Association of Perinatal Factors With Blindness in Children

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STUDIES by Kerby (*1*) and Hatfield (*2*) have indicated that unspecified prenatal factors play a major role in the etiology of blindness among school children. In view of the importance of prenatal factors in the etiology of blindness, and because of the apparent deficiency of information pertaining to the identity of such factors, a retrospective study was undertaken to explore this subject.

The objectives of the study were to determine (*a*) whether the birth weight distribution of children classified as blind due to unspecified prenatal factors is different from that of an appropriate control population, and (*b*) whether the pregnancies of mothers of such blind children are characterized by an excess of complications of pregnancy, labor, and delivery.

Birth certificates were used as the source of information for pertinent factors, for reasons described in a preliminary report (*3*).

The following conditions were paramount in designing the study.

1. The subjects should be classified as blind according to a commonly accepted definition. For this study blindness was defined as visual acuity for distance not greater than 20/200 in the better eye with best correction, or field of vision restricted to 20 degrees or less in the widest diameter.

2. Information as to the cause of blindness should be available, so that children with blindness of presumed prenatal origin could be identified and those with blindness of well-understood etiology could be excluded from the study.

3. The study group should be sufficiently large for meaningful analysis, but reasonably homogeneous in that all the subjects were born within a fairly recent time period and within a limited geographic area.

4. The subjects' birth certificates should contain, in a reasonably uniform manner, the necessary information relating to the prenatal and delivery periods.

Selection of Subjects and Controls

The conditions for the study were satisfied by records and birth certificates available in New York State. The New York State Commission for the Blind has maintained a register of blind persons since 1913, and reporting

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of blind persons to the commission became mandatory by legislation in 1945. The legal definition of blindness in New York State is essentially the same as the one accepted for this study. The cause of blindness for each person reported is coded by the commission according to the Standard Classification of the Causes of Blindness, which has been used (with revision) since 1940 (*4*).

A search of the commission's records uncovered 801 potential study subjects. These were children registered as blind before 1961 who were born during a 12-year period, from January 1, 1948, through December 31, 1959, and whose cause of blindness was reported by an ophthalmologist and coded as due to unspecified prenatal influences, or hereditary origin, or unknown cause. Pertinent identifying and demographic information and information on the site or type of eye affection were abstracted from the records.

Next the files of the New York State and New York City Health Departments were searched for the birth certificates of potential subjects known or presumed to have been born in the State during the 12-year period. Information was obtained from their birth certificates on the pertinent factors for study, including complications of pregnancy, labor, and delivery which appear on the confidential medical supplement of the certificate. Where pertinent, information was obtained from death certificates to identify and exclude from the study any infant who died neonatally (under 28 days of age).

Of the 801 potential study subjects, 248 were excluded: 69 were born out of New York State, 11 did not meet the date-of-birth criterion, birth certificates could not be found for 46, birth certificates could not be positively identified for 43, 37 were products of a multiple birth, 13 were "court cases" (foundlings or adopted children) whose original birth certificates were not identifiable or obtainable, 1 died neonatally, and for 28 the medical supplement on the birth certificate was not completed.

Thus, the study group consisted of 553 single-birth children registered as blind who survived the neonatal period (28 days) and whose verified birth certificates contained completed medical supplements regarding complications of pregnancy, labor, and delivery. All were born in the State during the period 1948–59, 322 in New York City and 231 upstate.

The control group was a stratified systematic sample of 2 of every 1,000 live births recorded in New York State during the study period. The birth certificates in the New York City and New York State Departments of Health are filed in numerical sequence. Starting with each certificate having a number ending in the three digits 162 (randomly selected) and proceeding sequentially, the first certificate on which a complication of pregnancy was recorded and the first certificate on which no complication of pregnancy was recorded were selected. (Originally, we planned to employ a control sample of 3 per 1,000 by including the first 2 certificates in each 1,000 with a reported complication of pregnancy; but this was modified to include only the first such certificate, mainly because of certain difficulties, which are described elsewhere (*3*), in deciding on the spot whether or not a complication was in fact recorded.) However, certificates for multiple-birth children were excluded from consideration, as were those for children whose original certificate had been replaced by an amended one which had no medical supplement (court cases).

From the sample of birth certificates so selected, those of children who died during the neonatal period were replaced by the next sequentially appropriate certificate. The sampling procedure provided an over-sampling of birth certificates with recorded complications of pregnancy. This was done to obtain an adequate estimate of the frequency of the reported specific complications of pregnancy in the underlying population. By knowing the number of certificates which had to be skipped over in order to obtain certificates as specified by the sampling design, we were able to estimate the frequency and distribution of reported complications of pregnancy and other study variables in the general population of single-birth children who survived the neonatal period. The data derived from this control sample thus formed the basis for the "expected" values against which the observations for the study group were compared.

From the birth certificates and their confi-

Table 1. Percent distribution of 553 study group children, by year of birth

Year of birth	Total	Place of birth	
		New York City (N=322)	Upstate New York (N=231)
Total	100.0	100.0	100.0
1948	16.1	14.9	17.8
1949	11.6	13.4	9.1
1950	13.2	13.7	12.6
1951	11.9	12.1	11.7
1952	10.3	10.9	9.5
1953	10.1	9.9	10.4
1954	8.7	8.4	9.1
1955	6.0	5.9	6.1
1956	3.1	2.5	3.9
1957	3.3	3.4	3.0
1958	3.4	3.1	3.9
1959	2.4	1.9	3.0

dential supplements, items of information abstracted for both study subjects and controls included date and place of birth, sex, maternal age, maternal race, number of prior live births, number of prior stillbirths, specific complications of pregnancy, specific complications of labor, operative procedures, Rh factor, birth weight, birth injury, and congenital malformations.

The distribution of the study group children according to year of birth revealed that they were not drawn uniformly from all births during the 12-year period. This was to be expected because, aside from delays in reporting diagnosed blindness, not all blindness (as defined here) reported to be of prenatal origin is necessarily present or recognizable at birth or in the early years following birth. Thus, almost three-fourths of the children in the study group were born during the first half of the 12-year study period (table 1). Because the reporting of information such as complications of pregnancy on the birth certificate may be affected by the format of the certificate or by other matters related to the birth year, the control group data were adjusted for year of birth according to the birth-year distribution of the study group.

Results

Race of mother. The observed number of nonwhite mothers was higher than expected for New York City and for upstate New York (table 2). The difference between the observed and expected was statistically significant ($P<0.05$) for the city. (Except where otherwise indicated in this paper, the chi-square goodness-of-fit test of significance was used.) The excess was 32 percent for the total State. These data suggest that the reported incidence rate of blindness is higher among nonwhites than whites, and this is consistent with the limited data available for other sections of the country (*5* and unpublished data of the National Institute of Neurological Diseases and Blindness, Biometrics Branch).

Age of mother. The observed and expected distributions of maternal age at delivery are shown in table 3. While there was little difference between the observed and expected distributions for New York City mothers, the difference for those in upstate New York was

Table 2. Observed and expected distributions of race of mothers of study children

Race	Total State				New York City				Upstate New York			
	Observed		Expected	O:E	Observed		Expected	O:E	Observed		Expected	O:E
	Number	Percent	Percent		Number	Percent	Percent		Number	Percent	Percent	
Total	553	100.0	100.0	------	322	100.0	100.0	------	231	100.0	100.0	------
White	474	85.7	89.2	0.96	257	79.8	84.3	0.95	217	93.9	95.9	0.98
Nonwhite	79	14.3	10.8	1.32	65	20.2	15.7	1.29	14	6.1	4.1	1.49

statistically significant ($P<0.05$). The upstate difference was due to the excess of observed over expected number of mothers in the extremes of the age span (under 20 years and 35 years or over). For upstate, the ratio of observed to expected (O:E) number of mothers in the combined under 20 and 35 or over age groups was 1.38. When the data for New York City were subdivided by race, the pattern for whites, although not statistically significant at the 0.05 level, was similar to the pattern for upstate New York: the corresponding O to E ratio for white mothers in New York City was 1.20.

Sex. The distribution of study children according to sex was not significantly different at the 0.05 level from that expected.

Prior pregnancy history. The birth certificates used in New York City and upstate New York during the study period provided space for recording the number of children previously born alive or dead to the mothers of the study group. However, the information on stillbirths was not comparable for New York City and upstate New York, because the city included abortions in the category of "previously born dead" and the upstate certificates requested information on only stillbirths which occurred after 20 weeks gestation. The data on previous pregnancy history are shown in tables 4 and 5.

For upstate New York the observed distribution of study group mothers according to number of prior total births (live births and still-

Table 3. Observed and expected distributions of maternal age at delivery

Age group at delivery (years)	New York City			Upstate New York		
	Observed		Expected	Observed		Expected
	Number	Percent	Percent	Number	Percent	Percent
Total	322	100.0	100.0	231	100.0	100.0
Under 20	21	6.5	6.9	27	11.7	8.0
20–24	91	28.3	30.8	68	29.4	30.9
25–29	113	35.1	33.0	56	24.2	31.2
30–34	60	18.6	19.1	48	20.8	19.4
35–39	31	9.6	8.1	23	10.0	8.5
40 or over	6	1.9	2.1	9	3.9	2.0

Table 4. Observed and expected distributions of mothers of study children, by number of prior births

Number of prior births	New York City, all races				New York City, white				Upstate New York, all races			
	Observed		Expected	O:E	Observed		Expected	O:E	Observed		Expected	O:E
	Number	Percent	Percent		Number	Percent	Percent		Number	Percent	Percent	
Total mothers	[1] 315	100.0	100.0	------	[2] 251	100.0	100.0	------	231	100.0	100.0	------
0	117	37.1	34.4	1.08	104	41.4	34.9	1.19	84	36.4	28.1	1.30
1–4	179	56.8	60.1	.95	133	53.0	61.0	.87	132	57.1	66.3	.86
5 or more	19	6.0	5.5	1.09	14	5.6	4.1	1.37	15	6.5	5.5	1.18

[1] Excludes 7 mothers whose prior pregnancy history was not reported.
[2] Excludes 6 mothers whose prior pregnancy history was not reported.

NOTE: Data for New York City include abortions (under 20 weeks gestation).

births) was significantly different from the expected ($P<0.05$), a difference largely due to the appreciable excess of primiparae (O:E=1.30) over the expected. In New York City the observed distribution according to reported prior births was not materially different from the expected. However, when limited to white mothers only, the excess over expected in number of mothers with no previous births (live births, stillbirths, or abortions) was statistically significant at the 0.01 level (O:E=1.19). Thus, the data suggest a possible association of blindness with primiparity.

Among the mothers who had one or more prior births, the number with one or more prior stillbirths was more than three times the expected in upstate New York ($P<0.001$). (For New York City there was no appreciable difference between the observed and expected numbers of mothers with one or more reported prior stillbirths and abortions.)

Data on previous stillbirths were also evalu-

Table 5. Observed and expected distributions of mothers of study children with 1 or more prior births, by number of prior stillbirths

Number of prior stillbirths	New York City				Upstate New York			
	Observed		Expected	O:E	Observed		Expected	O:E
	Number	Percent	Percent		Number	Percent	Percent	
Total mothers	198	100.0	100.0		147	100.0	100.0	
0	151	76.3	79.3	0.96	130	88.4	96.5	0.92
1 or more	47	23.7	20.7	1.14	17	11.6	3.5	3.31

NOTE: Data for New York City include abortions (under 20 weeks gestation).

Table 6. Observed and expected distributions of study children, by birth weight

Birth weight (grams)	New York City			Upstate New York			Total State					
							All races			White		
	Observed		Expected	Observed		Expected	Observed		Expected	Observed		Expected
	Number	Percent	Percent	Number	Percent	Percent	Number	Percent	Percent	Number	Percent	Percent
Total	322			231			553			474		
Unknown birth weight	10			5			15			10		
Known birth weight	312	100.0	100.0	226	100.0	100.0	538	100.0	100.0	464	100.0	100.0
Less than 1,001	3	1.0	.1			(1)	3	.6	(1)	2	.4	(1)
1,001–1,500	12	3.8	.4	11	4.9	.2	23	4.3	.3	17	3.7	.2
1,501–2,000	17	5.4	1.1	14	6.2	1.1	31	5.8	1.1	25	5.4	1.0
2,001–2,500	28	9.0	5.0	14	6.2	3.4	42	7.8	4.3	32	6.9	3.9
2,501–3,000	92	29.5	22.5	48	21.2	19.8	140	26.0	21.4	118	25.4	20.8
3,001–3,500	89	28.5	41.7	79	35.0	39.5	168	31.2	40.8	155	33.4	40.7
3,501–4,000	57	18.3	23.0	48	21.2	28.3	105	19.5	25.2	93	20.0	26.2
4,001–4,500	14	4.5	5.4	10	4.4	6.3	24	4.5	5.8	20	4.3	6.0
4,501 or more			.9	2	.9	1.3	2	.4	1.1	2	.4	1.2

[1] Less than 0.05.

ated for upstate New York in terms of the total number of such events (as distinct from the number of mothers with one or more stillbirths). Adjustment was made for the difference in distribution of observed and expected numbers of mothers with specific numbers of prior births (live births or stillbirths) so as to take into account the effect of the prior birth distribution on the frequency of prior stillbirths. Of the 338 prior births, 20 (5.9 percent) were stillborn in contrast to an adjusted expectancy of 6.9 stillbirths (2.0 percent). This difference was highly significant ($P<0.001$). The observed ratio of prior stillbirths to prior total births was higher than expected for each group of mothers with the same number of prior births.

Birth weight. The observed distribution of the study children by birth weight is compared with the expected distribution in table 6 and the chart. In view of the relationship between birth weight and race, the observed and expected distributions for the total study group are shown in the table for whites and for all races combined. (Although the number of nonwhite children was relatively low, the relationship of observed to expected in the distribution by birth weight of nonwhites followed the same pattern as that for whites.)

As shown in table 6, there were more children than expected in each weight group under 3,001 grams, and correspondingly fewer than expected in each birth weight group thereafter. The difference between the observed and expected birth weight distributions was highly significant ($P<0.001$). Using birth weight under 2,501 grams to define prematurity, there is little doubt from these data that the incidence of blindness due to prenatal factors is highly associated with premature birth (O:E=3.22). The difference between the observed and expected mean birth weights was similar for New York City and upstate. For the State as a whole the mean birth weight observed for all races was 3,004 grams compared with an expected mean weight of 3,277 grams, and for whites the observed and expected means were 3,039 and 3,295 grams respectively. Thus, the difference between the observed and expected mean birth weights was consistent by race: the observed mean was 273 grams less than expected for the total study group.

Rh factor. Little information could be gained regarding Rh factor, because this was not reported on the birth certificates of about 40 percent of the study group. Where this information was reported, the observed and expected frequencies of Rh negative were almost identical.

Observed and expected birth weight distributions for total study group

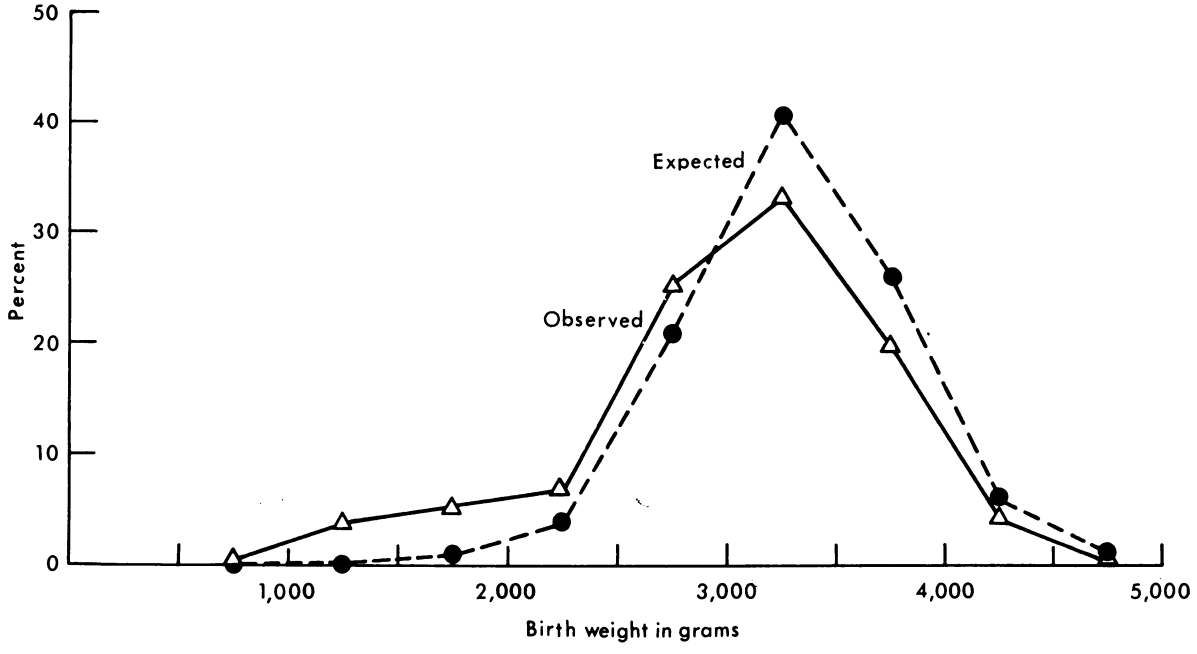

Table 7. Observed and expected distributions of study children, by complications of pregnancy among their mothers

Complications of pregnancy	Total State				New York City				Upstate New York			
	Observed		Expected	O:E	Observed		Expected	O:E	Observed		Expected	O:E
	Number	Percent	Percent		Number	Percent	Percent		Number	Percent	Percent	
Total	553	100.0	100.0	------	332	100.0	100.0	------	231	100.0	100.0	------
No complications	511	92.4	96.4	0.96	296	91.9	96.1	0.96	215	93.1	96.8	0.96
1 or more	42	7.6	3.6	2.11	26	8.1	3.9	2.08	16	6.9	3.2	2.16
Preeclampsia	21	3.80	1.25	3.04	10	3.11	1.35	2.30	11	4.76	1.11	4.29
Eclampsia	1	.18	.04	4.50	1	.31	.03	10.33	------	-------	.04	------
Hypertensive disease	2	.36	.34	1.06	2	.62	.34	1.82	------	-------	.25	------
Uterine bleeding	5	.90	.41	2.20	3	.93	.59	1.58	2	.87	.15	5.80
Urinary tract condition	4	.72	.22	3.27	3	.93	.20	4.65	1	.43	.25	1.72
Viral infection	1	.18	.05	3.60	1	.31	.05	6.20	------	-------	.06	------
Heart disease	2	.36	.30	1.20	2	.62	.34	1.82	------	-------	.26	------
Diabetes	2	.36	.12	3.00	1	.31	.11	2.82	1	.43	.13	3.31
Injury or operation	1	.18	.08	2.25	1	.31	.09	3.44	------	-------	.06	------
Other complications [1]	11	1.99	1.22	1.63	8	2.48	1.23	2.02	3	1.30	1.19	1.09

[1] The most frequent other pregnancy complications reported among mothers of study children were premature rupture of membranes and "other" nonviral infections.

Complications of pregnancy. Table 7 shows the distribution of complications of pregnancy among the mothers of the study group, as reported on the birth certificates, compared with the expected distribution. The number of mothers with one or more complications of pregnancy far exceeded the expected: the O:E ratio was about 2.1 for both subdivisions of the State. This difference was highly significant, with $P<0.001$ for the total study group.

Among the study mothers, preeclampsia was the only pregnancy complication reported rather frequently and with an appreciable excess over expected. This condition was reported for 21 of the 42 mothers reported to have at least one complication of pregnancy, and it accounted for most of the difference between observed and expected numbers with one or more complications. The observed excess of preeclampsia was similar for New York City and upstate, with an O:E ratio of 3.04 for the total study group. This excess was highly significant statistically ($P<0.001$).

Preeclampsia was reported on the birth certificates of 4 percent of the entire study group. This relative frequency may not appear particularly unusual; however, since complications of pregnancy are somewhat underreported on birth certificates, 4 percent is undoubtedly a minimum relative frequency of preeclampsia in pregnancies producing blind children. The fact that this was three times the expected frequency, as derived from the same source documents in the general population of births, strongly supports the potential relationship of preeclampsia to blindness.

Complications of labor. Data on complications of labor are shown in table 8. For New York City, little difference was noted between the observed and expected numbers of mothers reported with one or more complications of labor. For upstate, however, the excess over expected was significant ($P<0.01$). The factor of race could not account for this difference, since the findings were consistent for both whites and nonwhites in New York City. However, the lack of agreement between both subdivisions of the State may be due partly to artifacts of re-

porting, including differences in the birth certificate format which are discussed later.

As to specific complications of labor, the data for upstate New York revealed an appreciable excess over expected of breech and other malpresentations. However, this finding was in marked contrast with, and hence not supported by, the data for New York City. An observed excess of placenta praevia and premature separation was noted for both the city and upstate, but the number of mothers affected (16) was rather small, and this excess is associated with the higher than expected frequency of premature birth in the study group (both conditions were reported in 1 pregnancy and 10 of the 16 pregnancies produced infants weighing less than 2,501 grams).

Operative procedures. There was little difference between the observed and expected numbers of infants delivered by one or more operative procedures. The higher frequency of malpresentation in the upstate New York study

Table 8. Observed and expected distributions of study children, by complications of labor among their mothers

Complications of labor	Total State				New York City				Upstate New York			
	Observed		Expected	O:E	Observed		Expected	O:E	Observed		Expected	O:E
	Number	Percent	Percent		Number	Percent	Percent		Number	Percent	Percent	
Total	[1] 551	100.0	100.0	------	322	100.0	100.0	------	[1] 229	100.0	100.0	------
No complications	490	88.9	90.9	0.98	291	90.4	90.0	1.00	199	86.9	92.2	0.94
1 or more	61	11.1	9.1	1.22	31	9.6	10.0	.96	30	13.1	7.8	1.68
Placenta praevia	7	1.27	.34	3.74	4	1.24	.34	3.65	3	1.31	.33	3.97
Premature separation of placenta	10	1.81	.60	3.02	4	1.24	.50	2.48	6	2.62	.73	3.59
Anomaly of cord	1	.18	.37	.49	------	-------	.16	------	1	.44	.66	.67
Breech presentation	14	2.54	2.10	1.21	4	1.24	2.27	.55	10	4.37	1.87	2.34
Other malpresentation	7	1.27	1.30	.98	2	.62	1.57	.39	5	2.18	.92	2.37
Contracted pelvis	7	1.27	.97	1.31	4	1.24	.68	1.82	3	1.31	1.36	.96
Other dystocia	4	.73	1.24	.59	2	.62	1.25	.50	2	.87	1.24	.70
Other complications [2]	15	2.72	3.09	.88	13	4.04	4.29	.94	2	.87	1.41	.62

[1] Excludes 2 children for whom information on mothers' complication of labor was not reported.
[2] The most frequent other complications of labor reported among the mothers of the study children were fetal distress, lack of progress, and transverse arrest.

Table 9. Observed and expected proportions of study group children reported with 1 or more congenital abnormalities at time of birth

Place of birth	Total children	Children with 1 or more congenital abnormalities			
		Observed		Expected	O:E
		Number	Percent	Percent	
Total	553	50	9.04	0.78	11.59
New York City	322	21	6.52	.75	8.69
Upstate New York	231	29	12.55	.82	15.30

group resulted in a corresponding excess of breech extraction over expected.

Congenital abnormalities at birth. As anticipated, both subdivisions of the State showed an appreciable excess over expected in the number of infants for whom congenital abnormalities were reported on the birth certificates (table 9). The O to E ratio was more than 11 to 1 for the entire study group. Also as anticipated, review of the types of malformations reported on the birth certificates of the study group showed a great preponderance with specific mention of eye defects and a number with mention of brain or facial abnormalities.

Birth injury. Less than 1 percent of the birth certificates of the study group indicated a birth injury. The four children for whom birth injury was reported were far too few to be statistically meaningful. Further, for three of these children the injury was reported as questionable without mention of type of injury.

Site or type of affection. From the foregoing it appears that certain factors, either alone or in combination, may be associated with the occurrence of blindness in children. These factors are birth weight, complications of pregnancy (specifically preeclampsia), complications of labor, age of mother, parity, and previous pregnancy loss. In an effort to determine whether any of these variables were associated with specific blinding conditions, we reviewed each variable according to the site or type of blinding affection as classified by the New York State Commission for the Blind at the time of the original report of blindness.

The data on these variables showed a particularly strong association of birth weight with a specific type of eye affection—congenital cata-

Table 10. Distribution of study group by birth weight, and by site and type of eye affection

Site and type of eye affection	Total children	Number of children with known birth weight			Percent under 2,501 grams [1]
		Total	Under 2,501 grams	2,501 grams or more	
Total	553	538	99	439	18.4
Eyeball in general	202	196	29	167	14.8
Refractive errors	51	48	10	38	20.8
Myopia	48	45	10	35	22.2
Other	3	3	----------	3	----------
Structural anomalies	148	145	19	126	13.1
Albinism	44	43	5	38	11.6
Anophthalmus or microphthalmus	34	34	5	29	14.7
Congenital glaucoma	53	51	6	45	11.8
Aniridia	7	7	----------	7	----------
Other	10	10	3	7	30.0
Other	3	3	----------	3	----------
Cornea	14	14	2	12	14.3
Iris and ciliary body	8	8	1	7	*12.5*
Crystalline lens	105	99	27	72	27.3
Cataract	96	90	26	64	28.9
Dislocated lens	9	9	1	8	*11.1*
Choroid and retina	47	47	7	40	14.9
Macular degeneration	15	15	----------	15	----------
Other retinal degeneration	4	4	----------	4	----------
Detached retina	5	5	1	4	*20.0*
Other	23	23	6	17	26.1
Optic nerve, visual pathway, and cortical visual centers	120	118	21	97	17.8
Optic nerve atrophy, optic neuritis	108	106	20	86	18.9
Other	12	12	1	11	8.3
Vitreous	2	2	1	1	*50.0*
Miscellaneous and ill-defined	55	54	11	43	20.4
Amblyopia	28	27	4	23	14.8
Other and ill-defined	27	27	7	20	25.9

[1] Percent based on total with known birth weight; where base is less than 10 children, percents are shown in italics.

ract. As shown in tables 10 and 11, congenital cataract was responsible for blindness in 26.3 percent of the children who weighed less than 2,501 grams at birth, whereas it was present in only 14.6 percent of those with birth weights of 2,501 grams or more. (Since the distributions for New York City and upstate New York were similar with respect to birth weight and type of affection, tables 10 and 11 show data only for the total study group.) Viewed another way, 28.9 percent of all infants with cataract were premature in contrast to a relative frequency of only 16.3 percent premature infants with all other eye affections. This association of cataract with low birth weight is statistically significant ($P<0.01$, based on chi-square test of independence).

With regard to preeclampsia, the number of mothers affected was too small to permit any clear-cut conclusions concerning their offsprings' types of eye affection. However, it is of interest to note the frequency of congenital cataract among the 42 infants of mothers who had complications of pregnancy: cataract was reported for 10 of these infants, and preeclampsia was reported for 7 of their mothers. Thus, one-third of the 21 preeclamptic pregnancies resulted in children with cataracts, while only one-sixth of all other study children (89 of 532) had congenital cataracts.

Complications of labor and prior pregnancy history of the mother did not appear to be associated with site or type of eye affection in the child. However, some association was found between site or type of eye affection and maternal age. For upstate New York, a significantly higher relative frequency of congenital cataract was found among children of mothers 35 years or older than among those of mothers under 35 years ($P<0.05$, based on chi-square test of independence). In contrast, optic nerve atrophy was relatively more common among children of mothers under 20 years than among those of mothers 20 years or older ($P<0.05$, based on chi-square test of independence). While these findings appear to be consistent for upstate New York and the State as a whole, they are nevertheless difficult to interpret etiologically.

Cataracts may obscure other anomalies of the eye, due to the opacity of the lens. In fact, congenital cataract is frequently associated with other ocular anomalies (*6*). Nevertheless, from the study data, cataracts seemed to be the most common type of blinding affection among children whose birth weight was low, or whose mothers had preeclampsia during the prenatal period, or whose mothers were aged 35 years or older.

Table 11. Distribution of all children with congenital cataract and other eye affections, by birth weight

Birth weight (grams)	Total	Number with cataract	Number with other affections	Percent with cataract
Total [1]	538	90	448	16.7
Under 2,501	99	26	73	26.3
2,501 or more	439	64	375	14.6
Percent under 2,501 grams	18.4	28.9	16.3	

[1] Excludes 15 children whose birth weight was not reported.

Twinning

Although the objectives of the study did not include an investigation of the relationship between twinning and the occurrence of blindness, the process of selecting subjects for study provided limited information on this relationship. In checking the 801 potential subjects for study against various sources, including birth certificates in New York State, we found that 618 children were neonatal survivors known to have been born in the State during the study period, and 37 of these survivors, including 3 twin pairs, were of twin birth. (The medical supplement of the birth certificate was completed for 35 of the twins and 553 single births.) Thus, approximately 6 percent of the study group was of twin birth, a figure appreciably higher than the usual frequency of some 2 percent among live births.

As noted earlier, blindness was found to be associated with low birth weight. We thought that this might account for the relatively high frequency of twin births among blind children, since low birth weight is generally more common among multiple than single births (two-

thirds of the blind twin group were under 2,501 grams at birth). However, a review of birth weights in the twin group indicated that this alone did not account for the high proportion of twins among the blind children. The twin frequency was found to be higher than the usual occurrence for those with birth weight under 2,501 grams as well as for those of 2,501 grams or more. Although the number of twins was small, the patterns were consistent and they indicate that the relationship between twinning and blindness incidence is worthy of further study.

Discussion

More reliance could have been placed on the prenatal and delivery data required for study if such data had been obtained directly from hospital records instead of from birth certificates, and if a matched set of controls was used, as in other reported studies (*7–13*). However, use of the hospital records for the blindness study would have presented serious difficulties. These problems, as well as the advantages of employing birth certificates as a source of data and the limitations of birth certificate information pertaining to prenatal factors, have been described elsewhere (*3*). It will suffice to note that previous studies (*14, 15*) have shown that some items, such as birth weight, are usually reported accurately on nearly all birth certificates, whereas other items, including complications of pregnancy, are far less adequately reported. The effect of underreporting factors associated with blindness generally would be to reduce the chance of finding the association and hence to increase the credibility of any association found (*16*).

The birth certificate formats of the New York City and the New York State Departments of Health were revised during the 12-year study period. The most significant revision, insofar as this study was concerned, pertained to the recording of complications of pregnancy and labor and of operative procedures on the medical supplement. The certificates used in upstate New York from 1948 through 1951 provided "fill-in" spaces for complications of pregnancy and labor and the operative procedures used. Beginning in 1952, the upstate certificates provided a check-box arrangement for each of the complications and operative procedures listed on the certificate (including "none" and "other-specify") which were applicable to the pregnancy. In New York City, the open-ended fill-in spaces for complications of labor and for operative procedures were used on all certificates during the study period. However, for complications of pregnancy, the fill-in space was replaced in 1954 (and thereafter) by a check-box arrangement somewhat similar to that for upstate New York.

It was evident from the abstracted data for the control sample that the frequency of reported pregnancy complications was affected by the birth certificate format. However, since the control sample was weighted in proportion to the distribution of subjects by year of birth, the effect of this factor in the subject-control comparisons was minimized.

Despite the limitations of birth certificate information on complications of pregnancy, the study results relative to such complications merit further comment. We noted that preeclampsia largely accounted for the appreciable excess over expected in the number of mothers with one or more complications of pregnancy. Further, the data suggested that this condition may be specifically associated with congenital cataracts in the offspring. Because of the significant finding for preeclampsia, we reviewed the data on the 21 mothers with reported preeclampsia to determine whether other pertinent variables might also be associated with this observation.

The variables considered were race, parity, birth weight, age of mother, and other complications of pregnancy and labor. Of the 21 mothers with preeclamptic pregnancies, only 1 was nonwhite. Sixteen of these mothers had had no previous live-born children. Thus, three-fourths of this group were primiparae in contrast to an observed primiparity rate of less than 40 percent among all mothers of the study children. Birth weight was known for 20 children in the preeclamptic group, and 8 (40 percent) were premature in contrast to a prematurity rate of 18.4 percent for all study children of known birth weight. As to maternal age, 5 mothers were under 20 years, 12 were between 20 and 34 years, and 4 were over 35. Finally, preeclampsia was the only reported pregnancy

complication for 17 of the 21 mothers; and of 20 mothers for whom information on labor was reported, 4 were reported to have had a complication of labor.

Interestingly, McDonald (*17*) also noted a relatively high incidence of cataract among single, live-born children of low birth weight and that the affection appeared to be associated with maternal preeclampsia. Although the number of children with cataract in his study was small (and not necessarily blind by the definition used in our study), McDonald's findings lend added significance to the apparent association of cataract with low birth weight and maternal preeclampsia which we found in our study.

The significant finding regarding preeclampsia must be considered in the light of other factors which are not only related to this condition but which are also pathological with regard to pregnancy outcome. Because preeclampsia is associated with primiparity and premature birth, and is most common among pregnant women in the extremes of the maternal age span (over 35 and under 20 years), it is difficult to divorce these factors from one another in attributing possible etiological significance to the occurrence of congenital cataract or other types of blindness in children.

In view of the limitations of birth certificate data, corresponding limitations must be placed on the study findings, depending on the variable under consideration. Thus, the association of low birth weight with blindness is undoubtedly of real significance and not due to any artifact of study. However, the other significant associations or indications of the study should be viewed as leads for further investigation to establish cause-and-effect relationships.

Accepting the concept of a "continuum of reproductive wastage" postulated by Lilienfeld and Parkhurst (*18*), subsequently referred to as a "continuum of reproductive casualty" (*7*), the results of our study suggest that blindness in children is a component of such a "continuum." Similar findings were noted in a recent study (*13*) dealing with the association of perinatal factors and the occurrence of strabismus in children. Among the findings of that study was an association of low birth weight, short duration of pregnancy, and high previous fetal loss with the occurrence of strabismus, a condition which may lead to blindness.

Summary

A retrospective study of 553 legally blind children of single birth, born in New York State during a 12-year period, was conducted to investigate the association of perinatal factors and birth weight with the occurrence of blindness. A stratified systematic sample of the recorded single live births in the State over the same period provided expected values for comparison with the study group. Perinatal information was obtained from the birth certificates and their accompanying medical supplements, and information on the study children's blindness was obtained from the New York State Commission for the Blind.

The results of the study showed that the study group was characterized by low birth weight. A somewhat higher proportion than expected of mothers of the study children were nonwhite, and also a higher than expected proportion were at the extremes of the maternal age span at delivery (under 20 or 35 years or older). More mothers than expected were primiparae. For upstate New York, the mothers of the study children were characterized by a higher than expected frequency of prior stillbirths. The proportion of mothers of the study children with one or more complications of pregnancy was twice the expected, and this was due principally to a significant excess of preeclampsia among these mothers. With regard to type of blinding affection, congenital cataract was the most notable affection associated with low birth weight. Supplementary information indicated that the proportion of blind children who were of twin birth was appreciably higher than the usual incidence of twins among live births.

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Rear Vision Systems in Cars

Scientists at Tufts University, Medford, Mass., will study the advantages of using convex rear-view mirrors and other new types of rear-view display systems instead of the conventional flat mirror on automobiles.

The Injury Control Program, National Center for Urban and Industrial Health of the Public Health Service has awarded $55,285 to Tufts for the first year of an anticipated 3-year project.

Convex mirrors of different curvatures, providing a wide view of the rear scene, will be tested in the laboratory under simulated driving conditions. Later, radically new systems will be considered; for example, a television screen presentation of a camera view of the rear roadway, a rear-view periscopic system, similar to a submarine's, and a "contact analog" display that would present radar images of surrounding objects.

The merit of each rear-view system will be determined by the amount and accuracy of information provided to the driver and by the driver's resulting ability to judge distance and closing speeds of approaching vehicles.

Program Notes

Chances of Losing Parents

An American child born to a father 25 years of age stands a 46 to 1,000 chance of losing that father by death before he is 18. (In most cases, the mother then faces the dual responsibility of providing economic support and of maintaining a home.)

The chances that a child born to a mother 20 years old will lose his mother within 18 years are only 19 in 1,000. Of course, the likelihood of a child's losing a parent before he is 18 rises with the age of the parent at the time the child is born. Chances are no greater than 85 in 1,000, however, that the child's mother will die before is 18, even if she is 40 years old.

The greater risk of premature death for the father reflects the higher mortality at every age among husbands compared with wives, as well as the fact that the husband is usually a few years older than his mate.—*Statistical Bulletin* (Metropolitan Life Insurance Company), December 1966.

Health Careers Council

Formation of a State health careers council is the goal of a recently established committee in Massachusetts. Its members are concerned with providing the health workers needed to meet the increasing demands for health care.

The purpose of the council will be to induce more persons completing educational programs to enter and remain in the health field. Professional groups, health agencies and workers, educators, and counselors will plan a coordinated program which will provide opportunities for students to explore the broad spectrum of health careers before making a career choice. An integral part of the program will be a study of the effect of health care trends on existing and emerging career opportunities.

The Massachusetts League for Nursing fostered the formation of the committee and continues to sponsor it.

Telecast on Venereal Disease

Venereal disease was the subject of a 90-minute telecast presented on WBAL–TV, Baltimore, Md., on January 27, 1967. The program was arranged by Sidney King, director of public service for the station, and Harvey Felix, information-education specialist in the city health department.

The program opened with a filmed dramatization. Then a panel discussion followed to examine the venereal disease problem in Baltimore, especially as related to teenagers. The viewing audience was invited to phone in questions for the panel members to answer.

The television station helped to alert residents to the program and the problem by means of large billboards, posters, and other informational media.

N.C.'s Traveling Psychiatrist

Physicians in five rural counties of North Carolina can get free advice on treatment of patients with relatively minor psychiatric disorders. Almost all of the general practitioners in Alleghany, Avery, Burke, Caldwell, and Watauga Counties have been participating in a pilot project that has provided them, since 1964, with opportunities for free psychiatric consultation.

Dr. James L. Cathell of the State's mental health department, psychiatric consultant to local physicians, visits each of the participating general practitioners once or twice a month to discuss any case with which he may be able to help. In 2 years, he reported, admission rates for the State hospital from the five counties dropped 25 percent. "But that's only one benefit," he said. "I believe we're improving our care of mild psychiatric illness too."—*SK&F Psychiatric Reporter* (Smith, Kline and French Laboratories), November–December 1966.

Need for Safer School Bus Seats

Seats in school buses are too low, exposing children to serious injury from either head-on or rear-end collisions, according to a recent Government-financed study conducted by the University of California at Los Angeles.

The authors of the study reported that 3,700 children in the United States were injured in school bus accidents in 1965—an increase of 75 percent over 1960.

The most effective school bus seat, the authors stated, would be 28 inches or more in height, with a well-padded back, well-padded arm rests, and a harness or lap belt.

Support for Sewage Treatment

Towns in the State of Maryland need not wait for a priority in order to obtain a Federal grant to construct a sewage treatment plant.

The Federal money available is divided each year among all eligible programs, reported Dr. William J. Peeples, Commissioner of the Maryland State Department of Health. The State then contributes to each program the difference between the Federal money and 75 percent of the plant's construction costs. Thus, pollution abatement can proceed as rapidly as the local communities are willing to move, Peeples pointed out.

During the past 10 years, Maryland and the Federal Government have shared in the cost of 151 sewage treatment plant projects. The State has made outright grants of more than $26 million, and the Federal Government has contributed more than $14 million. Counties and communities of Maryland put up more than $44 million to match these funds.

Items for this page: Health departments, health agencies, and others are invited to share their program successes with others by contributing items for brief mention on this page. Flag them for "Program Notes" and address as indicated in masthead.
