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CHILDBEARING AFTER AGE 35: ITS EFFECT ON EARLY PERINATAL OUTCOMES

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Summary. Births to women aged 35 years and older are compared with birtns to women aged 20–34 in three hospitals, one each in Mexico, Egypt and Hungary. In the two developing countries, babies born to the older women had lower rates of survival until hospital discharge, and were more likely to have depressed 5-minute Apgar scores. They were not, however, more likely to be of low birth weight. The differences were statistically significant, and remained when several other variables were controlled. The variables controlled were known to be age-related and to influence pregnancy outcome.

Hungary, the only developed country in the analysis, was quite different. Age had a significant influence on the weight of the infant, but not on survival or Apgar score. It seems therefore that when older women are in general good health and there are no concurrent social risk factors, advanced maternal age does not necessarily increase the risk of an adverse pregnancy outcome.

Introduction

In many developing countries many births are to women 35 years or older. The risk of adverse maternal and fetal outcome is greater with increasing age, and so is the risk of certain congenital malformations. These risks have been well summarized by Nortman (1974).

In a relatively large collaborative study (1835 gravidae aged 35 and over), Israel & Deutschberger (1964) found there was a significant increase with age in stillbirth rates, but that older women had lower rates of neonatal deaths. This can presumably be attributed to the fact that neonatal deaths are affected by environmental as well as congenital factors. Other authors have concluded that

there is a real (i.e. physiological) relationship between maternal age and stillbirths; however, Resseguie (1977) has plausibly argued that, in the United States at least, this relationship is an artifact of analysis rather than a genuine increase in risk. 'When births to mothers . . . are subdivided according to the amount of education completed by the mother, the association between stillbirth rate and maternal age in each educational group differs substantially from the others.' Baird, on the other hand, found that the influence of age on perinatal mortality was not affected when social class was controlled (Baird, 1963).

The increased incidence of depressed Apgar scores (a score of <7 representing neonatal morbidity) has been commented upon by many authors (e.g. Caspi & Lifshitz, 1979; Morrison, 1975) as has the increased incidence of low-birth-weight infants (e.g. Caspi & Lifshitz, 1979; Kajanoja & Widholm, 1978; Namboodiri & Balakrishnan, 1958–59). However, some authors have found that the difference in birth weight was not statistically significant for primigravidae (Morrison, 1975).

Although the relative risk for older women is high compared with gravidae in the low-risk childbearing years (20–34), the absolute risk can be quite low depending on the management of the pregnancy. Obstetricians in developed countries are anticipating an increase in the number of elderly primigravidae and low-parity gravidae as delayed childbearing becomes more common. Daniels & Weingarten (1979) have satisfactorily summarized the risks of postponed childbearing in the United States.

Although late childbearing in developed countries often involves low parity women, in developing countries it is more likely to involve grandmultiparae (women with four or more previous live births). This paper, therefore, compares the outcome of deliveries to women aged 35 or older with women in the low-risk ages (20–34) in three very different cultural settings, Mexico, Egypt and Hungary. Data from three hospitals—one in each country—are analysed. Since these are hospital deliveries, the findings cannot be generalized to these countries as a whole, the more so since all three of these hospitals are urban teaching and referral centres. Because of this, it is probable that patients admitted are not representative of women delivering in the catchment area; in particular they may be more likely to have a higher rate of complications, and are, perhaps, more likely to be older. Nevertheless, the percentage of births to older women is not greater in these hospitals than in the country as a whole, as Table 1 shows.

Materials and methods

Data on consecutive cases admitted for obstetric delivery were recorded on a single-sheet Maternity Record (reprinted in *Int. J. Gynaec. Obstet.* (1978). The Maternity Record is not designed specifically to record information on complications characteristic of older gravidae. Rather, it is intended to collect data for general purposes on the characteristics of maternity patients, their reproductive history, antepartum, intrapartum and postpartum complications, fetal/neonatal outcome, pre-conception contraceptive practice and post-partum contraceptive intentions.

The number of cases and the range of dates analysed in this study are as follows:

Mexico 5,379 cases 7th March 1977–6th April 1980
Egypt 7,355 cases 1st March 1977–1st April 1979
Hungary 11,278 cases 1st January 1977–5th August 1980

The three hospitals were selected because of the large number of older women delivering there; although the number in the Hungarian hospital is much smaller than in the other two hospitals (see Table 1), it is the only hospital from a developed country sending data to the International Fertility Research Program (IFRP) for which there are sufficient cases for analysis.

Compared with the national data of 3–5 years earlier (Table 1), the IFRP data for Mexico show a greater percentage of the older women to be grandmultiparae and a smaller percentage (3·2% compared with 9·5%) to be primiparae. For Egypt, there is a greater similarity in the percentage that are primiparae (3·1% in the IFRP

Table 1. Distribution of births by age of mother in Mexico, Egypt and Hungary: selected characteristics of births to mothers over 35 years

	Mexico		Egypt		Hungary	
	UN* 1973	IFRP† 1977–80	UN* 1973	IFRP† 1977–79	UN* 1974	IFRP† 1977–80
Total no. of births	2,572,287	7,085	1,259,004	8,379	186,288	12,581
% in each age group‡						
<20	12·4	22·8	3·5	8·9	15·1	9·1
20–24	25·2	27·5	21·1	30·7	42·4	42·3
25–29	23·4	18·7	27·6	27·9	26·2	31·7
30–34	16·5	13·4	21·2	17·3	11·7	12·1
35–39	12·7	11·6	15·8	11·6	3·7	3·6
40+	8·1	6·0	8·7	3·6	0·9	1·1
35+	20·8	17·6	24·5	15·1	4·6	4·7
No. of births to women 35+	535,490	1,247	308,823	1,269	8,577	592
% of births to women 35+						
First births	9·5	3·2	3·4	3·1	11·4	21·2
5th and higher order	66·7	82·6	62·2	65·9	29·9	10·7
10th and higher order	20·2	34·5	3·1	7·6	5·9	2·1

* National data. Source: *Demographic Yearbook, 1975*, United Nations.
† International Fertility Research Program data.
‡ May not equal 100% because some mothers are of unknown age.

data compared with 3·4% in the national data), but the IFRP data show a percentage of patients of parity ten or higher that is more than twice the rate in the earlier national data. The IFRP data for Hungary show a larger percentage of primiparae (21·2% compared with 11·4% in the national data) and a correspondingly smaller percentage of grandmultiparae (10·7% compared with 29·9% in the national data).

It is apparent that older women who deliver tend to have characteristics in addition to their age that contribute to their risk status. Most obviously, they tend to be of high parity; Table 1 shows the percentage of obstetric patients aged 35 or older with at least ten previous live births, and Table 2 shows the mean parity for each of three age groups in the three hospitals. In the Mexican hospital, in particular, the oldest parturients tend to be of very high parity (9·2 live births). In the Hungarian hospital, as might be expected, a much smaller percentage are of very high parity, and the mean parity of the women over 40 is 2·8 live births. As well as the additional risk from high parity, older obstetric patients are less likely to seek antenatal care, and are likely to have less education than younger patients—both factors that are associated with increased obstetric risk. Table 2 shows the distribution of each of these variables with respect to age for the three hospitals.

Thus it is necessary to control for these additional characteristics in examining the relationship between maternal age and the fetal outcome variables. To this end, the Mantel–Haenszel (1959) procedure was used to test the statistical significance, by a chi-squared test statistic, of the relationship after controlling for the additional factors. Use of the Mantel–Haenszel statistic in the case of no controls yields

Table 2. Selected maternal characteristics by age of mother: Mexico, Egypt and Hungary

Characteristic/age group	Mexico	Egypt	Hungary
Mean years of schooling			
20–34	4·4	3·4	11·2
35–39	2·4	1·6	10·6
40+	1·9	1·1	8·1
Mean parity			
20–34	2·2	1·6	0·7
35–39	7·4	5·2	1·8
40+	9·2	6·7	2·8
Mean no. of antenatal visits			
20–34	1·2	1·0	7·4
35–39	1·1	1·0	7·1
40+	1·0	1·1	6·4
% with no antenatal care			
20–34	64·2	66·9	1·0
35–39	66·9	67·3	1·6
40+	69·1	66·1	4·6

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results almost identical to the commonly used Pearson chi-squared statistic when the sample size is large. Throughout this paper, the 0·05 level of statistical significance is used, and the word significance refers to statistical significance.

Results

Three outcome variables were examined: (1) depressed Apgar score, (2) low birth weight, and (3) survival. For each data set, the association between age and each outcome variable is tested both without controlling for other factors and with control for factors one at a time.

Depressed Apgar score

An Apgar score of <7 at 5 minutes is generally regarded as indicating neonatal morbidity. As shown in Table 3, older women in the Mexican and Egyptian hospitals have a significantly larger percentage of babies with a depressed Apgar score when other factors are not controlled. In the Mexican hospital, 2·6% of the live-born babies of the younger mothers had a depressed Apgar score at 5 minutes, compared with 5·1% of the older mothers. In the Egyptian hospital, the comparable percentages were 2·4 and 3·8. In the Hungarian hospital, however, there was no difference, 0·6% of the infants of both groups of mothers had a low Apgar score.

In the Mexican hospital, the association between age and Apgar score remains significant when each of the covariables is controlled. For the levels of all the covariables except parity, the older women have a larger percentage of babies with a depressed Apgar score. Evidence of such an association is less consistent in the Egyptian hospital data where residence is the only covariable having both a higher percentage of depressed Apgar scores in the older age group for each type of residence and a significant Mantel–Haenszel test statistic. Although the test statistics are significant when controlling for either education or smoking, the intra-level evidence is not consistent (e.g. older non-smokers show a higher percentage of depressed Apgar scores while older smokers do not). Finally, the Hungarian hospital data produce no significant associations when each of the covariables is controlled.

Low birth weight

Table 4 shows the percentage of infants weighing less than 2500 g at birth for each of the three hospitals, as well as for the levels of the several related variables. In each of the three hospitals, a higher percentage of older mothers had low-birth-weight babies: the difference was small in Mexico and Egypt and not statistically significant. Only in Hungary was the difference of a magnitude (16·0% compared wth 11·2%) to achieve statistical significance.

When other variables are controlled, the same pattern remains. None of the Mantel–Haenszel statistics, when the covariables are controlled singly, achieves significance in either the Mexican or Egyptian data sets. For the Hungarian data, however, there is a significant increase in the percentage of low-birth-weight babies for older women after controlling in turn for each of the covariables. Further, the

Table 3. Percentage of infants with Apgar scores of less than seven at 5 minutes, by age and other selected characteristics: Mexico, Egypt and Hungary

		Age (years)					
		Mexico		Egypt		Hungary	
Type of comparison	Characteristic	20–34 (4162)†	35+ (1217)	20–34 (6134)	35+ (1221)	20–34 (10,697)	35+ (581)
Age with	Total	2·6	5·1	2·4	3·8	0·6	0·6
Apgar	M–H χ^2‡	16·5*		6·5*		0·1	
Age with	Parity						
Apgar	0	3·2	3·0	2·4	3·7	0·6	0·0
controlling	1–3	2·3	3·4	2·0	4·1	0·6	0·6
for	4+	2·7	5·5	3·4	3·7	0·0	1·4
parity	M–H χ^2	9·7*		1·6		0·1	
Age with Apgar	Antenatal visits						
controlling	0	2·7	6·0	2·4	4·1	1·9	0·0
for	1–4	2·7	3·4	2·4	2·1	0·8	3·3
antenatal	5+	1·5	3·4	2·1	6·8	0·6	0·4
visits	M–H χ^2	16·0*		1·6		0·1	
Age with	Education (years)						
Apgar	0	4·3	6·0	2·6	4·3	0·0	0·0
controlling	1–6	2·2	4·4	2·1	2·6	0·8	0·0
for	7+	2·5	8·3	2·4	2·1	0·6	0·7
education	M–H χ^2	10·0*		5·0*		0·1	
Age with	Residence						
Apgar	Urban	1·8	4·6	2·4	3·2	0·5	0·0
controlling	Rural	3·4	5·7	3·5	4·8	0·9	2·0
for	Slum	3·5	4·5	1·6	4·3		
residence	M–H χ^2	13·0*		6·2*		0·1	
Age with Apgar	Smoking						
controlling	No	2·5	5·1	1·8	3·3	0·6	0·5
for	Yes	2·9	5·6	2·1	0·0	0·0	2·3
smoking	M–H χ^2	16·9*		5·9*		0·2	

In Tables 3–6: † N in parentheses.
‡ Mantel–Haenszel.
* Significant at $\alpha = 0{\cdot}05$. Pr (1 df $\chi^2 < 3{\cdot}84) = 0{\cdot}05$.
% underlined are based on 5 cases or less.

levels of parity, residence and smoking are consistent in the intra-level percentages of low birth weight. By applying the categorical data analysis methods of Grizzle, Starmer & Koch (1969), the relative importance of age, parity, antenatal visits, education, residence and smoking was established for the Hungarian data. Smoking offered by far the most explanatory information regarding the variability of birth weight, while age had a less significant effect than either antenatal visits, education or parity.

Table 4. Percentage of infants weighing less than 2500 g by age and by other selected characteristics: Mexico, Egypt and Hungary

		Age (years)					
		Mexico		Egypt		Hungary	
Type of comparison	Characteristic	20–34 (4162)†	35+ (1217)	20–34 (6134)	35+ (1221)	20–34 (10,697)	35+ (581)
Age with	Total	11·9	12·3	7·2	7·4	11·2	16·0
birthweight	M–H χ^2‡	0·1		0·1		12·4*	
Age with	Parity						
birthweight	0	15·0	5·1	6·4	5·9	11·3	20·2
controlling	1–3	11·0	14·2	7·3	6·7	11·0	12·8
for	4+	10·8	12·2	8·7	7·6	20·2	21·1
parity	M–H χ^2	0·8		0·9		5·5*	
Age with							
birthweight	Antenatal visits						
controlling	0	12·2	13·2	6·6	7·6	35·8	30·8
for	1–4	11·7	11·6	8·4	7·4	35·6	38·0
antenatal	5+	11·3	7·1	8·8	5·4	9·9	13·5
visits	M–H χ^2	1·5		<0·1		5·8*	
Age with	Education (years)						
birthweight	0	13·7	12·8	7·1	7·1	21·2	33·3
controlling	1–6	11·7	12·0	7·3	8·3	24·1	20·0
for	7+	10·7	11·1	7·4	8·5	11·0	14·8
education	M–H χ^2	0·1		<0·1		4·7*	
Age with	Residence						
birthweight	Urban	11·5	10·8	7·6	7·1	10·4	14·7
controlling	Rural	12·2	14·8	5·8	8·2	14·4	18·8
for	Slum	13·0	6·0	7·5	7·5	—	—
residence	M–H χ^2	<0·1		<0·1		9·8*	
Age with							
birthweight	Smoking						
controlling	No	12·0	12·6	7·7	7·7	9·7	15·0
for	Yes	12·0	7·2	6·7	5·3	22·2	27·9
smoking	M–H χ^2	<0·1		<0·1		13·7*	

Survival

The survival measure used here (the percentage of infants surviving until the mother's discharge from the hospital) does not necessarily reflect perinatal survival since it depends on the duration of hospital stay. Nevertheless, it is the only available approximation of perinatal survival in the data. Although we cannot precisely estimate perinatal survival, we can still test differences in infant survival between the two age groups by controlling, by the Mantel–Haenszel procedure, for the duration of mother's hospital stay after delivery (this approach is applied here

and will be discussed in more detail in a later paper). The survival percentages in Tables 5 and 6 are not adjusted for duration of mother's hospital stay after delivery, but the test statistics are.

In each of the three hospitals, the percentage of normal-weight babies (at least 2500 g) still alive when the mother was discharged from the hospital decreased with maternal age (Table 5). In Mexico, 96·1% of the infants of the younger mothers survived until discharge, compared with 90·7% of the infants of the older mothers, a significant difference. In Egypt, the comparable percentages are 94·9 and 87·7 (significant difference), while in Hungary there was virtually no difference in the

Table 5. Percentage of infants weighing 2500 g or more who survive until the mother's discharge from the hospital, by age and other selected characteristics: Mexico, Egypt and Hungary

		Age (years)					
		Mexico		Egypt		Hungary	
Type of comparison	Characteristic	20–34 (3665)†	35+ (1067)	20–34 (5690)	35+ (1131)	20–34 (9497)	35+ (488)
Age with survival	Total	96·1	90·7	94·9	87·8	98·9	98·4
	M–H χ^2‡	45·6*		65·7*		0·5	
Age with survival controlling for parity	Parity						
	0	96·7	89·2	96·0	87·5	99·0	100·0
	1–3	96·6	95·6	95·3	90·5	99·0	97·8
	4+	94·9	90·3	91·8	87·3	96·1	98·6
	M–H χ^2	17·7*		19·8*		0·1	
Age with survival controlling for antenatal visits	Antenatal visits						
	0	95·3	89·5	94·7	86·9	86·9	77·8
	1–4	97·8	92·6	95·6	89·2	87·9	96·8
	5+	96·8	95·6	95·3	90·9	99·4	98·9
	M–H χ^2	45·6*		82·9*		<0·1	
Age with survival controlling for education	Education (years)						
	0	93·3	90·5	93·5	88·1	96·2	90·0
	1–6	96·4	90·5	96·3	85·7	98·4	100·0
	7+	98·5	100·0	96·7	92·6	98·9	98·3
	M–H χ^2	41·6*		72·0*		<0·1	
Age with survival controlling for residence	Residence						
	Urban	98·1	93·5	95·0	86·6	99·1	99·4
	Rural	94·1	88·2	93·8	89·7	98·3	96·2
	Slum	93·9	93·0	95·5	88·7	—	—
	M–H χ^2	33·7		82·2*		0·1	
Age with survival controlling for smoking	Smoking						
	No	96·0	91·0	94·9	87·1	98·9	98·2
	Yes	97·2	89·6	92·9	94·4	98·4	97·7
	M–H χ^2	42·6*		66·2		0·5	

survival until discharge of the two groups of infants (comparable percentages are 98·9 and 98·4).

Because of the inter-relationship between maternal age, infant survival and several other factors, Table 5 shows the relationship between maternal age and infant survival with each of the other factors controlled. When the covariables are controlled one at a time, all of the Mantel–Haenszel statistics are significant for the Mexican and Egyptian data, but none reaches significance in the Hungarian data. Further, with the exception of education in Mexico and smoking in Egypt, all levels

Table 6. Percentage of infants weighing less than 2500 g who survive until the mother's discharge from the hospital, by age and other selected characteristics: Mexico, Egypt and Hungary

		Age (years)					
		Mexico		Egypt		Hungary	
Type of comparison	Characteristic	20–34 (497)†	35+ (150)	20–34 (443)	35+ (90)	20–34 (1200)	35+ (93)
Age with survival	Total	76·3	58·0	64·9	44·4	82·0	84·9
	M–H χ^2‡	13·7*		10·2*		0·8	
Age with survival controlling for parity	Parity						
	0	84·7	100·0	76·5	50·0	81·1	88·0
	1–3	73·7	53·3	56·9	50·0	83·2	80·4
	4+	71·0	57·4	63·9	43·2	73·1	89·5
	M–H χ^2	5·6*		6·1*		0·6*	
Age with survival controlling for antenatal visits	Antenatal visits						
	0	72·9	55·0	64·2	45·2	44·1	50·0
	1–4	79·5	64·7	71·2	43·5	68·1	84·2
	5+	90·0	71·4	48·8	40·0	85·5	87·1
	M–H χ^2	13·9*		14·1*		1·5	
Age with survival controlling for education	Education (years)						
	0	74·5	58·5	66·2	37·5	85·7	100·0
	1–6	77·2	58·5	64·7	57·1	85·0	76·5
	7+	73·5	33·3	60·3	80·0	81·9	85·9
	M–H χ^2	14·1*		14·5*		0·7	
Age with survival controlling for residence	Residence						
	Urban	81·4	57·8	62·8	31·8	83·4	86·0
	Rural	71·8	57·3	67·7	42·1	78·2	83·3
	Slum	73·0	66·7	67·4	66·7	—	—
	M–H χ^2	11·7*		12·4*		0·9	
Age with survival controlling for smoking	Smoking						
	No	74·7	58·0	63·8	42·9	81·9	83·6
	Yes	92·3	66·7	25·0	100·0	81·5	88·2
	M–H χ^2	12·7*		11·4*		0·3	

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of the covariables show a decline in the percentage of the survival measure in the older mothers.

Among the low-birth-weight infants (shown in Table 6), the survival percentages are, of course, much lower than for the normal-birth-weight infants. As with the normal-birth-weight infants, the survival percentages are significantly less among the older women in Mexico and Egypt but not in Hungary. Likewise, the pattern of differences extends to the levels of the covariates. For the Mexican and Egyptian data, the Mantel–Haenszel statistics are all significant when controlling for the covariables individually; none is significant in the Hungarian data. Furthermore, except for two levels with small cell sizes, the survival percentages are consistently smaller among the older women when the covariable levels are considered.

To summarize, although it is generally true that factors influencing perinatal mortality do so by operating through the mechanism of birth weight, this does not appear to be the case where advanced maternal age is concerned. In two of the three hospitals, there is a strong relationship between maternal age and infant survival, but none between maternal age and low birth weight. In the other hospital, there is a moderate relationship between maternal age and low birth weight (although age is the least important of the explanatory variables examined), but none between maternal age and infant survival.

Discussion

This paper supports the conclusions of earlier papers that maternal age does influence the outcome of pregnancy. These conclusions are reinforced by showing that in the two developing countries, the relationship between age and infant survival and morbidity (as indicated by depressed Apgar scores) persists even when various social factors are controlled. Contrary to the findings of some other writers, no relationship was found between maternal age and birth weight, except in the Hungarian hospital where, although age explained some of the variance, other factors (especially smoking) predominated.

Perhaps the most important conclusion to be drawn from this analysis is that although maternal age does influence infant survival, in a population otherwise considered low risk and when the pregnancy is well managed, the influence of age can be greatly reduced. Although Baird (1963) found that maternal age differences remained (although less pronounced) in spite of increased intervention intended to eliminate them, the Hungarian data analysed suggest that today (20 years after Baird's study) the technology exists to reduce the difference substantially among socioeconomically low-risk patients. The great majority of the patients delivering at the Hungarian hospital are relatively well-educated, receive good antenatal care and are of low parity; for these patients, age appears to be relatively unimportant. In the Mexican and Egyptian hospitals also, the difference between the older and younger women is at its smallest in the low-risk groups with maximum antenatal care, maximum education and medium parity.

Also emerging from this analysis is the fact that the older mothers contribute more than their share to perinatal mortality. In the Mexican hospital, for example

(Table 7), mothers of 35 and older represent 22·6% of all the non-teenage mothers, yet 38·3% of the deaths occurring before discharge are to the infants of these mothers. In the Egyptian hospital, the contribution is even greater; older mothers constitute 16·6% of deliveries (to non-teenagers), but nearly twice that percentage (29·7%) of the identified perinatal deaths.

Table 7. Contribution of older mothers to the number of perinatal deaths compared with their contribution to the total number of births

	Mexico	Egypt	Hungary
Women 35+ years as % of all deliveries*	22·6	16·6	5·2
Deaths to infants of mothers 35+ as % of all early infant deaths*	38·3	29·7	6·5

* Teenaged mothers excluded, so percentages are higher than in Table 1.

Since it is probable that a majority of the pregnancies to the women over 35 were unplanned, especially those at higher parities, it seems likely that older women would be particularly receptive to post-partum family planning. In the Mexican hospital, 80% of the older women state that they want no more children after this delivery: the comparable figures for Egypt and Hungary are 90% and 89%, respectively. Even among those older mothers whose babies died before discharge from the hospital, the percentages are 80, 85 and 68 for the three hospitals. Elimination of unplanned pregnancies after age 35 would not only significantly reduce the birth rate among these populations, but would have an even greater impact on perinatal mortality.

The impact of childbearing at advanced ages is great, both in terms of maternal and child health and in demographic terms. Table 1 shows the percentage of all births in Mexico, Egypt and Hungary to women aged 35 years or more. In Mexico, more than one-fifth and in Egypt almost one-fourth of all births are to older women, compared with less than 5% in Hungary. Thus, simply by eliminating births to women over 35, Egypt could reduce its birth rate by 25%.

The contribution made by older mothers to maternal and perinatal mortality and morbidity is greater than the number of births would suggest, and elimination of childbearing beyond age 35 would significantly reduce mortality and morbidity.

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