noted in the 1980 study, stronger relations were found for Black than for White WIC participants. Similar results were found by Schramm[3] and Kotelchuck.[4] This could be due to the Black WIC participants having more risk conditions that can be influenced by nutrition than White WIC participants or that not enough information was available to equate the two White groups to see if there was a treatment effect.

In reviewing when women entered WIC, it was found that Whites were more apt than Blacks to enter WIC late in their pregnancies.

Smoking cessation is not a standard part of the National WIC program. However, from the results of the present study and that of Schramm[8] and others[7,11,12] it would be wise to look at the inclusion of smoking cessation programs as a part of the emphasis of WIC for prenatal participants. It is estimated that "a moderately successful smoking cessation program incorporated as a part of WIC statewide could increase the mean birthweight of WIC babies by approximately 23 grams and decrease the low birthweight rate by 0.1 per cent for all Missouri births"**

APPENDIX A

Matching Criteria Used to Develop Pair-Match Study Group

Mother's age: 10–15, 16–17, 20–24, 25–29, 30–34, 35–49, unknown
Mother's education: 0–8, 9–11, 12, 13–16, 17+, unknown
Marital status: Married, Unmarried
Gravidity: 1, 2, 3, 4, 5+
Child's Race: White, Black†

ACKNOWLEDGMENTS

The author thanks Richard Blount, Director of the Missouri WIC Program, for his support of this study; Wayne Shramm, Chief, Bureau of Health Data Analysis and Garland Land, Director of the Missouri Department of Health's Division of Health Resources, for their critical review and comments on the paper; William Gathright of the Missouri Center for Health Statistics for developing the SAS program to produce the control group; and Katherine Binkley for the Missouri Center for Health Statistics for assistance in preparing the data and manuscript.

**Land GH, Stockbauer JW: Missouri Maternal Smoking Trends and Variations by Sociodemographic Characteristics and Public Program Participation. Paper presented at the International Conference on Smoking and Reproductive Health October 16, 1985, San Francisco.

†Black is comprised of 97 per cent Black, 2 per cent Asian and Pacific Islanders, and 1 per cent American Indian.

REFERENCES

1. General Accounting Office: WIC Evaluations Provide some Favorable but no Conclusive Evidence on the Effects Expected for the Special Supplemental Program for Women, Infants, and Children. PEMD-84-4. Washington, DC: Government Printing Office, 1984.
2. Stockbauer JW: Evaluation of the Missouri WIC program: prenatal component. J Am Dietet Assoc 1986; 86:61–67.
3. Brenner WE, Edelman DA, Hendricks CH: A standard of fetal growth for the United States of America. Am J Obstet Gynecol 1976; 126:555–564.
4. Schramm WF: WIC prenatal participation and its relationship to newborn Medicaid costs in Missouri—a cost/benefit analysis. Am J Public Health 1985; 75:851–857.
5. Kotelchuck M, Schwartz, Anderka M, Finison K: WIC participation and pregnancy outcomes: Massachusetts Statewide Evaluation Project. Am J Public Health 1984; 74:1086–1092.
6. Edozien JC, Switzer BR, Bryan RB: Medical evaluation of the Special Supplemental Food Program for Women, Infant, and Children. Am J Clin Nutr 1979; 32:677–692.
7. Kennedy ET, Gershoff S, Reed RB, Austin JE: Evaluation of the effect of WIC supplemental feeding on birthweight. J Am Dietet Assoc 1982; 80:220–227.
8. Niswander JR, Gordon M (eds): The Women and Their Pregnancies. The Collaborative Perinatal Study of the National Institute of Neurological Diseases and Stroke. Bethesda, MD, NINDS, 1972.
9. Schramm WF: Smoking and pregnancy outcome. Mo Med 1980; 77:619–626.
10. Bailey LB, O'Farrell-Ray B, Mahan CS, Dimperio D: Vitamin B_6, iron and folacin status of pregnant women. Nutr Res 1983; 3:783–793.
11. Metcoff J: Nutrition in pregnancy. Final report. Oklahoma City: Univ. of Oklahoma Health Science Center, 1982.
12. Scott A, Moar V, Ounsted M: The relative contributions of different maternal factors in small-for-gestational-age pregnancies. Eur J Obstet Gynaecol Reprod Biol 1981; 12:157–165.
13. Haworth JC, Ellestad-Sazed JJ, King J, Dilling LA: Fetal growth retardation in cigarette-smoking mothers is not due to decreased maternal food intake. Am J Obstet Gynecol 1980; 137:719–723.

ERRATA

In: Kaplan GA, et al: Mortality among the elderly in the Alameda County study: Behavioral and demographic risk factors. Am J Public Health 1987;77:307–312. The following errors should be noted and corrected:

- Tables 2 and 3, p 309, change "moderate/else" to "else/moderate"
- p 309, line 1, left-hand column, text should read "had not maintained moderate relative weight"
- Appendix (p 312): categories for weight should read "Moderate (9.9% underweight to 29.9% overweight)/other"

* * * * *

In: Miller WJ, Stephens T: The prevalence of overweight and obesity in Britain, Canada, and United States. Am J Public Health 1987;77:38–41. Table 2 has the following error: The % overweight among women age 45–54 in the United States should read 28 rather than 48.

* * * * *

In: Mattson ME, Pollack E, Cullen J: What are the odds that smoking will kill you? Am J Public Health 1987;77:425–431.

In APPENDIX 3 (p 430) a typographical error occurred on calculating the odds of dying of smoking-induced disease. In step 3, the authors calculate the number exposed to the risk of dying of lung cancer in a given interval as:

$$1^*_x = 1_x\,(1-1/2q_{xA})$$

This result is then used in step 4 to obtain the expected number of deaths from lung cancer in a given interval:

$$D_{xL} = q_{xL}\,1^*_x$$

In spite of the typo in the published version, the authors assure the readers that they *did* use the value derived in step 3 as the base number in the calculation in step 4. No recalculations are needed.