Stillbirth rates in singleton pregnancies in a stable population at Karl Bremer and Tygerberg hospitals over 50 years

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Objective. To determine the changes in stillbirth rates in singleton pregnancies in a stable population over a period of 50 years.
Methods. Stillbirth rates for singleton pregnancies where the fetus weighed ≥1 000 g were collected from 1962 to 2011. From 1972 to 2011, rates included fetuses weighing ≥500 g at birth.
Results. When the birth weight was ≥1 000 g, the stillbirth rate declined from 70 to 12.6 per 1 000 births, and when the birth weight was ≥500 g, it dropped from 34.2 to 24.5 per 1 000 births. The decline was very much slower towards the end of the study period.
Conclusion. To achieve further sustained reductions in stillbirth rates, healthcare workers should continue to emphasise quality of healthcare, but should also address and prevent specific conditions associated with stillbirth, such as smoking and drinking during pregnancy.

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Stillbirth rates are declining very slowly,[1] and various programmes have been instituted to address this major problem. The American College of Obstetricians and Gynecologists (ACOG)[2] updated their guidelines on the management of stillbirth, Cnattingius and Stephansson[3] requested more studies to focus specifically on the epidemiology of stillbirth, and Silver *et al.*[4] published an extensive work-up of stillbirth to explain how these losses should be approached and investigated. Concern was expressed about the recent increase in the rates of stillbirth in the UK.[5] In addition, to identify causes of stillbirths, a new classification system was developed,[6] different classification systems were compared,[7] pre-pregnancy risks for antepartum stillbirths were addressed,[8] an international meeting was held to develop consensus on the classification of stillbirths,[9] and a new system for determining causes of stillbirth was suggested.[10] Much attention has also been given to the support of bereaved patients.[11,12]

At present, about 1 in 41 pregnancies at Tygerberg Hospital (TBH), Western Cape Province, South Africa, ends in a stillbirth when the fetus weighs ≥500 g and 1 in 79 ends in a stillbirth when the fetus weighs ≥1 000 g. Since knowledge about the local trend in stillbirth rates over long periods in stable populations is essential to develop new strategies, we investigated stillbirth rates over 50 years from 1962, when information from the newly established Faculty of Medicine at Stellenbosch University first became available. Since stillbirth rates are greatly influenced by population groups,[13] it was essential to keep the population group studied as homogeneous as possible.

Methods

The Faculty of Medicine (now known as the Faculty of Medicine and Health Sciences) at Stellenbosch University was established in 1956, with Karl Bremer Hospital (KBH), situated in Bellville, northeast of Cape Town, as the first teaching hospital. Stillbirth rates, as published in the annual reports of the hospital from 1962 to 1971, were collected in 1972. These rates were obtained from the weekly perinatal mortality meetings and published at the end of each year in the annual report. Stillbirth rates only applied to fetuses ≥1 000 g, as stillbirths of fetuses weighing <1 000 g were regarded as late abortions.

In 1972, obstetrics was the first clinical department to be transferred from KBH to TBH. The number of stillbirths and the total number of viable deliveries were obtained every month from the delivery register, and at the end of each year the stillbirth rate for the year was calculated. From this time, women with pregnancies dated from about 20 weeks were admitted to the labour ward rather than the gynaecology wards, in case the fetus should be viable. Formal perinatal mortality meetings were reintroduced in 1987 and prospective records were kept of all stillbirths, neonatal deaths and deliveries, from which the stillbirth rates for fetuses ≥500 g and ≥1 000 g were derived. In this way, the stillbirth rate register was updated annually. Stillbirths from multiple pregnancies were always excluded from this study.

From 1962 to 2007, the total number of deliveries from which the stillbirth rates were calculated included both hospital and supervised home deliveries, but the latter were later replaced by deliveries in a mobile delivery unit and eventually by the Midwife Obstetric Units (MOUs) of Bishop Lavis, Kraaifontein (previously Scottsdene) and Elsies River. From 1979 to 1986, stillbirths of fetuses weighing 500 - 999 g were not recorded prospectively, but this information was recently obtained from the delivery registers. Because the number of white pregnant women seen at provincial hospitals declined substantially after the introduction of private hospitals, and referrals from black residential areas have recently increased rapidly, the study was limited to referrals from traditionally coloured residential areas.

Results

Denominators from which the stillbirth rates were calculated were no longer available from 1962 to 1973. From 1974, the number of

deliveries gradually increased from 4 960 to 15 567 in 2011. For pregnancies in which the fetus weighed ≥1 000 g, the stillbirth rate declined rapidly from 70/1 000 in 1962 to 20.2/1 000 in 1974; it then fell much more slowly to 12.6/1 000 in 2011. There were prolonged periods for which the stillbirth rate did not seem to decline, but there appears to have been a decline in the last 2 years of the study period (Table 1, Fig. 1). For fetuses weighing ≥500 g, the stillbirth rate declined from 34.2/1 000 in 1972 to 24.5/1 000 in 2011.

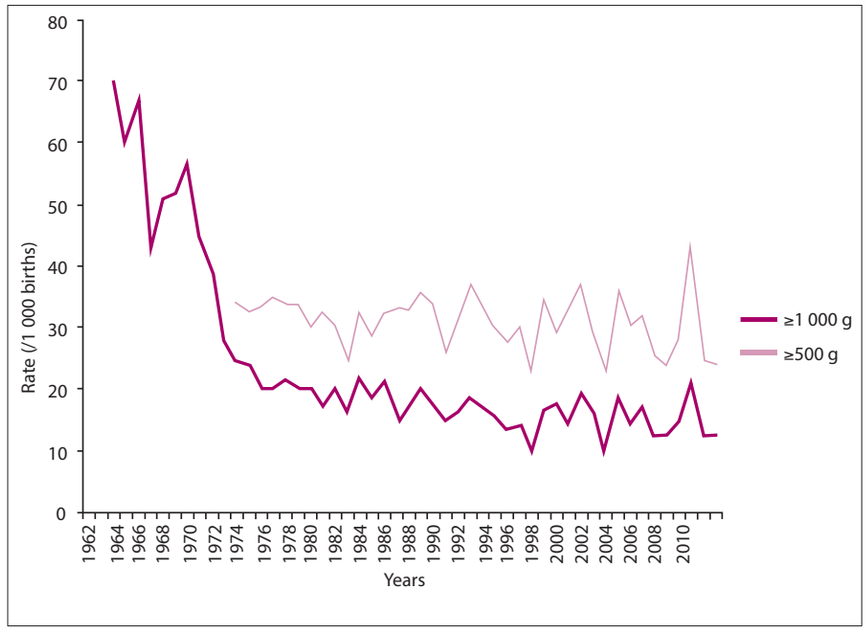

Fig. 1. Stillbirth rates in singleton pregnancies in a stable population at Karl Bremer and Tygerberg hospitals, Western Cape, South Africa, over 50 years.

Discussion

The initial decline in the perinatal mortality (PNM) rate, when organised antenatal care was introduced to the community by the newly established medical school, was rapid. Essentially the service consisted of antenatal clinics at the hospital and in residential areas, supervised home deliveries, adequate care of emergencies and complicated cases, and the provision of a flying squad service consisting of a registrar and a midwife to attend to mothers when complications arose during home deliveries and transport them to hospital if necessary in a fully equipped Land Rover ambulance, driven by the registrar.

From 1972, many new advanced technologies were introduced, such as fetal scalp blood sampling, ultrasound, fetal heart rate monitoring during labour, stress and non-stress tests, symphysis pubis-fundal measurements to assess fetal growth, and umbilical artery Doppler flow velocity measurements. However, the decline in the stillbirth rate was less dramatic, indicating that the introduction of these techniques had a lesser effect on the stillbirth rate than the introduction of basic obstetric care.

The very slow improvement in stillbirth rates indicates that it is necessary to revisit the causes and associated factors to enable specific problems to be addressed. In an ACOG Practice Bulletin on the management of stillbirths, the most prevalent risk factors are listed as non-Hispanic black race, low parity, advanced maternal age and obesity.[2] From a public health point of view, obesity, smoking and drug and alcohol abuse are also mentioned. Associated factors are hypertension and diabetes, multiple gestation, congenital abnormalities, other medical diseases, growth restriction and placental abnormalities. As potential causes of stillbirth, the bulletin refers to fetal growth restriction, chromosomal and genetic abnormalities, infection and cord events[2] – basically the same risk factors are identified by Cnattingius and Stephansson.[3] Caffeine use is another risk factor.[14] Factors associated with unexplained stillbirths are high pre-pregnancy maternal weight, fewer than four antenatal clinic visits, primiparity, parity of three or more, low socio-economic status, and maternal age of 40 years or more.[15,16]

Salihu *et al.*[17] found that the risk of placenta-associated syndromes (PAS – placental abruption, placenta praevia, pre-eclampsia, small-for-gestational-age neonate, preterm birth, stillbirth) progressively increased with greater antenatal alcohol consumption. Five or more drinks per week more than double the risk of PAS. Maternal cigarette smoking during pregnancy, as well as smoking by the partner, also contribute to the stillbirth rate as causes of placental abruption. In a cohort of 46 742 singleton pregnancies, independent risk factors for abruption were maternal and paternal smoking, use of alcohol, placenta praevia, pre-eclampsia and chorio-amnionitis.[18] Flenady *et al.*[19] found that in disadvantaged populations, maternal smoking could contribute to 20% of stillbirths or, expressed differently, that *in utero* exposure to tobacco smoke doubles the risk of stillbirth (odds ratio (OR) 2.0; 95% confidence interval (CI) 1.4 - 2.9).

Risk of stillbirth is also linked to maternal mental illness.[20] Although fetal congenital abnormality is associated with a history of maternal affective disorders (OR 2.4; 95% CI 1.1 - 5.1), the excess stillbirths are more likely to be due to factors linked to the maternal psychiatric illness, such as smoking and drinking, rather than the mental illness *per se*.

In a review of stillbirths, Smith and Fretts[5] found that most stillbirths are related to placental dysfunction, which in many women is associated with fetal growth restriction. In a study of 60 antepartum stillbirths of normally formed fetuses that occurred at ≥37 weeks' gestation, Evers *et al.*[21] found that 35% of infants were small for gestational age, but growth restriction was only suspected in about half of the cases.

Several systems of classification of stillbirths have been described. Since it is difficult to compare the results of different systems, efforts have been made to develop international consensus on the classification for research purposes.[9] However, these authors concluded that because of the lack of adequate knowledge about disease states and normal development, there will be a degree of uncertainty about whether a specific condition was indeed the cause of death. Six most commonly used classification systems were compared by 9 teams from 7 countries.[22] It was concluded that the Extended Wigglesworth and Amended Aberdeen systems cannot be recommended. Although three of the systems performed well, best agreement was found in one system that also had the lowest proportion of unexplained stillbirths. The authors recommended that the virtues of all four

Table 1. Stillbirth rates in singleton pregnancies in a stable population at Karl Bremer and Tygerberg hospitals, Western Cape, South Africa, over 50 years

	Birth weight ≥1 000 g			Birth weight ≥500 g		
Year	Deliveries *N*	Stillbirths *n*	Rate /1 000 births	Deliveries *N*	Stillbirths *n*	Rate /1 000 births
1962	-	-	70	-	-	-
1963	-	-	60	-	-	-
1964	-	-	67	-	-	-
1965	-	-	43	-	-	-
1966	-	-	51	-	-	-
1967	-	-	52	-	-	-
1968	-	-	56	-	-	-
1969	-	-	45	-	-	-
1970	-	-	39	-	-	-
1971	-	-	28	-	-	-
1972	-	-	24.5	-	-	34.2
1973	-	-	24.3	-	-	32.9
1974	-	-	20.2	-	-	33.6
1975	-	-	20.5	-	-	35.1
1976	-	-	21.6	-	-	33.9
1977	-	-	20.5	-	-	34.1
1978	-	-	20.4	-	-	29.6
1979	-	-	17.5	-	-	32.9
1980	-	-	20.7	-	-	30.8
1981	-	-	16.8	9 051	224	24.7
1982	-	-	21.9	9 415	306	32.5
1983	-	-	19.2	9 283	269	29.0
1984	-	-	21.5	8 717	283	32.5
1985	-	-	15.2	8 026	269	33.5
1986	-	-	18.1	8 411	279	33.2
1987	8 519	176	20.7	8 695	313	35.9
1988	8 165	145	17.8	8 306	286	34.4
1989	7 419	112	15	7 505	198	26.4
1990	8 874	146	16.5	9 018	290	32.2
1991	8 752	166	19	8 916	330	37.0
1992	9 314	160	17.2	9 468	314	33.2
1993	9 723	154	15.8	9 863	294	29.8
1994	9 687	130	13.4	9 825	271	27.6
1995	9 292	113	14.3	9 443	284	30.1
1996	8 839	92	10.4	8 952	205	22.9
1997	7 621	129	16.9	7 761	269	34.7
1998	-	-	17.9	-	-	29.3
1999	6 852	99	14.4	7 025	200	28.5
2000	7 512	148	19.7	7 759	291	37.5
2001	9 602	112	16.2	7 050	204	28.9
2002	6 639	68	10.2	6 798	158	23.3
2003	7 631	107	14.0	7 797	208	26.7
2004	9 668	139	14.4	9 975	303	30.4
2005	10 498	184	17.5	10 816	347	32.1
2006	10 365	132	12.7	10 584	268	25.3
2007	10 520	136	12.9	10 735	260	24.2
2008	9 774	149	15.2	9 971	286	28.7
2009	12 801	270	21.1	13 075	554	41.6
2010	12 515	156	12.5	12 673	314	24.8
2011	15 280	192	12.6	15 476	379	24.5

systems should be considered for a system for developing countries.

From a scientific point of view, it would be ideal to have an autopsy done in all stillbirths, unless the cause is obvious. This is not feasible, however, from financial and consent points of view. In any case, one should try to approach parents for consent for autopsy when possible.[23] Developing countries seldom have the resources to perform autopsies, even when there is an unexplained fresh stillbirth at term. Under these circumstances, histological examination of the placenta or even a verbal autopsy will provide valuable information in many cases.[24] Although the aim is to find an answer for the cause of death in all cases, this is unfortunately not always possible, and not all parents feel that autopsy helped them to live with their loss.[11] In general, it is important to know that parents value emotional support. It is essential to understand that for parents, avoidance of acknowledgement of the loss, insensitivity and poor staff communication are experienced as the most upsetting behaviours on the part of healthcare workers. In addition, it is important to note that nurses are generally viewed as more emotionally supportive than doctors.[12]

In a detailed survey of fellows of the ACOG, it was found that their approach to the prevention and management of stillbirth varied.[25] In their conclusions, they recommend a comprehensive educational effort to improve current knowledge of the problem. Although much progress has been made with the introduction and implementation of the Perinatal Problem Identification Program in South Africa to identify primary obstetric causes of perinatal deaths, more should be done to identify and address underlying causes such as smoking, alcohol use and poor nutrition, which contribute to abruption, preterm labour and poor fetal growth.[26]

Although we demonstrated a decline in the stillbirth rate in the predominantly coloured population, it became more difficult to obtain clean data at the end of the study period because distinctions between racial groups were no longer made. However, correlating data according to patients' residential areas solved this problem to a great extent, and very few (estimated as <5%) deliveries of black and white mothers were included in the study. As these deliveries were in the minority and influenced stillbirth rates in opposite directions, their inclusion probably did not have much effect on the stillbirth rate.

As far as the PNM rate for TBH is concerned, Talip *et al.*[27] compared three surveys, done in 1986, 1993 and 2006. In the last survey, comprising 10 396 singleton births, the PNM rate, including births from 500 g and neonatal deaths within the first week, was 25.3/1 000 births, a decline from 33.9/1 000 in 1986 and 29.2/1 000 in 1993. The first two surveys indicated that improvement in the early neonatal death rate contributed most to the decline. In the last survey, the leading primary obstetric causes were infection (17.3%), spontaneous preterm labour (15.1%), antepartum haemorrhage (mostly placental abruption, 14.7%) and intra-uterine growth restriction (14.7%).

As alcohol use and cigarette smoking have a synergistic effect on rates of preterm birth and growth restriction,[28] specific programmes to reduce smoking and drinking during pregnancy should be introduced at all antenatal clinics. From the review of the literature, it seems that PAS conditions and inflammatory processes play the most dominant role in stillbirths. Smoking, excessive use of alcohol and anxiety disorders should be identified and specifically addressed. High-risk pregnancies should continue to be identified; however, identification often occurs after placentation. The ideal is to ensure that risk factors are eliminated before placentation, and therefore before conception. A healthy lifestyle prior to conception is essential. Although infection has been mentioned as a primary obstetric cause of stillbirth in 17.3% of cases,[27] we need to learn much more about the specific micro-organisms involved and whether intervention could lead to a reduction in stillbirths. Intrapartum asphyxia is a major cause of stillbirths in South Africa,[26] but it plays a lesser role in the local community, as Talip *et al.*[27] reported that only 4.4% of perinatally related wastage was attributed to this cause.

Further reduction in stillbirth rates will require lifestyle interventions in the community in addition to specific medical interventions to improve early identification and correct management of women with perinatal risk.

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