PERINATAL MORTALITY*

L. G. R. VAN DONGEN, M.Sc., M.D. (RAND), M.R.C.O.G.

University of the Witwatersrand

The stillbirth rate is often taken as an index of the standard of obstetric practice for any institution or country. Though this index is one of the best we have, many other factors than the purely obstetric are involved in the problem of stillbirths. It is known that the age of the mother influences the stillbirth rate considerably; the older the mother the higher the stillbirth rate. Parity also plays an important part, the stillbirth rate being higher with the first infant than with the second, and once the patient has become a grande multipara the stillbirth rate rises very markedly. Again it has been shown that a rapid succession of pregnancies is associated with a higher incidence of stillbirths than where the births are spaced at intervals of 2 years. Good and adequate nutrition of the mother is known to reduce the incidence of stillbirths and also of premature labours. The importance of nutrition was clearly demonstrated during the siege of Leningrad in 1942. Here the stillbirth rate doubled itself and the incidence of prematurity rose from 6·5% to 41·2%. General social factors also play some part, as revealed by a study of the British Registrar-General's report, which shows a much higher stillbirth rate among the families of unskilled workers than among those of professional and business people.

The basic cause of a stillbirth may be very different from the immediate cause. For example, stillbirth from intracranial haemorrhage may be caused by overmoulding of the head in its passage through a small pelvis. Although the immediate cause of death is intracranial haemorrhage the basic cause is pelvic contraction, which in turn may have developed because the mother's environment in childhood was faulty and a deficient diet stunted her skeleton. It seems reasonable to postulate that such a mother will show other effects of reproductive inefficiency, which a high standard of antenatal care may be unable to avert. If this should be the case then, as Dugald Baird (1955) has said, the moral is clear that the planning of a pregnancy should begin when the mother herself is born.

Stillbirth rates between 1929 and 1939 varied but little, but between 1939 and 1945 a most dramatic decline in the incidence of stillbirths took place. This is illustrated by the graphs in Fig. 1 (after Ryle, 1948):

The decline in the number of stillbirths began during World War II. This is all the more remarkable when one recalls what living conditions were like during that time. There appear to be several reasons to account for this improvement. The first is that, with the introduction of rationing of food, pregnant mothers were ensured of a diet that contained the essential elements and foodstuffs. Then there were well-organized antenatal clinics made available in the areas to which the pregnant mothers had been evacuated and, in the spirit of the times, these pregnant women attended them almost as a national effort. Blood-transfusion services became highly organized and penicillin came into use, both of which must have had an indirect but beneficial effect. Lastly, but not least, a change seems to have come into obstetric practice, inasmuch as the more heroic measures to deliver vaginally were abandoned in favour of delivery by the lower-segment Caesarean section, which operation became very much safer with blood transfusions and antibiotics at hand.

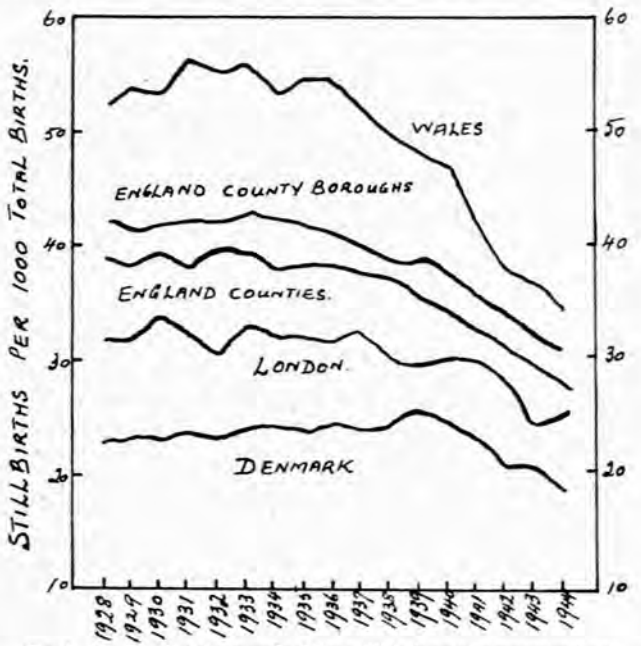

Fig. 1. Illustrating the trend of the stillbirth rate in geographical areas of England and Wales and in Denmark (1928 to 1944).

QUEEN VICTORIA HOSPITAL STATISTICS

The stillbirth rate and the neonatal death rate for the Queen Victoria Hospital, Johannesburg, for the years 1952, 1953 and 1954 will now be considered and this

* A paper presented at the South African Medical Congress, Pretoria, October 1955.

will be followed by a brief analysis of the stillbirths and the neonatal deaths for these 3 years.

The total number of deliveries was 3,866 in 1952, 3,913 in 1953, and 3,988 in 1954. These totals (11,767 in the 3 years) include all deliveries, booked and unbooked, 'hospital' and 'district'.

Stillbirth Rates

The total uncorrected stillbirth rates for the 3 years are as follows:

1952—21·9 per 1,000 births
1953—19·1 per 1,000 births
1954—15·8 per 1,000 births

Now, if only the patients who attended the antenatal clinic are considered—and this group forms 94% of our total practice—the uncorrected stillbirth rates are as follows:

1952—17·1 per 1,000 births
1953—13 per 1,000 births
1954—11·9 per 1,000 births

Correcting these latter figures for macerated stillbirths and for gross congenital abnormalities, then the corrected stillbirth rates, for antenatal-clinic cases are:

1952—6·5 per 1,000 births
1953—3·9 per 1,000 births
1954—2·9 per 1,000 births

There has thus been a progressive improvement over the 3 years. This improvement may partly be explained by stricter and more diligent supervision in the antenatal wards and in the labour wards of the hospital, and also by the freer use of Caesarean section in the treatment of placenta praevia and also in those cases where foetal distress occurred in the first stage of labour. The uncorrected stillbirth rate for all antenatal-clinic patients delivered in 1954—11·9 per 1,000 births—is getting close to the 'biological possible' of 10 per 1,000 mentioned by Baird (1947).

Neonatal Death Rates

The neonatal death rate has remained practically the same over the 3 years. The uncorrected neonatal death rates for all cases are as follows:

1952—17·2 per 1,000 live births
1953—16·1 per 1,000 live births
1954—19·8 per 1,000 live births

The uncorrected neonatal death rates for patients attending the antenatal clinic are:

1952—14·4 per 1,000 live births
1953—12·5 per 1,000 live births
1954—12·2 per 1,000 live births

If these figures are corrected for all infants of less than 32 weeks, for those with gross congenital abnormalities and for the cases of hydrops foetalis, then the corrected neonatal death rates for antenatal clinic patients become:

1952—7·8 per 1,000 live births
1953—8·0 per 1,000 live births
1954—7·9 per 1,000 live births

Though the freer use of Caesarean section has reduced the incidence of stillbirths in cases of placenta praevia, nevertheless a proportion of these infants are lost in the neonatal period from prematurity and its associated conditions.

For the sake of clarity the analysis of our perinatal mortality will be presented in the 3 natural divisions: macerated stillbirths, fresh stillbirths and neonatal deaths.

MACERATED STILLBIRTHS

There were 117 macerated stillbirths born in the 3 years 1952, 1953 and 1954. In the great majority of these cases death had occurred *in utero* well before the onset of labour. In other words, the intra-uterine death had no relationship to the actual labour or method of delivery.

A striking feature is revealed when the ages of the mothers are considered. Comparing the ages of these mothers with the ages of all the mothers delivered in the hospital, it becomes clear that macerated stillbirths occur much less frequently among young mothers and much more frequently among mothers over the age of 30 years:

Age of Mother	*Macerated Foetus*	*All Deliveries*
Under 20	5·9%	14·5%
20-29	47·9%	62·0%
30-39	39·4%	20·7%
40 and over	6·8%	2·8%

Thus the chance of a mother under 20 years of age producing a macerated stillbirth is less than half that of the average mother. Similarly, macerated stillbirths occurred twice as commonly in the mother over 30 years of age. It follows then that an age factor must either directly or indirectly play an important part in the occurrence of macerated stillbirths.

When parity is considered, it is seen that there are twice as many multiparae as primiparae. Comparing parity in this group with parity for all cases delivered in the hospital, it becomes obvious that macerated stillbirths occur less frequently among primiparae:

	Macerated Stillbirths	*All Deliveries*
Primiparae	31·6%	46·5%
Multiparae	68·4%	53·5%

No doubt the age factor mentioned above must play some part in explaining this preponderance of multiparae over primiparae.

It was found that 60% of the macerated foetuses weighed less than 5½ lb. at birth, which means that by the international standard for prematurity these 60% were premature, and that the factor causing intra-uterine death must have been operative in the majority of the cases before the 36th week of pregnancy.

The causes of the 117 macerated stillbirths of this series are expressed briefly by the following table:

Cause	*Number*	*Percentage*
Cause unknown	57	48·7%
Toxaemia of pregnancy ..	17	14·5%
Placenta grossly infarcted (? pre-eclampsia)	10	8·5%

Cause	*Number*	*Percentage*
Accidental haemorrhage (? pre-eclampsia)	5	4·3%
Chronic nephritis	1	0·9%
Diabetes *plus* pre-eclampsia	1	0·9%
Rh antibodies	15	12·8%
Accidents to the cord (cord tightly around neck, true knots, etc).	7	6·0%
Gross congenital abnormalities	3	2·6%
Extra-uterine pregnancy	1	0·9%

The first point that strikes one from this analysis is that in about one half of the cases the cause of the stillbirth is unexplained. This finding is in accordance with other analyses of macerated stillbirths found in the literature. It is in these mysterious deaths that a large field for further research lies. The age of the mother, her hereditary factors, her diet, her endocrine system must all be investigated, and then, of course, the placenta itself must come under strong suspicion. One hopes that further investigations into placental metabolism will eventually throw some light on these possibly preventible deaths.

Toxaemia of pregnancy accounts for the next largest group of macerated stillbirths (14·5%). In a further 8½% of the cases a grossly infarcted placenta was found—and possibly some of these at least might have been associated with a pre-eclampsia whose signs disappeared after the death of the foetus. Another 4·3% were associated with accidental haemorrhage, and one cannot but feel that there must have been an underlying toxaemic factor in some of these. Chronic nephritis and diabetes complicated by toxaemia of pregnancy each accounted for a further 0·9% of the cases. These cases have been placed together because of the common background of toxaemia of pregnancy, which must be implicated in the causation of these intra-uterine deaths. Possibly earlier diagnosis and treatment of the toxaemia might have prevented some of these deaths.

The presence of the Rh antibodies accounted for as many as 12·8% of the macerated stillbirths. In the present state of our knowledge regarding the Rh antibodies those deaths that occur from this cause before the 36th or 37th week of pregnancy are unavoidable.

No less than 6% of the intra-uterine deaths were caused by mechanical obstruction of the blood flow in the umbilical cord, by true knots of the cord or because the cord was tightly around the foetal neck or body. One feels that these too are unavoidable.

The 2·6% caused by gross congenital abnormalities may have been due to hereditary factors, or environmental and dietetic factors. It has been shown that in animals certain deficient diets given to the mother will result in abnormal offspring; whether this is so in human beings as well is yet to be demonstrated.

Advanced extra-uterine pregnancy, which accounted for 1 case of macerated stillbirth, is fortunately very rarely met with.

FRESH STILLBIRTHS

There was a total of 97 fresh stillbirths in the 3 years under consideration. The fact that they were fresh indicates that the death occurred within 24 hours of delivery, and so it follows that the majority of these deaths occurred during labour and were associated in some way with labour or delivery.

An analysis of the ages of the mother again shows a greater incidence of fresh stillbirths in those over the age of 30 years. In those over 40 the incidence is more than 5 times the average:

Age of Mother	*Fresh Stillbirths*	*All Deliveries*
Under 20	11·4%	14·5%
20-29	39·6%	61·98%
30-39	33·4%	20·66%
40 and over	15·6%	2·8%

Both the unknown age-factor and the factors involved with grande multiparity must enter into this very much higher stillbirth rate over the age of 40 years. In our series fresh stillbirths were found to occur relatively less frequently in primiparae than in multiparae:

	Fresh Stillbirths	*All Deliveries*
Primiparae	33·3%	46·5%
Multiparae	66·6%	53·5%

This can largely be explained by the fact that the hospital admits all primiparae, but tries to limit admission of multiparae to those who are, or have been, abnormal obstetrically. A further analysis into the degrees of parity would probably show, as other analyses have shown, that the stillbirth rate is higher in primiparae than in multiparae who have had 1, 2, 3 or 4 children, but that after the 5th delivery the stillbirth rate rises above that found in primiparae.

Unlike the macerated stillbirths, the majority of fresh stillbirths were over 5½ pounds at birth:

	Macerated Stillbirths	*Fresh Stillbirths*
Less than 5½ lb.	60%	35%
Over 5½ lb.	40%	65%

The method of delivery of the 97 fresh stillbirths was as follows:

	Number	*Percentage*
Spontaneous vertex delivery	54	55·8%
Breech delivery	14	14·4%
Internal version and breech extraction	10	10·3%
Craniotomy and extraction	5	5·1%
Forceps delivery	8	8·2%
Caesarean section	3	3·1%
Laparotomy (ruptured uterus)	3	3·1%

Of the 5 craniotomies, 3 were done for hydrocephalus and the other 2 for obstructed labour where the foetal heart sounds had disappeared. Of the 8 forceps deliveries 6 were done for marked foetal distress in labour, and the other 2 in severely toxaemic patients where the foetal heartsounds had disappeared. Of the 3 Caesarean sections 1 was done in a patient with type-4 placenta praevia in whom no foetal heart could be heard on admission, and the other 2 for foetal distress in early labour.

The causes of fresh stillbirth make a long and varied

list and it may be profitable to group them under 3 general headings:

1. CONDITIONS ASSOCIATED WITH PREGNANCY

	Number	Percentage
Toxaemia of pregnancy ..	11	11·3%
Accidental haemorrhage ..	15	15·5%
Placental praevia	7	7·2%
Hydrops foetalis	3	3·1%
Chronic nephritis	1	
Syphilis	1	
External version followed by retroplacental haematoma ..	1	4·1%
Premature rupture of membranes (5 days before onset of labour)	1	
	40	41·2%

Of the cases caused by toxaemia of pregnancy 3 were associated with eclampsia and the other 8 with a severe form of pre-eclampsia, half this number occurring between the 28th and 34th week of pregnancy. Of the cases that succumbed to accidental haemorrhage 2/3rds were also associated with severe pre-eclampsia. Of the 7 fresh stillbirths associated with placenta praevia 1 was delivered by Caesarean section for type-4 placenta praevia, in spite of there being no foetal heart sounds on admission; the other 6 were delivered vaginally. The stillbirth due to congenital syphilis occurred at the 34th week of pregnancy in a patient who had only just commenced treatment and who had a history of a previous stillbirth probably due to the same cause.

2. CONDITIONS ASSOCIATED WITH LABOUR

	Number	Percentage
Accidents to the cord (prolapse, cord around neck, etc) ..	11	11·3%
Aftercoming head held by cervix (premature breech)	4	4·1%
Foetal distress in labour with disappearance of the foetal heart	8	8·2%
Internal version for transverse lie (also with foetal distress)	4	4·1%
Cerebral haemorrhage (1 forceps, 1 brow)	2	2·1%
Ruptured uterus	3	3·1%
	32	32·9%

Most of the cases of accidents to the cord, which accounted for 11·3% of the fresh stillbirths of this series, were sent into the hospital because of these conditions; in a large proportion of them the foetal heart-beat had already disappeared on admission. Prolapse of the cord was usually associated with premature labour or with abnormal presentations. The 8 fresh stillbirths associated with foetal distress in labour were theoretically avoidable if prompt delivery had been effected. Of the 3 ruptured uteri 2 were ruptures through a previous classical Caesarean-section scar, and the 3rd was associated with a brow presentation. These are also avoidable tragedies—provided the case is seen in time.

3. MISCELLANEOUS

	Number	Percentage
Cause unknown	15	15·5%
Gross congenital abnormalities	10	10·3%
	25	25·8%

The group of 'unknown causes' were the cases admitted in labour in which no foetal heart could be heard on admission, and in whom no obvious cause for the stillbirth could be found. In all these the placenta came under suspicion, but macroscopically they appeared quite normal. Nevertheless, one feels that 'placental insufficiency' must account for some of these. The group of major congenital abnormalities is a large one and with the improvement in the incidence of stillbirths due to other causes, it is assuming greater prominence as a cause of stillbirth.

NEONATAL DEATHS

During the 3 years 1952-54 there were 206 neonatal deaths among all cases admitted to the hospital. This number includes 9 pairs of twins. It also includes 19 cases admitted to hospital after delivery outside, mostly because of premature infants. The age of the mother does not appear to have the same significance here as it does with stillbirths, except that once again mothers over the age of 40 years are associated with a slightly higher incidence of neonatal deaths.

The duration of pregnancy in weeks at the time of delivery of the 206 infants is as follows:

28-32 weeks ..	42·2%
32-36 weeks ..	28·7%
36 weeks and over	29·1%

It is no surprise to find the largest proportion of neonatal deaths amongst those infants who were less than 32 weeks. If prematurity is gauged by the international standard of 5½ lb. birth-weight and less, then we find that 75% of the neonatal deaths fall into this group (155 out of 206).

There was a proponderance of male infants in the group of neonatal deaths, 56·3% of the infants being male and only 43·7% being female.

No less than 60% of the neonatal deaths occurred within the first 24 hours of life.

The method of delivery has been considered in two sections: (1) infants less than 5½lb. and (2) infants over 5½lb.

1. METHOD OF DELIVERY OF INFANTS 5½ LB AND LESS

Method	Number	Percentage
Spontaneous vertex delivery ..	110	71%
Breech delivery	27	17·4%
Internal version	2	1·3%
Forceps delivery	3	1·9%
Caesarean section	13	8·4%
	155	100%

Of the 13 Caesarean sections, 6 were done for placenta praevia, 5 for severe pre-eclampsia, 1 for chronic nephritis, and 1 for carcinoma of the breast.

2. METHOD OF DELIVERY OF INFANTS OF 5½ POUNDS AND OVER

Method	Number	Percentage
Spontaneous vertex delivery ..	43	84·3%
Breech delivery	3	5·9%
Internal version	0	0
Forceps delivery	2	3·9%
Caesarean section	3	5·9%
	51	100%

Of the Caesarean sections 2 were done for diabetes, and 1 for foetal distress in the first stage of labour.

The causes of the 206 neonatal deaths is presented most briefly in the form of a table:

Cause	*Number*	*Percentage*
Prematurity	96	46·6%
Prematurity associated with pre-eclampsia	10	4·9%
Prematurity associated with diabetes	3	1·5%
Atelectasis	39	19·0%
Bronchopneumonia	4	2·0%
Cerebral haemorrhage	18	8·7%
Rh antibodies	9	4·4%
Gross congenital abnormalities	22	10·9%
Congenital syphilis	1	
Cerebral oedema and adrenal haemorrhage	1	2·0%
Gastro-intestinal haemorrhage	1	
Cause unknown (no cause of death found P.M.)	1	

The largest group falls under 'prematurity', and though immaturity of the infant must be the usual cause of the death, there were probably a good number in whom atelectasis and the hyaline-membrane syndrome were the factors which actually precipitated death. Of the 18 cases of cerebral haemorrhage, 1 was delivered by forceps and 1 by Caesarean section; the remaining 16 were spontaneous deliveries. No doubt some of these, cerebral haemorrhages were caused by an asphyxial state during the delivery.

CONCLUSION

Perinatal mortality therefore, is a challenge which must be met in a diversity of ways. Basically it is associated with the health of the nation, particularly the standard of nutrition and the general standard of society. More specifically it is concerned with expert antenatal supervision and with adequate facilities and organization for recognizing any abnormality early and dealing correctly with it. In Nature's way of things, the perinatal mortality will never be completely eliminated, but the constant striving towards this ideal should bring out all that is best in obstetric practice.

REFERENCES

1. Baird, D. (1947): Lancet, **2**, 531.
2. *Idem* (1955): British Obstetrical Practice, London: Heinemann.