Is Incarceration during Pregnancy Associated with Infant Birthweight?

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ABSTRACT

Objectives. This study examined whether incarceration during pregnancy is associated with infant birthweight.

Methods. Multivariable analyses compared infant birthweight outcomes among three groups of women: 168 women incarcerated during pregnancy, 630 women incarcerated at a time other than during pregnancy, and 3910 women never incarcerated.

Results. After confounders were controlled for, infant birthweights among women incarcerated during pregnancy were not significantly different from women never incarcerated; however, infant birthweights were significantly worse among women incarcerated at a time other than during pregnancy than among never-incarcerated women and women incarcerated during pregnancy.

Conclusions. Certain aspects of the prison environment (shelter, food, etc.) may be health-promoting for high-risk pregnant women. (*Am J Public Health.* 1997;87:1526–1531)

Introduction

In 1994, over 64 000 women were incarcerated in US prisons.[1] Although females compose a minority of all US prison inmates, the growth of female incarceration has been much greater than that of male incarceration.[2]

Approximately 6% of the women entering US prisons are pregnant[3]; however, there is no consensus concerning the impact that incarceration has on their health and pregnancy outcomes. One viewpoint is that incarceration is detrimental to the well-being of pregnant women and their unborn babies because of stresses caused by imprisonment. Incarceration of pregnant women may emotionally traumatize the women through environmental restrictions, separation from family/friends, and concerns regarding the placement of the expected baby (newborns are usually placed with the women's families soon after delivery).[4,5] Others have proposed that incarceration may enhance the health of some pregnant women and may foster healthy pregnancy outcomes. Proponents of this view argue that incarceration may improve women's health by supplying these often high-risk women with shelter and regular meals, restricting their alcohol and illicit drug use, limiting physically demanding work, eliminating sexual intercourse with male partners, and eliminating physical/sexual abuse by their male partners.[6,7] Furthermore, prisons are required to provide all pregnant inmates with appropriate prenatal health care services. These differences of opinion concerning the impact of incarceration on pregnant women's birth outcomes flourish owing to the paucity of research in this area.[8]

A few studies have examined the birth outcomes of incarcerated pregnant women, but without reference to comparison groups of nonincarcerated pregnant women. Two small-scale ethnographic studies of pregnant inmates in the midwestern United States found that about a quarter of the women delivered infants with severe health problems.[9,10] In contrast, an Ohio study of 106 pregnant inmates found that longer durations of incarceration were associated with better birth outcomes than shorter durations.[11]

Other studies have compared pregnancy outcomes of inmates to pregnancy outcomes of nonincarcerated high-risk women. A southeastern US study detected no significant difference between the average birthweight of 69 infants born to prison inmates and 68 infants born to prenatal care patients of a health department.[12] A report focusing on English women noted that stillbirths were more common among pregnant women on probation compared with pregnant prisoners.[13]

The present study extends this small body of research by examining the birthweights of infants born to three relatively large and representative samples of pregnant women in North Carolina: women who experienced incarceration during at least part of their pregnancy, women who experienced incarceration at a time other than during pregnancy, and women who never experienced incarceration. The mean infant birthweights and the proportions of low-birthweight infants (infants weighing less than 2500 grams) are compared across the three groups of women, with potentially confounding variables controlled for. In addition, this study examines whether there is a linear "exposure–response" relationship between the proportion of pregnancy spent incarcerated and infant birthweight.

Methods

Sample Selection

North Carolina prison records were matched to North Carolina vital/health

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statistics records to identify both women who had been in prison in North Carolina during at least part of their pregnancy and women who had been in prison at a time other than during their pregnancy. Specifically, North Carolina Department of Corrections' records, which documented female prison inmates of the North Carolina Correctional Institution for Women during a 5-year period (from January 1, 1987, through December 31, 1991) were computer-matched to linked North Carolina birth certificate/Medicaid records that covered a 4-year period (from January 1, 1988, through December 31, 1991). Approximately 5% of the total possible births (20 842 of the 413 372 North Carolina births over the 4 study years) were excluded from the matching procedure, including nonsingleton births, births to non–North Carolina residents, and births to women who were aged less than 16 years or greater than 45 years.

This matching procedure identified 1657 live-born infants delivered to 1238 different women who had been incarcerated either during at least part of their pregnancy or at a time other than during their pregnancy. A total of 885 (71%) of these 1238 women were pregnant and gave birth to only one infant during the 4-year period (1988 through 1991). The remaining 353 women (women who were pregnant more than once and who gave birth more than once during this period) were excluded from further analysis. Complete prison and birth certificate/Medicaid information was available for 798 (90%) of these 885 women. This paper focuses on these 798 women with complete information, 168 (21%) who had been incarcerated for at least part of their pregnancy and 630 (79%) who had been incarcerated at some point other than during their pregnancy.

A comparison group of 4000 North Carolina women who gave birth to exactly one infant between January 1, 1988, and December 31, 1991, but who had not been incarcerated between January 1, 1987 and December 31, 1991, was randomly selected from the data file, with 1000 women being selected for each of the 4 birth years (1988 through 1991). Complete information was available on 3910 (98%) of the women who compose the never-incarcerated comparison group for this study.

Assessment

Several types of information were available through the linked birth certificate/Medicaid data file, including sociodemographic information (the women's racial/ethnic group, age, marital status, and education level) and information concerning the women's use of cigarettes and alcohol during pregnancy. Data documenting the women's utilization of health services during pregnancy also were available, including information on participation in the Special Supplemental Food Program for Women, Infants, and Children (WIC), use of Maternity Care Coordination services, use of Medicaid, and use of prenatal care services (the trimester in which women began prenatal care, the total number of prenatal care visits, and the Kessner/Institute of Medicine Adequacy of Prenatal Care Index[14]). In addition, information was available concerning the birthweight of the women's newborns.

Analyses

Descriptive statistics and chi-squared analyses were used to compare the types of criminal convictions among the two groups of incarcerated women (those incarcerated during pregnancy and those incarcerated at a time other than during pregnancy). In addition, descriptive statistics, chi-squared analyses, and analysis of variance techniques were used to compare the sociodemographic characteristics of the three groups of study women (the two groups of incarcerated women and the never-incarcerated women) and the types of services the women received during pregnancy. Descriptive statistics were used to examine the birthweights of the women's infants, including a continuous measure of birthweight and an indicator of low birthweight.

Multiple linear regression analysis[15] was used to model the continuous infant-birthweight outcome (in kilograms) as a function of the main predictor variables of interest, namely, incarceration status of the three groups of women, and several potential confounder variables (the women's racial/ethnic group, age, education level, marital status, smoking during pregnancy, drinking during pregnancy, use of Medicaid, use of WIC, use of Maternity Care Coordination, and prenatal care adequacy as assessed by the Kessner/Institute of Medicine Adequacy of Prenatal Care Index). The fitted multiple linear regression model was used to estimate average differences in infant birthweight among the three groups of interest, adjusted for all other variables in the model. Specifically, point estimates of adjusted mean birthweight differences and associated 95% confidence intervals were computed for the following comparisons: women incarcerated for at least part of their pregnancy compared with the referent group of women never incarcerated; women incarcerated at a time other than during pregnancy compared with the referent group of never-incarcerated women; and women incarcerated for at least part of their pregnancy compared with the referent group of women incarcerated at a time other than during pregnancy.

Logistic regression analysis[16] was used to model the probability of having a low-birthweight infant as a function of incarceration status and the aforementioned potential confounder variables. Estimated odds ratios and corresponding 95% confidence intervals were computed to assess associations between women's incarceration status and the probability of having a low-birthweight infant, while all other model variables were controlled for.

To examine whether there was a significant linear exposure–response effect relating the duration of pregnancy spent incarcerated to infant birthweight, an additional analysis was undertaken that included only women who had spent at least part of their pregnancy in prison. Multiple linear regression analysis was used to model infant birthweight (in kilograms) as a function of the number of weeks of each woman's pregnancy spent incarcerated and the potential confounder variables used in the previously described multivariable analyses. The fitted model was used to compute the estimated regression line, and associated 95% confidence band, relating the number of weeks of pregnancy spent in prison to infant birthweight, while the other variables in the model were assigned their mean values.

Results

Description of the Study Women

Women incarcerated during pregnancy spent only a portion of their pregnancies in prison since the women entered prison after their pregnancies had begun. Of the women incarcerated during pregnancy, 52% spent 8 weeks or less of their pregnancy in prison; 25% spent 9 through 16 weeks of pregnancy in prison; and 23% spent more than 16 weeks of pregnancy in prison. The mean number of weeks of pregnancy spent incarcerated was 12 (SD = 9).

The two groups of incarcerated women did not differ significantly in terms of their types of criminal convic-

TABLE 1—Comparison of the Characteristics of the Three Groups of Study Women, North Carolina (n = 4708)

	Women Incarcerated during Pregnancy (n = 168)	Women Incarcerated at a Time Other than during Pregnancy (n = 630)	Women Who Had Been Pregnant but Never Incarcerated (n = 3910)
Race/ethnicity, %*			
White	36	38	69
Non-White	64	62	31
Education, %*			
High school graduate	52	54	78
Not high school graduate	48	46	22
Marital status, %*			
Married	17	25	72
Single	83	75	28
Cigarette smoker, %*			
Yes	54	54	20
No	46	46	80
Alcohol drinker, %*			
Yes	11	12	3
No	89	88	97
Age, y, mean (SD)**	24.4 (4.8)	24.0 (4.8)	25.5 (5.5)

*$P < .001$ based on a chi-squared test statistic.
**$P < .001$ based on an F-test statistic from an analysis of variance.

TABLE 2—Comparison of Service Utilization of the Three Groups of Study Women during Pregnancy (n = 4708)

	Women Incarcerated during Pregnancy (n = 168)	Women Incarcerated at a Time Other than during Pregnancy (n = 630)	Women Who Had Been Pregnant but Never Incarcerated (n = 3910)
Medicaid, %*	66	74	32
WIC, %*	51	66	34
Maternity Care Coordination, %*	21	29	13
Initiation of prenatal care, %*			
First trimester	48	48	76
Second trimester	29	36	19
Third trimester	17	9	4
No prenatal care	7	7	1
Adequacy of prenatal care, %*			
Adequate	39	41	72
Intermediate	33	36	21
Inadequate	28	23	7
No. prenatal visits, mean (SD)**	9.1 (5.1)	9.3 (5.2)	12.1 (4.5)

Note. WIC = Special Supplemental Food Program for Women, Infants, and Children.
*$P < .001$ based on a chi-squared test statistic.
**$P < .001$ based on an F-test statistic from an analysis of variance.

tions ($\chi^2_{(3)} = 3.17$; $P = .366$). Of the 168 women incarcerated during pregnancy, 57% were incarcerated for crimes against property (burglary, etc.); 25% were incarcerated for public order crimes (primarily drug/alcohol related crimes); 8% were incarcerated for crimes against persons (assault, etc.); and 10% were incarcerated for other types of offenses. Of the 630 women incarcerated at a time other than during pregnancy, 53% were incarcerated for property crimes; 26% were incarcerated for public order crimes; 12% were incarcerated for personal crimes; and 8% were incarcerated for other types of crimes.

The sociodemographic characteristics of the two groups of incarcerated women were similar to one another, but were different from those of the never-incarcerated women (Table 1). Compared with never-incarcerated women, the two groups of incarcerated women were less likely to be White, high school graduates, and married. Incarcerated women were more likely than never-incarcerated women to smoke cigarettes and drink alcohol during pregnancy. The mean age of both groups of incarcerated women was approximately 24 years, whereas the mean age of women never incarcerated was approximately 25 years.

The two groups of incarcerated women were similar in their use of Medicaid, WIC, and Maternity Care Coordination services, and they were more likely than never-incarcerated women to use these services (Table 2). Patterns of prenatal care services were also similar for the two groups of incarcerated women, but were different from the utilization by never-incarcerated women. Compared with never-incarcerated women, incarcerated women tended to initiate prenatal care later in their pregnancies, were less likely to receive adequate prenatal care, and had a lower mean number of prenatal care visits.

Birthweight of the Women's Infants

Among never-incarcerated women, the crude (unadjusted) mean infant birthweight was 3340 grams (SD = 596), with 255 (7%) of the 3910 infants being low birthweight. Among women incarcerated during pregnancy, the mean infant birthweight was 3181 grams (SD = 614), with 19 (11%) of the infants being low birthweight. Among women who had been incarcerated at a time other than during pregnancy, the mean infant birthweight was 3021 grams (SD = 657), with 110 (18%) of the infants being low birthweight.

Multivariable Analyses

The multiple linear regression analysis found that after all of the covariates in

the model were controlled for, the adjusted mean birthweight of infants born to women incarcerated during pregnancy was not significantly different from the adjusted mean birthweight of infants born to never-incarcerated women; this adjusted mean difference in birthweight was 82 grams (95% confidence interval [CI] = −11, 176) (Table 3). However, the adjusted mean birthweight of infants born to women incarcerated at a time other than during pregnancy was significantly less than the adjusted mean birthweight of infants born to never incarcerated women; this adjusted negative mean difference in birthweight was −100 grams (95% CI = −154, −45). Comparison of the adjusted mean birthweights of infants born to the two groups of incarcerated women found that infants born to women incarcerated during pregnancy weighed significantly more, an average of 182 grams more (95% CI = 83, 281), than infants born to women incarcerated at a time other than during pregnancy. Other variables in the model were significantly related to infant birthweight, including race/ethnicity (with non-White women having infants of lower birthweight than White women), marital status (with single women having infants of lower birthweight than married women), cigarette and alcohol use (with women who smoked and drank having infants that weighed less than women who did not smoke or drink), and WIC and adequate prenatal care (with women who received these services having infants who weighed more than infants of women who did not receive these services).

The logistic regression analysis produced findings similar to those for the multiple linear regression analysis (Table 3). After all of the covariates in the model were controlled for, women incarcerated during pregnancy were not significantly more or less likely than never-incarcerated women to have had a low-birthweight baby ($\widehat{OR}$ = 0.86; 95% CI = 0.51, 1.45). However, women incarcerated at a time other than during pregnancy were 1.5 times more likely to have had a low-birthweight baby as compared with never-incarcerated women ($\widehat{OR}$ = 1.58; 95% CI = 1.20, 2.10). In addition, women incarcerated during pregnancy were significantly less likely to have had a low-birthweight baby compared with women incarcerated at a time other than during pregnancy ($\widehat{OR}$ = 0.54; 95% CI = 0.32, 0.93). Consonant with the findings of the multiple linear regression model, the logistic regression model found that being non-White, nonmarried, a cigarette user, an alcohol user, not using WIC, and not having adequate prenatal care were statistically significantly associated with low infant birthweight.

When multiple linear regression analysis was used to assess whether there was a linear exposure–response relationship between the duration of pregnancy spent incarcerated and infant birthweight, analysis of data from the women incarcerated during pregnancy found that after adjustment for all the covariates in the model, there was a statistically significant linear relationship between the number of weeks of pregnancy spent incarcerated and infant birthweight. In particular, women who spent greater numbers of weeks of pregnancy incarcerated tended to have infants who weighed more than did women who spent fewer numbers of weeks of pregnancy incarcerated (Figure 1).

TABLE 3—Results of the Multiple Linear Regression Analysis of the Continuous Birthweight Outcome and the Logistic Regression Analysis of the Categorical Birthweight Outcome (Low Birthweight) (n = 4708)

	Multiple Linear Regression Model[a]		Logistic Regression Model	
Predictor Variables	Estimated Regression Coefficient	*P*	Estimated OR	95% CI
Incarcerated during pregnancy	0.082	.0842	0.86	0.51, 1.45
Incarcerated not during pregnancy	−0.100	.0003	1.58	1.20, 2.10
Racial/ethnic group	−0.201	.0001	1.75	1.36, 2.26
Age	0.002	.2802	1.01	0.99, 1.03
Education level	−0.027	.2309	1.19	0.92, 1.53
Marital status	−0.113	.0001	1.39	1.04, 1.85
Cigarette smoking	−0.212	.0001	1.79	1.41, 2.27
Alcohol drinking	−0.099	.0179	1.52	1.02, 2.25
Medicaid	−0.019	.4371	1.09	0.83, 1.44
WIC	0.076	.0008	0.71	0.55, 0.93
Maternity Care Coordination	−0.009	.7419	1.02	0.75, 1.39
Adequate prenatal care	0.090	.0001	0.63	0.50, 0.80

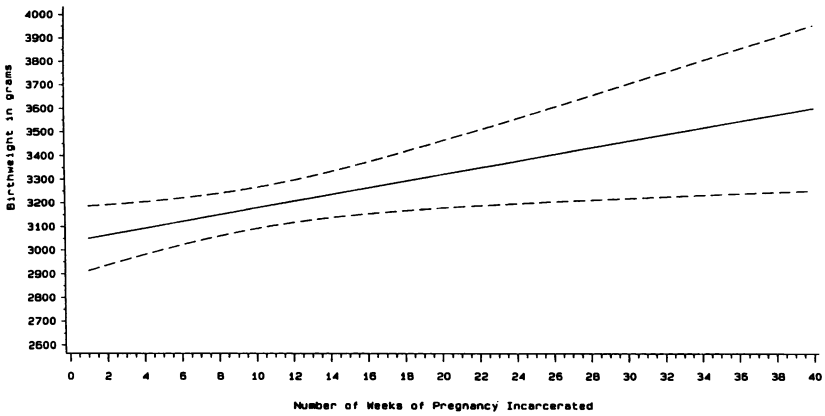
Note. OR = odds ratio; CI = confidence interval. WIC = Special Supplemental Food Program for Women, Infants, and Children.

[a]The following coding was used in the multiple linear regression analysis: birthweight (in kilograms); incarcerated during pregnancy (1 if pregnant in prison, 0 otherwise); incarcerated not during pregnancy (1 if in prison at a time other than during pregnancy, 0 otherwise); racial/ethnic group (1 if non-White, 0 otherwise); age (in years); education (1 if not a high school graduate, 0 otherwise); marital status (1 if never married, 0 otherwise); cigarette smoking (1 if smoked during pregnancy, 0 otherwise); alcohol drinking (1 if drank during pregnancy, 0 otherwise); Medicaid (1 if received Medicaid, 0 otherwise); WIC (1 if received WIC, 0 otherwise); Maternity Care Coordination (1 if received Maternity Care Coordination, 0 otherwise); prenatal care adequacy (1 if adequate on the Kessner Adequacy of Prenatal Care Index, 0 otherwise). (Although birthweight was modeled in kilograms, the adjusted mean birthweights reported in this paper are reported in grams.) The same coding was used in the logistic regression analysis except that low birthweight was coded as 1 if less than 2500 grams and 0 otherwise.

Discussion

Like past investigations of incarcerated women, this study found that many female inmates evidence characteristics and behaviors that place them at risk for poor pregnancy outcomes (single marital status, cigarette smoking, etc.).[3,9–13,17] Furthermore, this study found that women incarcerated during pregnancy and women incarcerated at a time other than during pregnancy differed significantly from never-incarcerated women in terms of race/ethnicity, education level, marital status, and use of cigarettes and alcohol during pregnancy, with the two groups of incarcerated women being less likely than the never-incarcerated women to be White, high school graduates, married, nonsmokers, and nondrinkers.

This study is unique in comparing the utilization of various types of services during pregnancy among three representative, statewide, population-based samples



Note. The following coding scheme was used in the multiple linear regression analysis: birthweight (in kilograms); number of weeks of pregnancy incarcerated; racial/ethnic group (1 if non-White, 0 otherwise); age (in years); education (1 if not a high school graduate, 0 otherwise); marital status (1 if never married, 0 otherwise); cigarette smoking (1 if smoked during pregnancy, 0 otherwise); alcohol drinking (1 if drank during pregnancy, 0 otherwise); Medicaid (1 if received Medicaid, 0 otherwise); WIC (1 if received WIC, 0 otherwise); Maternity Care Coordination (1 if received Maternity Care Coordination, 0 otherwise); Prenatal Care Adequacy (1 if adequate on the Kessner Adequacy of Prenatal Care Index, 0 otherwise).
Although birthweight was modeled in kilograms, the adjusted mean birthweights in this graph are plotted in grams. In addition, mean values are used for all control variables in the model.

FIGURE 1—Estimated linear regression line and 95% confidence bands relating the duration of pregnancy spent incarcerated with infant birthweight (n = 168).

of pregnant women, some incarcerated during pregnancy, others incarcerated at a time other than during pregnancy, and others never incarcerated. Significant differences were found between the groups in their use of Medicaid, WIC, and Maternity Care Coordination services, with greater proportions of the two groups of incarcerated women using these services than the never-incarcerated women. Significant differences also were found when the women were compared in terms of their patterns of prenatal care utilization, with smaller proportions of the two groups of incarcerated women having received adequate prenatal care as compared with women who had never been incarcerated.

In addition, this is the only study of which we are aware that has used representative, statewide samples of women to compare birthweights of infants born to women incarcerated during pregnancy, women incarcerated at a time other than during pregnancy, and women who had never been incarcerated. Both linear regression analysis of the continuous birthweight outcome and logistic regression analysis of the dichotomous low-birthweight outcome found that after confounding factors were controlled for, the infant outcomes of women incarcerated during pregnancy were not significantly different from those of never-incarcerated women; however, the infant outcomes of women incarcerated at a time other than during pregnancy were significantly worse than those of both never-incarcerated women and women incarcerated during pregnancy. Analysis of birthweights of infants born to women who spent at least part of their pregnancy incarcerated provided evidence of a significant linear exposure–response relationship between the number of weeks of pregnancy spent incarcerated and infant birthweight, with women who spent greater numbers of weeks of pregnancy incarcerated having higher-birthweight infants than women who spent fewer numbers of weeks of pregnancy incarcerated.

It is of note that substance use during pregnancy, especially cigarette smoking, was associated with poor infant birthweight. These findings underline the need for greater health education efforts focused on improving the health behaviors of women before conception, especially given that few women plan their pregnancies. Also, clinicians, working both within and outside of prison settings, should incorporate substance-use cessation programs into their prenatal services and should strengthen their relationships with substance–abuse treatment providers.

The findings of this research must be viewed in light of the study limitations. Since this study was restricted to the examination of live infant births, potential differences between the groups of women in terms of both spontaneous abortions and fetal deaths would not have been detected. In addition, since this study classified women as "never incarcerated" if they had not been in prison in North Carolina from January 1, 1987, through December 31, 1991, incarcerations that occurred before or after these dates, as well as incarcerations that occurred in other states during this period, would have been missed. Moreover, it is likely that this study has underestimated the extent of cigarette and alcohol use among the women since this information was drawn from infant birth certificates, which probably minimize substance-use behaviors of the mothers. Furthermore, since this study relied upon secondary data, information was not available on many factors that might have helped to explain the study findings (data on diet during pregnancy, etc.). Finally, the study was restricted to women who delivered infants in North Carolina, including women incarcerated in North Carolina; these findings may not be generalizable to other populations.

More research is needed to understand why particular components of the prison environment may be health-promoting for some high-risk pregnant women. (Why do high-risk incarcerated pregnant women deliver heavier infants than do high-risk women who have been incarcerated at a time other than during pregnancy?) More community-based investigations of high-risk pregnant women are necessary to determine which aspects of their lives are most associated with poor birth outcomes. Past empirical and anecdotal reports offer some potential areas for study, including the roles of shelter,[18] nutrition,[19] alcohol and illicit drug abuse,[3,20–24] and domestic violence.[3,25–30]

Although certain aspects of incarceration may be viewed as health-promoting for some women, it must be emphasized that prison is no panacea for the problems of high-risk pregnant women, including substance-abusing or substance-dependent women. Although some have advocated that punitive strategies (incarceration, mandated treatment, withdrawal of public service benefits, etc.) be used to force high-risk pregnant women to modify their potentially risky health behaviors

(such as substance abuse) in order to improve the health of the fetus, many health professionals believe that such measures might actually backfire by causing high-risk women to avoid health and social services that could be helpful to them; furthermore, mandated interventions for pregnant women to improve the potential health of the fetus raise many important ethical and legal issues.[31–33] Instead, health professionals and policymakers should ensure that health-promoting resources and services are easily accessible to all women within our communities (including pregnant women) who suffer from multiple health and social problems.

In summary, this study found that infants born to women incarcerated during pregnancy were not significantly different from infants born to never-incarcerated women in terms of their birthweights; however, the birthweights of infants born to women incarcerated at a time other than during pregnancy were significantly lower than the birthweights of both infants born to never-incarcerated women and the infants born to women incarcerated during pregnancy. Unfortunately, there are no quick fixes for the problems of high-risk pregnant women; however, awareness of the issues is a crucial first step in assuring the health of these women and their babies. □

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