THE INFLUENCE OF AGE AND COLOR ON THE MATERNAL AND FETAL DEATH RATE

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In A preceding communication, we have dealt with the age incidence in a large number of women delivered consecutively on the Obstetrical Service of the Johns Hopkins Hospital, and have discussed the influence of age on the type of delivery. Following this, it has seemed important to investigate the maternal and fetal death rate as influenced by the race of the mother, as well as by her age at the time of delivery.

For this purpose, we have used the same series of cases as in the former investigation, i. e. 15,370 consecutive deliveries, premature and full-term, during the period from January 1, 1907, to December 31, 1929. The material is almost equally divided between whites and blacks, primiparae and multiparae, as may be seen from Table I, from which twelve cases have been omitted because of lack of sufficient data.

Table I.

	WHITE	BLACK	TOTAL
Primiparae	4057	4347	8404
Multiparae	3738	3216	6954
Total	7795	7563	15,358

Tables II and III show the distribution of maternal deaths according to age, race, and parity in the entire series, together with the mortality percentage in each group. There were in all 121 deaths, a gross maternal mortality of 0.79 per cent. The death rate was higher among the black than the white women, being 0.94 and 0.64 per cent, respectively. It will be noted that the death rates are consistently higher in the black than in the white race when the cases are divided not only according to parity but also according to type of delivery. At first glance many of these racial differences seem small. Their significance has, however, been tested statistically by dividing each difference by its standard deviation, and from the quotient obtained, computing the probability of such an observed difference being the result of chance or of a sampling error. The results of these tests are shown in Table VIII.

It will be noted that the death rate in each type of delivery is higher in multiparae than in primiparae. As has been stated before, we con-

sider the primiparous population in this series of cases as fairly representative and normal. However, the multiparae contain a disproportionate number of referred emergency cases, and a decreased number of normal women, which to some extent accounts for the observed difference. Nevertheless, we believe that in a normal population similar conditions

TABLE II. MATERNAL DEATHS, ACCORDING TO RACE, AGE, AND PARITY*

	AGE - 16		17 - 19		20 - 24		25 - 29		30 - 34		35 - 39		40 -		TOTAL	
	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS	TOTAL DELIV.	MAT. DEATHS
White para 0	299	2	1347	2	1649	7	489	4	172	0	80	3	21	0	4057	18
Black para 0	806	6	1976	10	1180	10	269	4	75	1	37	0	4	0	4347	31
White para x	5	0	202	1	1007	3	1037	6	797	9	491	7	199	6	3738	32
Black para x	28	0	507	4	1244	11	737	6	373	9	242	8	85	2	3216	40
Total para 0	1105	8	3323	12	2829	17	758	8	247	1	117	3	25	0	8404	49
Total para x	33	0	709	5	2251	14	1774	12	1170	18	733	15	284	8	6954	72
Total white	304	2	1549	3	2656	10	1526	10	969	9	571	10	220	6	7795	50
Total black	834	6	2483	14	2424	21	1006	10	448	10	279	8	89	2	7563	71
Total pts.	1138	8	4032	17	5080	31	2532	20	1417	19	850	18	309	8	15.358	121

*Deliv., deliveries. Mat., maternal.

MATERNAL MORTALITY PERCENTAGE

	-16	17-19	20-24	25-29	30-34	35-39	40-	TOTAL
White para 0	0.67	0.15	0.42	0.82	—→	1.10	←—	0.44
Black para 0	0.74	0.51	0.85	1.49	—→	0.86	←—	0.71
White para x	—→0.48←—		0.30	0.58	1.13	1.43	3.02	0.86
Black para x	—→0.75←—		0.88	0.81	2.41	3.31	2.35	1.24
Total para 0	0.72	0.36	0.60	1.06	—→	1.03	←—	0.58
Total para x	—→0.67←—		0.62	0.68	1.54	2.05	2.82	1.04
Total white	0.66	0.19	0.38	0.66	0.93	1.75	2.73	0.64
Total black	0.72	0.56	0.87	0.99	2.23	2.87	2.25	0.94
Total pts.	0.70	0.42	0.61	0.79	1.34	2.12	2.59	0.79

*Deliv., deliveries. Mat., maternal.

would be observed, though to a lesser extent, owing to the increased number of obstetric complications to which the multipara is subject.

It will be observed that in both whites and blacks, primiparae and multiparae, the death rate is lowest in women delivered spontaneously at term, rises definitely with operative delivery, and is highest in premature births. Since in many cases the premature delivery is due to some grave obstetric complication, the latter finding is not surprising. Furthermore, the increased mortality of operative over spontaneous delivery is significant, and gives added force to the arguments of those advocating more conservative methods of obstetrics throughout the country, as well as more intelligent care of abnormal cases.

TABLE III. MATERNAL MORTALITY PERCENTAGES

	PER CENT
Total cases, both races	0.79
Total cases, white	0.64
Total cases, black	0.94
Total primiparae, both races	0.58
Total multiparae, both races	1.04
Total primiparae, white	0.44
Total primiparae, black	0.71
Total multiparae, white	0.86
Total multiparae, black	1.24
Total full-term spontaneous deliveries	0.21
Total full-term operative deliveries	2.12
Total premature deliveries	3.90
Full-term spontaneous, white	0.19
Full-term operative, white	1.86
Premature, white	2.96
Full-term spontaneous, black	0.24
Full-term operative, black	2.44
Premature, black	4.48
Full-term spontaneous, white primiparae	0.07
Full-term spontaneous, black primiparae	0.18
Full-term spontaneous, white multiparae	0.30
Full-term spontaneous, black multiparae	0.33
Full-term operative, white primiparae	1.28
Full-term operative, black primiparae	1.73
Full-term operative, white multiparae	2.81
Full-term operative, black multiparae	3.36
Premature, white primiparae	2.23
Premature, black primiparae	4.19
Premature, white multiparae	3.65
Premature, black multiparae	4.78

In each rubric of Tables II and III the mortality is higher among the blacks than the whites. Tested statistically some of these differences are highly significant, while others mean little. However, since all these differences, even though small, show the higher mortality to be on the side of the black race, one is safe in asserting that women of that race throughout their obstetric career are significantly poorer risks than are the white.

TABLE IV. CAUSES OF MATERNAL DEATHS

	WHITE			BLACK			TOTAL
	PARA 0	PARA X	TOTAL	PARA 0	PARA X	TOTAL	
Group 1. Infection *22.31 Per Cent of Total Deaths*							
1. Infection	2	4	6	9	12	21	27
Group 2. Toxemia *28.10 Per Cent of Total Deaths*							
1. Eclampsia	8	4	12	6	7	13	25
2. Nephritis	2	5	7	1	1	2	9
Group 3. Hemorrhage *14.05 Per Cent of Total Deaths*							
1. Placenta previa	0	5	5	0	2	2	7
2. Premature separation placenta	0	2	2	1	2	3	5
3. Postpartum hemorrhage	0	2	2	2	1	3	5
Group 4. Other Obstetric Causes *18.18 Per Cent of Total Deaths*							
1. Rupture of uterus	0	1	1	0	5	5	6
2. Embolus	1	2	3	1	1	2	5
3. Chloroform poisoning	1	0	1	1	1	2	3
4. Anesthesia	0	0	0	2	0	2	2
5. Cardiac	0	1	1	1	0	1	2
6. Extrauterine pregnancy	0	0	0	1	0	1	1
7. Other	2	0	2	1	0	1	3
Group 5. Nonobstetric Causes *17.36 Per Cent of Total Deaths*							
1. Lobar pneumonia	1	5	6	2	5	7	13
2. Tuberculosis	0	1	1	2	2	4	5
3. Other	1	0	1	1	1	2	3
Totals	18	32	50	31	40	71	121

TABLE IV A. DEATHS OF OBSTETRIC PATIENTS FOR 10,000 DELIVERIES, ACCORDING TO CAUSE OF DEATH

	WHITE			BLACK			TOTAL
	PARA 0	PARA X	TOTAL	PARA 0	PARA X	TOTAL	
Infection	4.9	10.7	7.7	20.7	37.3	27.8	17.6
Toxemia	24.6	24.1	24.4	16.1	24.9	19.8	22.1
Hemorrhage	0.0	24.1	11.5	6.9	15.5	10.6	11.1
Other Obstetric Causes	9.9	10.7	10.3	16.1	21.8	18.5	14.3
Nonobstetric causes	4.9	16.1	10.3	11.5	24.9	17.2	13.7
Total	44.3	85.7	64.2	71.3	124.4	93.9	78.8

Table II indicates the mortality differences according to age. A study of this Table II indicates that the young woman of 16 years or less is not an ideal obstetric subject, and shows that the optimum age for childbearing is between 17 and 19 years, inclusive. From then onward, there is a trend upward in the mortality rate, which rises rapidly as the older age groups are reached.

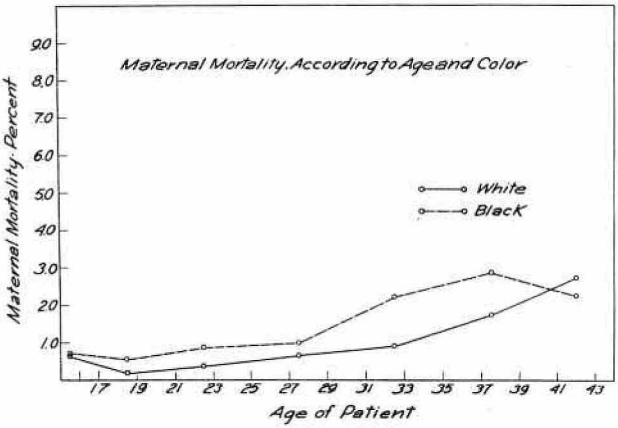

Fig. 1.—Indicating the higher maternal mortality among the black race. In both races the mortality increases with age.

Table IV sets forth the causes of death in the 121 women who succumbed in this series. Infection, toxemia, and hemorrhage, the three chief causes of death among obstetric patients, account for 64.46 per cent or about two-thirds of the total number. Infection, which in most statistics accounts for more deaths than any other cause, yields precedence to toxemia in our series. Moreover, it will be noted that only 6 of the 27 deaths due to infection occurred in white women. Consequently, the experience in this service indicates that the colored woman is not only more prone to become infected than the white, but is also less able to combat the infection once it has made its appearance.

Table IV A indicates the mortality rate among the patients in this series expressed in terms of 10,000 deliveries. In both races the maternal mortality from infection is higher in multiparous than in primiparous women. In white women toxemia accounts for approximately two-fifths of the mortality, while only one-eighth of the deaths are due to infection. Among the colored women, on the other hand, toxemia and infection account for almost one-fifth and one-third of the total deaths, respectively. Deaths due to hemorrhage are about equally divided in the two races. From our observation, it would seem that the higher mortality observed in the black race is due chiefly to a death rate from infection which is almost four times greater than in the white.

Turning now to a consideration of fetal mortality, Table V indicates the stillborn and neonatal deaths observed in this series, according to race, age, and parity, together with the mortality percentage in each category. Again, a higher rate is found throughout in the black race, and one sufficiently higher to be in most cases extremely significant. As

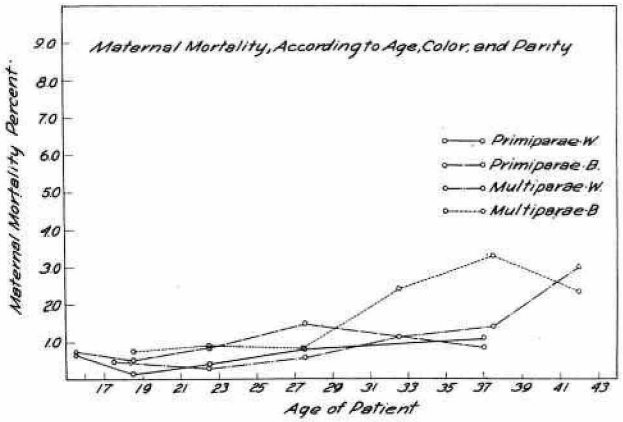

Fig. 2.—Indicating the higher mortality among multiparae. The "young primipara" has a higher mortality rate than does the woman of seventeen to twenty-five years.

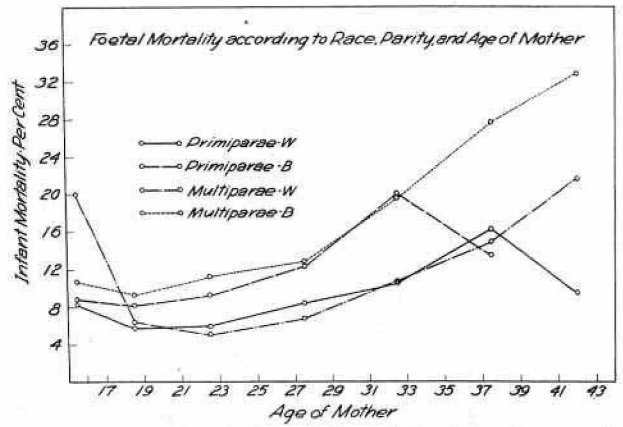

Fig. 3.—Indicating a relatively high fetal mortality below the age of seventeen, an optimum from seventeen to nineteen, and a steady rise from the age of twenty, becoming great as the older age groups are reached.

was observed in the discussion of maternal deaths, the fetal rate is higher among the multiparous than the primiparous women. The abnormal population in the former group probably accounts for a considerable part of this observed difference. A relatively high mortality is again noted among the young women; and this is particularly true in the case of the "young primipara." The black woman seems correspondingly

less affected by extreme youth than does the white. Again we find a rapidly rising mortality percentage in the later age groups, both in primiparae and multiparae. Here the abnormal population factor among the multiparae would seem to have little influence on the trend of the death rate, and we believe that this finding is significant.

TABLE V. TOTAL FETAL DEATHS, ACCORDING TO AGE, RACE AND PARITY

	AGE - 16		17 - 19		20 - 24		25 - 29		30 - 34		35 - 39		40 -		TOTAL	
	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS
White para 0	299	24	1347	78	1649	98	489	41	172	18	80	13	21	2	4057	274
Black para 0	806	72	1976	163	1180	109	269	33	75	15	37	5	4	0	4347	397
White para x	5	1	202	13	1007	51	1037	71	797	85	491	73	199	43	3738	337
Black para x	28	3	507	47	1244	139	737	94	373	73	242	67	85	28	3216	451
Total para 0	1105	96	3323	241	2829	207	758	74	247	33	117	18	25	2	8404	671
Total para x	33	4	709	60	2251	190	1774	165	1170	158	733	140	284	71	6954	790
Total white	304	25	1549	91	2656	149	1526	112	969	103	571	86	220	45	7795	613
Total black	834	75	2483	210	2424	248	1006	127	448	88	279	72	89	28	7563	848
Total pts.	1138	100	4032	301	5080	397	2532	239	1417	191	850	158	309	73	15,358	1461

FETAL MORTALITY PERCENTAGE

AGE	-16	17-19	20-24	25-29	30-34	35-39	40-	TOTAL
White para 0	8.03	5.79	5.94	8.38	10.47	—→14.85←—		6.75
Black para 0	8.93	8.25	9.24	12.27	20.00	—→12.20←—		9.13
White para x	—→6.76←—		5.06	6.85	10.92	14.87	21.61	9.07
Black para x	—→9.35←—		11.17	12.75	19.57	27.69	32.94	14.02
Total para 0	8.69	7.25	7.32	9.76	13.36	—→14.08←—		7.98
Total para x	—→8.63←—		8.44	9.30	13.50	19.10	25.00	11.36
Total white	8.22	5.87	5.61	7.34	10.63	15.06	20.45	7.86
Total black	8.99	8.46	10.23	12.62	19.64	25.81	31.46	11.21
Total pts.	8.79	7.47	7.81	9.44	13.48	18.59	23.62	9.51

TABLE VI. TOTAL FETAL DEATHS AT TERM ACCORDING TO AGE, RACE, AND PARITY

	AGE - 16		17 - 19		20 - 24		25 - 29		30 - 34		35 - 39		40 -		TOTAL	
	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS	TOTAL DELIV.	FETAL DEATHS		
White para 0	285	16	1276	40	1579	72	474	34	169	15	74	8	21	2	3878	187
Black para 0	745	46	1841	102	1097	67	247	21	67	10	36	5	4	0	4037	251
White para x	5	1	193	8	962	26	994	45	755	51	458	48	181	31	3548	210
Black para x	23	1	459	27	1150	79	673	48	338	49	207	41	73	17	2923	262
Total para 0	1030	62	3117	142	2676	139	721	55	236	25	110	13	25	2	7915	438
Total para x	28	2	652	35	2112	105	1667	93	1093	100	665	89	254	48	6471	472
Total white	290	17	1469	48	2541	98	1468	79	924	66	532	56	202	33	7426	397
Total black	768	47	2300	129	2247	146	920	69	405	59	243	46	77	17	6960	513
Total pts.	1058	64	3769	177	4788	244	2388	148	1329	125	775	102	279	50	14,386	910

FETAL MORTALITY PERCENTAGE

AGE	-16	17-19	20-24	25-29	30-34	35-39	40-	TOTAL
White para 0	5.61	3.13	4.56	7.17	8.88	—→10.53←—		4.82
Black para 0	6.17	5.54	6.11	8.50	14.93	—→12.50←—		6.22
White para x	—→4.55←—		2.70	4.53	6.75	10.48	17.13	5.92
Black para x	—→5.81←—		6.87	7.13	14.50	19.81	23.29	8.96
Total para 0	6.02	4.55	5.19	7.63	10.59	—→11.11←—		5.53
Total para x	—→5.44←—		4.97	5.58	9.15	13.38	18.90	7.29
Total white	5.86	3.27	3.86	5.38	7.14	10.53	16.34	5.35
Total black	6.12	5.61	6.50	7.50	14.57	18.93	22.08	7.37
Total pts.	6.05	4.70	5.10	6.20	9.41	13.16	17.92	6.33

The total fetal mortality is 9.51 per cent. This rather high figure is due to the presence of many premature labors in the series and in Table VI only those children born at or near term (2500 grams and over) are included, whereby the mortality is decreased to 6.33 per cent. The total mortality rates are of course considerably lower in this table than

TABLE VII. FETAL MORTALITY ACCORDING TO TYPE OF DELIVERY

	FULL-TERM SPONTANEOUS			FULL-TERM OPERATIVE			PREMATURE		
	TOTAL DELIV.	FETAL DEATHS	MORTALITY PER CENT	TOTAL DELIV.	FETAL DEATHS	MORTALITY PER CENT	TOTAL DELIV.	FETAL DEATHS	MORTALITY PER CENT
White para 0	2942	75	2.55	936	112	11.97	179	87	48.60
Black para 0	3344	101	3.02	693	150	21.65	310	146	47.10
White para x	2981	85	2.85	567	125	22.05	190	127	66.84
Black para x	2388	126	5.28	535	136	25.42	293	189	64.51
Total para 0	6286	176	2.80	1629	262	16.08	489	233	47.65
Total para x	5369	211	3.93	1102	261	23.68	483	316	65.42
Total white	5923	160	2.70	1503	237	15.77	369	214	57.99
Total black	5732	227	3.96	1228	286	23.29	603	335	55.56
Total pts.	11,655	387	3.32	2731	523	19.15	972	549	56.48

TABLE VIII. SIGNIFICANCE OF DIFFERENCES IN MATERNAL AND FETAL MORTALITY, ACCORDING TO RACE AND PARITY

	DIFF.	DIFF. / σ DIFF.	P.[1]
Maternal Mortality			
Total cases, white vs. black	0.0030	2.10	35.8 in 1000
Primiparae, white vs. black	0.0027	1.62	105.2 in 1000
Multiparae, white vs. black	0.0038	1.54	123.6 in 1000
Full-term spontaneous, white vs. black	0.0005	0.58	562.0 in 1000
Full-term operative, white vs. black	0.0058	1.03	303.0 in 1000
Premature, white vs. black	0.0152	1.25	211.2 in 1000
F.T.S. para O, white vs. black	0.0011	1.25	211.2 in 1000
F.T.O. para O, white vs. black	0.0045	0.73	456.4 in 1000
Premature para O, white vs. black	0.0196	1.24	215.0 in 1000
F.T.S. para X, white vs. black	0.0003	0.19	849.4 in 1000
F.T.O. para X, white vs. black	0.0055	0.54	589.2 in 1000
Premature para X, white vs. black	0.0113	0.61	541.8 in 1000
White para O vs. para X	0.0042	2.33	19.8 in 1000
Black para O vs. para X	0.0053	2.27	23.2 in 1000
Total cases para O vs. para X	0.0046	3.13	1.8 in 1000
Fetal Mortality			
Total cases, white vs. black	0.0335	7.07	1 in 1000
Primiparae, white vs. black	0.0238	4.05	1 in 1000
Multiparae, white vs. black	0.0495	6.41	1 in 1000
Full-term spontaneous, white vs. black	0.0126	3.78	1.2 in 1000
Full-term operative, white vs. black	0.0752	4.92	1 in 1000
Premature, white vs. black	0.0243	0.74	459.4 in 1000
F.T.S. para O, white vs. black	0.0047	1.13	258.4 in 1000
F.T.O. para O, white vs. black	0.0968	5.12	1 in 1000
Premature para O, white vs. black	0.0150	0.32	749.0 in 1000
F.T.S. para X, white vs. black	0.0243	4.42	1 in 1000
F.T.O. para X, white vs. black	0.0337	1.32	186.8 in 1000
Premature para X, white vs. black	0.0233	0.53	596.2 in 1000
White para O vs. para X, full term	0.0110	2.08	37.6 in 1000
Black para O vs. para X, full term	0.0274	4.21	1 in 1000
Total cases para O vs. para X, full term	0.0176	4.26	1 in 1000

P.[1]= probability of observed difference being due to chance.

in the preceding one which includes premature births, but otherwise the same differences are observed for race, age, and parity as have been previously discussed.

In Table VII, the fetal mortality rates are given according to whether the child is full-term or premature (the latter including all infants weighing between 1500 and 2500 gm. at birth). The full-term labors are divided according as delivery was spontaneous or operative. A study of this table shows that the mortality among premature infants is very high (56.48 per cent), and is considerably increased in the multiparous over the primiparous women. Very little racial difference is here noted, although contrary to the rest of our figures there is a slightly higher mortality among the whites. This finding, however, might be expected when one takes into consideration the fact that the black infant at birth averages between 250 and 300 gm. less than the white.

The difference in the mortality percentage between spontaneous and operative delivery at term is surprisingly high for both races, being about six times as great in the latter group. This would seem to indicate further the benefits of rational conservatism in obstetrics, or earlier interference at a more opportune time in such cases as require operative aid. Attention is again drawn to the higher rate among the multiparae and in the black race.

CONCLUSIONS

1. The gross maternal mortality in a series of 15,370 women delivered after the child has reached the period of viability is 0.79 per cent.

2. Division of the maternal cases according to parity and type of delivery shows that the maternal death rate is consistently higher in the black than in the white race.

3. In this series the mortality rate is higher in multiparae than in primiparae. This is probably due in great part to an abnormal multiparous population.

4. The maternal mortality is lowest following spontaneous delivery at term, increases in the operative type, and is highest when pregnancy terminates prematurely.

5. An increasing mortality is noted in the older age groups, although the girl under seventeen is not an ideal obstetric risk. The optimum age for both races is between seventeen and nineteen years, inclusive.

6. Approximately two-thirds of the maternal deaths are due to infection, toxemia, and hemorrhage. The death rate from infection is almost four times as high in the colored as in the white race. Death from hemorrhage occurs about equally frequently in the two races, while actually more white than black women succumb to toxemia. In our entire series, more deaths resulted from toxemia than from infection.

7. The fetal mortality is significantly higher in the black race; it is also increased in the multiparous women.

8. The fetal death rate increases with advancing age of the mother. The optimum age is seventeen to nineteen years, inclusive, while the results are poorer in the very young woman.

9. Omitting premature infants weighing less than 2500 gm., the still-born and neonatal death rate is 6.33 per cent.

10. The fetal death rate is about six times greater after operative than after spontaneous delivery at term.