

# Trends in prevalence and survival of very low birthweight infants, England and Wales: 1983-7

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## Abstract

Between 1983 and 1987 over 99% of all infants born in England and Wales had their birth weights recorded when the birth was registered. Trends in occurrence and one year survival of those who weighed under 1500 g at birth have been calculated in 100 g groups, separately for single and multiple births. By 1987 singleton live births in England and Wales who weighed between 700 and 799 g had a 43% chance of surviving to 1 year compared with a 32% chance five years earlier; those who weighed 800 to 899 g had a 55% chance compared with 46%. The absolute number of survivors weighing between 500 and 999 g at birth increased by nearly 50% between 1983 and 1987, and there was a 30% increase overall in survivors weighing less than 1500 g.

Infants of very low birth weight (less than 1500 g) are of considerable importance because of the large contribution they make to early deaths, the resources required for their care in the neonatal period, and most of all because of their increased risk of long term disability.<sup>1 2</sup> Their risk of death and morbidity is closely related to their weight, the risks rising sharply as birth weight falls.

Between 1983 and 1987 over 99% of all infants born in England and Wales had their birth weight recorded when the birth was registered, so that it is now possible for us to describe trends in occurrence and one year survival in 100 g groups separately for single and multiple births.

To help in the planning of their care, and the evaluation of the effects of medical intervention on their survival, the present study gives information on the frequency of births under 1500 g and their mortality.

## Methods

### BACKGROUND TO INFORMATION AVAILABLE

The birth weight for infants weighing 5.5 pounds (2494 g) or less (but not more) has been collected in England and Wales since 1952, but has been available only in aggregated weight categories.<sup>3</sup> Since 1975, however, provision has been made for birth weight to be entered on to the drafts of all birth certificates for live infants. The birth weight is copied from birth notifications sent from health authorities to the local Registrar of Births, Marriages and Deaths and now complements information given by the parents when the birth is registered. For some

years after 1975 birth weight was not completed, particularly for infants who died early, but between 1983 and 1987 it was obtained for over 99% of all live births.<sup>4</sup>

Data on occurrence and mortality by birth weight has been published regularly in publications from the Office of Population Censuses and Surveys (OPCS) annually but the breakdown has never been finer than 500 g groups.<sup>5</sup> This paper is confined to infants weighing less than 1500 g at birth; results are presented in 100 g groups and for single and multiple births separately. This grouping was prepared for the second full meeting of the International Collaborative Effort on Perinatal and Infant Mortality (ICE).<sup>6</sup>

There are a number of problems in the interpretation of the data. In England and Wales gestational age is obtained for stillbirths but not for live births, and babies that are born dead cannot be registered as stillbirths unless the pregnancy reached 28 completed weeks of gestation. All live births can theoretically be registered regardless of birth weight or gestational age, but—particularly with very preterm birth—there can be differences in opinion about what is considered to be a miscarriage rather than a live birth, or a stillbirth rather than a live birth. The attitudes of professionals towards the age of viability may affect the maturity threshold at which resuscitation is offered,<sup>7</sup> and there are international differences in the perceptions and regulations governing definitions of viability.<sup>8 9</sup>

### CALCULATION OF RATES

We have calculated mortality rates for deaths under the age of 1 year in children born in a given calendar year (birth cohort), even if the death occurred in the year after the birth. This was made possible by linking information from registrations of births and of infant deaths. The more conventional method of analysis is to relate the number of deaths in a given period (death cohort) to the births during the same period, even if the death was of a child born before the beginning of the period. Discrepancies between the use of birth and death cohorts are normally small and relate particularly to postneonatal deaths. Both are available from OPCS annual reports but the mortality rates for birth cohorts are not available until a year after those based on death cohorts.<sup>5</sup>

## Results

### TRENDS IN NUMBERS REGISTERED

Table 1 shows the numbers of infants born

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Table 1 Number (%) of live births weighing &lt;1500 g, England and Wales 1983-7

Birth weight (g)	1983	1984	1985	1986	1987
<400	64 (0.01)	65 (0.01)	73 (0.01)	82 (0.01)	67 (0.01)
400-	57 (0.01)	78 (0.01)	68 (0.01)	66 (0.01)	83 (0.01)
500-	154 (0.02)	152 (0.02)	147 (0.02)	178 (0.03)	198 (0.03)
600-	234 (0.04)	253 (0.04)	304 (0.05)	336 (0.05)	324 (0.05)
700-	309 (0.05)	332 (0.05)	361 (0.05)	400 (0.06)	412 (0.06)
800-	405 (0.06)	463 (0.07)	409 (0.06)	477 (0.07)	503 (0.07)
900-	493 (0.08)	531 (0.08)	560 (0.09)	526 (0.08)	556 (0.08)
1000-	565 (0.09)	610 (0.10)	625 (0.10)	654 (0.10)	758 (0.11)
1100-	616 (0.10)	635 (0.10)	690 (0.11)	680 (0.10)	754 (0.11)
1200-	689 (0.11)	671 (0.11)	706 (0.11)	813 (0.12)	816 (0.12)
1300-	824 (0.13)	817 (0.13)	926 (0.14)	822 (0.12)	958 (0.14)
1400-	896 (0.14)	947 (0.15)	1031 (0.16)	1047 (0.16)	1076 (0.16)
All <1500	5306 (0.84)	5554 (0.87)	5900 (0.91)	6081 (0.91)	6505 (0.95)
Not known	865 (0.14)	812 (0.13)	868 (0.13)	624 (0.09)	502 (0.07)
All live births	629134 (100)	636818 (100)	656417 (100)	661018 (100)	681511 (100)

weighing less than 1500 g and the percentage they formed of all births from 1983-7. There was a rise of 23% in the absolute numbers of registered live births of these weights, partly because there was an increase of 8% in births of all weights and partly because the proportion of all live births who had a birth weight of less than 1500 g rose from 0.84% in 1983 to 0.95% in 1987.

Table 2 gives the numbers by live births and stillbirths, and by single and multiple births. There was an increase of 21% in the number of live born singletons weighing less than 1500 g between 1983 and 1987, and an increase of 28% in multiple births. With the exception of the very lowest weight groups, the numbers of stillbirths actually fell over the period. Nevertheless, taking live births and stillbirths together, the total number of infants born weighing less

than 1500 g still increased over the period, by 16% for singleton and 24% for multiple births. Multiple births account for about one fifth of these very low birthweight babies.

#### INFANTS OF UNKNOWN BIRTH WEIGHT OR REPORTED TO HAVE WEIGHED LESS THAN 500 G

Table 3 gives the birthweight specific infant mortality rates for birth of less than 1500 g, and for births of unknown weight, separately for the years 1983 to 1987. In each year the mortality rates of those weighing less than 500 g are lower than those of babies weighing between 500 and 799 g. Moreover, babies of unknown weight have high infant mortality rates. For singletons these approximate to those of babies who weighed between 1200 and 1299 g in 1983, and to those who weighed between 1000 and 1099 g

Table 2 (A) Birth weight distribution in 1983 and 1987 for single and multiple births, and live births and stillbirths

Birth weight (g)	1983				1987			
	Live births		Stillbirths		Live births		Stillbirths	
	Single	Multiple	Single	Multiple	Single	Multiple	Single	Multiple
<500	98	23	36	20	126	24	59	16
500-	117	37	26	6	138	60	38	6
600-	183	51	58	8	266	58	58	11
700-	261	48	88	12	335	77	80	11
800-	339	66	90	11	412	91	72	7
900-	403	90	106	11	427	129	97	6
1000-	464	101	133	11	633	125	111	6
1100-	515	101	121	10	625	129	95	11
1200-	576	113	105	20	633	183	100	19
1300-	653	171	116	9	758	200	96	18
1400-	677	219	104	13	848	228	97	13
All <1500	4286	1020	983	131	5201	1304	903	124
Not known	810	55	35	17	474	28	22	11

(B) Percentage change from 1983 to 1987 for single and multiple births, and live births and stillbirths

Birth weight (g)	Live births		Stillbirths		All single	All multiple
	Single	Multiple	Single	Multiple		
<500	29	4	64	-20	38	-7
500-	18	62	46	0	23	53
600-	45	14	0	38	34	17
700-	28	60	-9	-8	19	47
800-	22	38	-20	-36	13	27
900-	6	43	-8	-45	3	34
1000-	36	24	-17	-45	25	17
1100-	21	28	-21	10	13	26
1200-	10	62	-5	-5	8	52
1300-	16	17	-17	100	11	21
1400-	25	4	-7	0	21	4
All <1500	21	28	-8	-5	16	24
Not known	-41	-49	-37	-35	-46	-46

in 1987. For multiple births the mortality of those of unknown weight is consistently higher than the average for all those known to have weighed less than 1500 g.

Between 1983 and 1987 there was a decrease in the total number of infants of unknown birth weight from 917 to 535 (table 2). These almost certainly include some of low birth weight, as indicated by the high proportion of multiple births (6% of live births and 33% of stillbirths in 1987) and their high infant mortality rates. The proportion whose birth weight was unknown is highest among stillbirths, being 1.0% of all stillbirths in 1987 compared with 0.1% of live births, and among multiple births, 4% among stillbirths, 0.2% among live multiple births.

The increase in the proportion of very low birthweight babies born between 1983 and 1987 is not, however, just an artefact caused by a decrease in the proportion for whom the weight was unknown. Even if all those of unknown weight are included with those known to have weighed less than 1500 g there would still have been an increase of 10% in the proportion of very low birthweight babies born between 1983 and 1987 compared with 8% in all births.

There must also be some doubt about the accuracy of the birth weights of live born babies registered as weighing less than 500 g, whose mortality rates are lower than those of slightly heavier babies. The number of such births rose from 121 to 150 between 1983 and 1987, an increase of over 20%. Analysis of data gathered since 1987 suggests that the increase in the use of metric birth weights may be increasing the number of transcription errors, particularly those which result in babies of 3000 or 4000 g being recorded as weighing 300 or 400 g. It is likely that some of these extremely low weights have been misclassified in this way, and may be contributing towards the increase in numbers of those registered as of very low birth weight, although the numbers are too small to have a serious effect.

TRENDS IN INFANT MORTALITY RATES

The most important feature shown in table 3 is the continuing reduction in birthweight specific infant mortality among singletons over the period, although the annual patterns in the individual weight groups from 500 g upwards are slightly inconsistent. The changes are summa-

risied in fig 1 by averaging rates for the first three, and last two, years of the period. There is a fall in infant mortality in each 100 g weight group, the biggest falls being in those who weighed between 700 and 900 g. The pattern for multiple births is different (fig 2) and shows no consistent improvement.

Table 3 also shows that, for the lowest birth weights, multiple births have higher mortality rates than singletons. This pattern is reversed at higher weights, the turning point varying by year, but becoming pronounced and quite consistent at weights of 1300 g or more.

RATIO OF STILLBIRTHS: INFANT DEATHS

At the lower tail of the birth weight distribution the problem of definition of viability means that the ratio of stillbirths: infant deaths is affected, because live births but not fetal deaths can be registered under 28 weeks' gestational age. Table 4 shows that in each of the years concerned at birth weights of less than 1000 g,

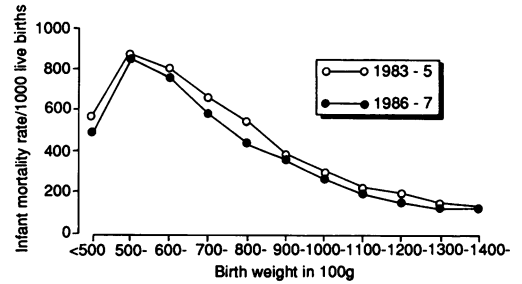


Figure 1 Averaged infant mortality rates for singleton births weighing <1500 g for 1983-5 and 1986-7.

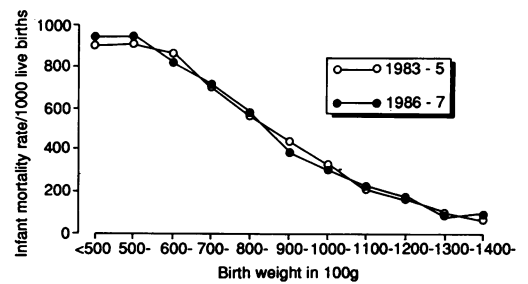


Figure 2 Averaged infant mortality rates for multiple births weighing <1500 g for 1983-5 and 1986-7.

Table 3 Trends in infant mortality rates/1000 live births of very low birthweight infants: England and Wales 1983-7

Birth weight (g)	1983		1984		1985		1986		1987	
	Singleton	Multiple	Singleton	Multiple	Singleton	Multiple	Singleton	Multiple	Singleton	Multiple
<500	592	783	565	964	530	961	458	933	532	958
500-	897	1000	849	939	866	800	899	959	804	933
600-	858	843	787	863	772	889	738	783	793	862
700-	678	771	666	680	643	672	598	710	567	727
800-	540	530	538	670	555	508	439	598	449	571
900-	427	500	366	412	347	405	397	369	323	403
1000-	349	366	285	286	249	308	247	321	289	288
1100-	239	218	216	259	223	161	188	220	206	225
1200-	226	186	168	229	189	86	162	144	155	202
1300-	167	82	142	108	123	109	125	81	128	80
1400-	123	82	128	28	136	81	135	114	111	61
All <1500	340	321	311	341	302	299	265	324	289	323
Not known	204	436	207	442	156	565	178	407	221	500
All weights	9.38	40.7	8.52	41.6	8.78	39.2	8.35	45.3	8.36	42.7

the ratio of stillbirths:infants deaths was smaller than among those weighing between 1000 and 1499 g.

#### AGE AT DEATH

Babies weighing less than 1500 g often die at very young ages, so that they contribute disproportionately to very early deaths. In 1987, 27% of all infant singleton deaths had weighed less than 1500 g at birth, but only 0.8% of singleton live births had been of this weight. Fifty four per cent of all singleton live born babies that died during the first 30 minutes had weighed less than 1500 g. Although this proportion fell with increasing age at death, there was an excess of babies of this weight even in the deaths occurring between 9 months and 1 year,

of which 6% had weighed less than 1500 g. The pattern for multiple births was similar but even more pronounced. Sixty eight per cent of all infant deaths of babies from multiple births in 1987 had been reported as weighing less than 1500 g at birth, and 92% of deaths among multiple births that occurred within 30 minutes of birth had been of this weight, compared with a third of deaths of multiple births between 9 months and 1 year of age.

Table 5 shows the proportions by age at death of all those weighing less than 1500 g at birth in 1983 and 1987. The proportion of all deaths that happened during the postneonatal period rose slightly from 11.8% in 1983 to 12.8% in 1987 in singletons, and from 11.6% to 12.3% in multiple births.

Table 4 Numbers of infant deaths and stillbirths weighing less than 1500 g—multiple plus singleton births: England and Wales 1983-7

Year	Birth weight (g)			
	Infant deaths		Stillbirths	
	<1000	1000-1499	<1000	1000-1499
1983	1067	719	472	642
1984	1109	650	490	612
1985	1112	668	499	580
1986	1173	663	479	621
1987	1191	733	461	566

#### TRENDS IN NUMBERS OF INFANTS SURVIVING

Between 1983 and 1987 the rise in the registered occurrences, together with the improvement in survival, led to an increased number of very low birthweight survivors at 1 year (table 6). Overall, the absolute number of singleton survivors reported as having a birth weight of less than 1500 g increased by 31% between 1983 and 1987, and that of multiple births by 27%. The number of survivors weighing between 500 and 999 g at birth increased even more, singletons by 46% and multiple births by 58%.

Table 5 Time of death by birth weight and multiplicity, England and Wales: 1983 and 1987

Infant deaths	1983				1987			
	Singleton		Multiple		Singleton		Multiple	
	No	%	No	%	No	%	No	%
All weights	5786	100	513	100	5573	100	620	100
All <1500 g	1459	25	327	64	1503	27	421	68
All <1500 g	1459	100	327	100	1503	100	421	100
<30 Minutes	94	6	16	5	114	8	36	9
-1 Day	622	43	142	43	604	40	145	34
1-6 Days	394	27	92	28	378	25	130	31
7-27 Days	176	12	39	12	215	14	58	14
All neonatal deaths	1286	88	289	88	1311	87	369	88
28 Days-2 months	91	6	18	6	85	6	22	5
3-5 Months	41	3	16	5	65	4	17	4
6-8 Months	31	2	2	1	32	2	8	2
9-11 Months	10	1	2	<1	10	1	5	1
All postneonatal deaths	173	12	38	12	192	13	52	12

Table 6 Birth cohort survivors at 1 year by birth weight, England and Wales: 1983-7

Birth weight (g)	No of survivors at 1 year*									
	1983		1984		1985		1986		1987	
	Singleton	Multiple	Singleton	Multiple	Singleton	Multiple	Singleton	Multiple	Singleton	Multiple
<500-	40	5	50	1	54	1	64	2	59	1
500-	12	0	18	2	15	7	13	2	27	4
600-	26	8	43	7	55	7	70	15	55	8
700-	84	11	94	16	106	21	133	20	145	21
800-	156	31	172	30	153	32	216	37	227	39
900-	231	45	275	57	293	66	255	65	289	77
1000-	302	64	361	75	401	63	394	89	450	89
1100-	392	79	410	83	440	104	449	99	496	100
1200-	446	92	460	91	469	117	541	143	535	146
1300-	544	157	582	124	651	163	569	158	661	184
1400-	594	201	667	117	720	182	693	218	754	214
All <1500	2827	693	3132	603	3357	763	3397	848	3698	883

\*Calculated as number of live births minus infant deaths.

### Discussion

The aim of this report was to make data available from a new national data set that show trends in the incidence and survival of infants weighing under 1500 g at birth. The main findings were an increase in the absolute number and the incidence of these births, and a fall in their infant mortality.

Some of the observed rise in the proportion of babies of very low birth weight from 0.84% in 1983 to 0.95% in 1987 may be the result of an increase in the proportion of triplets and higher order multiple births<sup>10</sup>; some is probably the result of a change in clinical perception, shifting the reported outcomes from non-registrable miscarriages to registered births; and some is the result of a decrease in the proportion for whom birth weight was not reported. Additionally, there is a suggestion that there may be a shift from stillbirths to live births, but in the absence of information about registration practices of very low weight stillbirths this will be difficult to prove. These issues were recently discussed in some detail at a meeting of the International Collaborative Effort into Perinatal and Infant Mortality.<sup>6</sup> It was thought that for complete reporting there should be a legal limit of viability defined in weeks of gestation, set at a point some weeks earlier than the maturity at which registrations may be expected to be reliable.

The next point to be considered is the evidence about the validity of reported weights at the lowest birth weights. There have long been problems caused by the dual use of imperial and metric measures of birth weight, which lead to digit preference when half or quarter pounds are converted to grams. Moreover, as stated earlier, this may also be leading to errors in placing the decimal point, which results in weights of 3000 or 4000 g being reported as 300 or 400 g. Although the numbers may be small such mistakes may have considerable effects on national statistics in this weight range. These are errors that should be eliminated by careful quality checks and the availability of data about gestational ages. The number of babies of unknown weights, which is often biased by a excess of stillbirths or infant deaths, should also be considered in the interpretation of changes in mortality rates over time.

Overall, however, during the years considered, the quality of data seems good enough to confirm the increase in survival to 1 year for babies of these very low weights, particularly for singletons weighing between 700 and 900 g. By 1987 a singleton live birth weighing between 700 and 799 g had a 43% chance of surviving to 1 year compared with a 32% chance five years earlier; one weighing 800 to 899 g had a 55% chance compared with 46% in 1983. The lack of improvement in survival of multiple births is probably related to the sharp increase in the number of the particularly high risk triplets and higher order multiple births.<sup>10</sup>

The number of survivors, both single and multiple, who weighed between 500 and 999 g at birth increased by nearly 50% between 1983 and 1987. Such babies are of course also at high risk of morbidity, and the increased number underlines the need for ongoing surveillance of their outcome, and for the maintenance of high quality data about the circumstances of their birth and their maturity.

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