Report on confidential enquiries into maternal deaths in England and Wales, 1964-1966 / by Humphrey Arthure [and others].

DEPARTMENT OF HEALTH AND SOCIAL SECURITY

Reports on Public Health and Medical Subjects

No. 119

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LONDON

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Report on confidential enquiries into maternal deaths in England and Wales 1964 - 1966

by

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LONDON
HER MAJESTY'S STATIONERY OFFICE
1969

m.m.R.

1900 4·81

1930 4·6

1968 0·24

1969 0·19

NS (28 Women died of puerperal sepsis)

Total deaths due to sepsis: 123.

SBN 11 320044 7

PREFACE

This Report, the fifth of a series of triennial reports on confidential enquiries into maternal deaths, covers the years 1964, 1965 and 1966. The method of enquiry and reporting follows the pattern established by Sir Arnold Walker, Mr. A. J. Wrigley and their co-authors in the four previous reports but Mr. Humphrey Arthure and Mr. John Tomkinson have been the Consultant Advisers in this period and are the principal authors of this report.

In the period under review 2,630,150 births occurred, the birth rate rose to 18·5 live births per 1,000 population in 1964 and the maternity services in England and Wales were working under considerable stress. Maternal deaths directly due to pregnancy and childbirth numbered 671 and there were 159 deaths due to disease which occurred during pregnancy or childbirth. These numbers are less than half those for the three years covered by the first report when only 2,079,275 births occurred and emphasize the great improvement in safety in pregnancy or childbirth we have achieved.

Nevertheless the report shows that substantial further progress can and should be made. Haemorrhage and sepsis are still too frequent causes of maternal deaths and the incidence of deaths due to or associated with anaesthesia has increased although the number of deaths associated with anaesthesia for all purposes is steadily falling. Over one-third of the deaths with an avoidable factor were associated with illegal abortion. It is of considerable importance that everyone concerned with the social or medical well-being of women in this country understands that the legislation of 1967 makes possible a comprehensive family planning service in every locality and the women themselves know of the facilities available. This is especially necessary in the case of immigrants who come from countries where family planning is not generally practised, and family limitation by abortion may be more commonly used.

Once more the importance of booking arrangements for the place of confinement is discussed. Despite increasing attention to the selection of women who are known to be at particular risk for hospital confinement, the incidence of death amongst those booked for delivery at home remains much the same as for those booked for delivery in hospital where the deliberate selection of women with adverse medical, obstetric and social histories would be expected to produce a higher rate.

The proportion of deliveries in hospital increased from 67 per cent to 72 per cent during the period and is still increasing. If this continues it must become questionable whether enough domiciliary midwifery remains to permit an efficient service.

The importance of age and parity is discussed in greater detail than in earlier reports. There is little doubt from the findings of this enquiry that in this country a woman is at least risk if she has her first child between the ages of 20 and 25 years and completes her family before her thirtieth birthday. A fifth or subsequent pregnancy at any age is associated with diminished safety, and the mother having her first pregnancy when she is forty or more years old requires very

special care from doctors and midwives. The identification of increasing age irrespective of parity as a factor associated with death from pulmonary embolism may help to throw light on an intractable problem and suggest the type of patient who requires special observation.

Despite the acknowledged usefulness of the maternal mortality enquiry and the published reports, the 1964–66 enquiry included only 86 per cent of the deaths directly due to pregnancy and childbirth. At the same time it included 10.7 per cent more deaths than those known to the Registrar General as not directly due to but associated with pregnancy and childbirth; yet comparison of enquiry forms with death certificates showed that 41 associated deaths known to the Registrar General were missing from the enquiry. A medical officer of health cannot initiate the enquiry into a maternal death unless he is either told of its occurrence locally or is informed by the Registrar General's staff who depend for their information on death certificates or on additional confidential letters to the Registrar General. Most of the women whose deaths are either due to or associated with pregnancy are admitted to hospital before death. Latterly we have received much help from the Society of Coroners.

This enquiry is unique in British medicine in its systematic appraisal of the results of medical work. It must be given some of the credit for the improvement achieved. For that I record our indebtedness to obstetricians, midwives, general practitioners and medical officers of health and especially to the Regional Assessors and Consultant Advisers who do most of the work.

G. E. GODBER,

Chief Medical Officer

Ministry of Health
London
July 1968

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1. INTRODUCTION

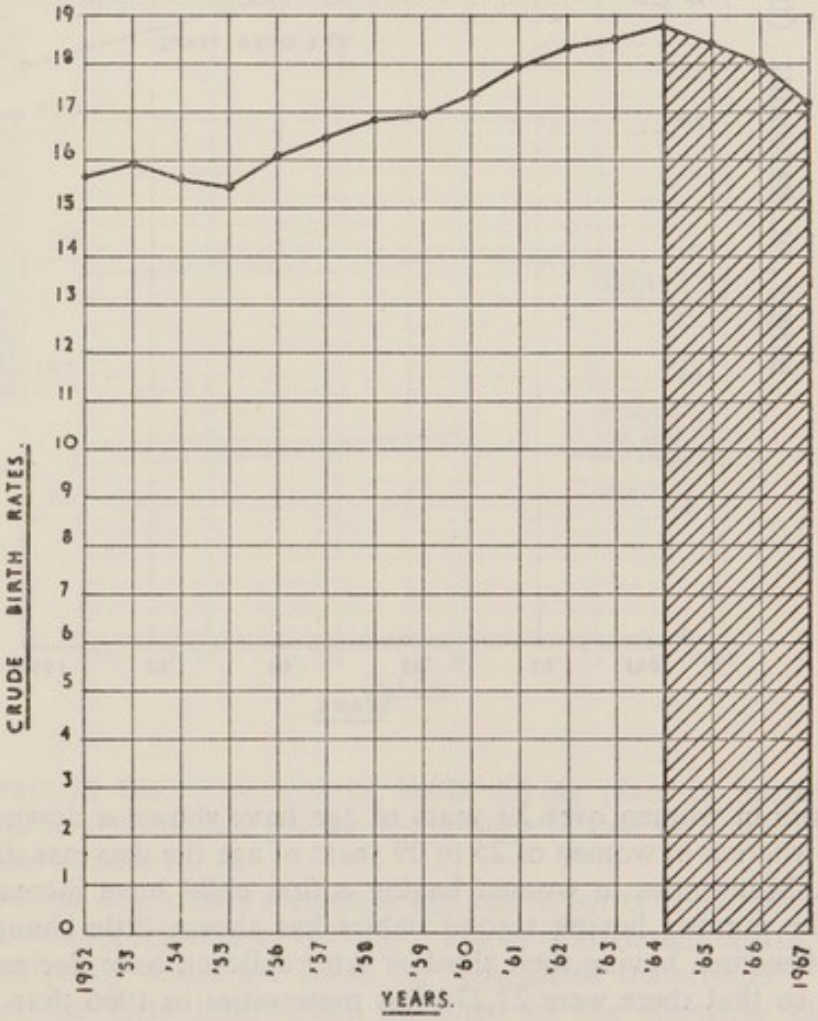
This report is the fifth in a series of reports on confidential enquiries into maternal deaths in England and Wales, and it covers the three years 1964, 1965 and 1966. During this three-year period the pattern of reproduction among women has been changing. The steady increase in the crude birth rate from 15·4 per thousand persons in 1955 reached a peak in 1964 at 18·8 per thousand persons and has fallen since then to 18·0 per thousand persons in 1966.

FIGURE 1.

CRUDE BIRTH RATES.

(TOTAL BIRTHS PER THOUSAND PERSONS LIVING.)

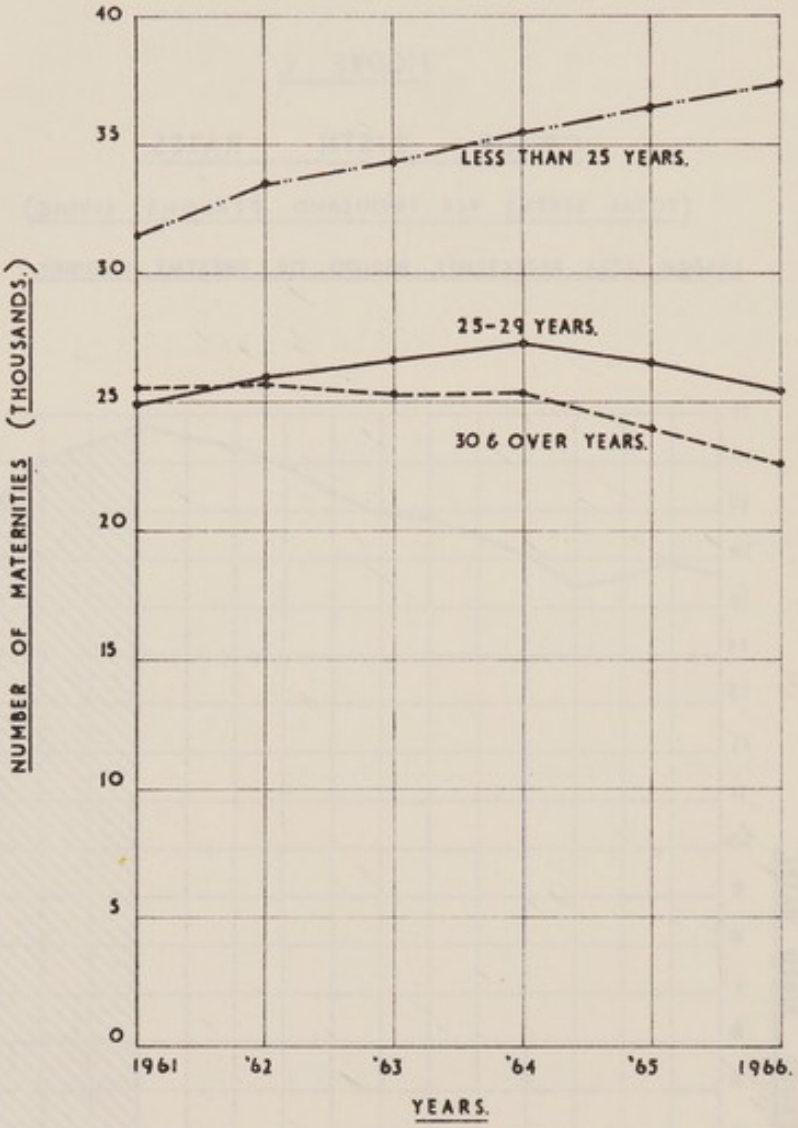
SHADED AREA REPRESENTS PERIOD OF PRESENT ENQUIRY.



This change has been accompanied by a steady rise in the number of maternities among women under 25 years of age and with earlier marriage.

FIGURE 2.

NUMBER OF MATERNITIES TO WOMEN BY AGE GROUP.

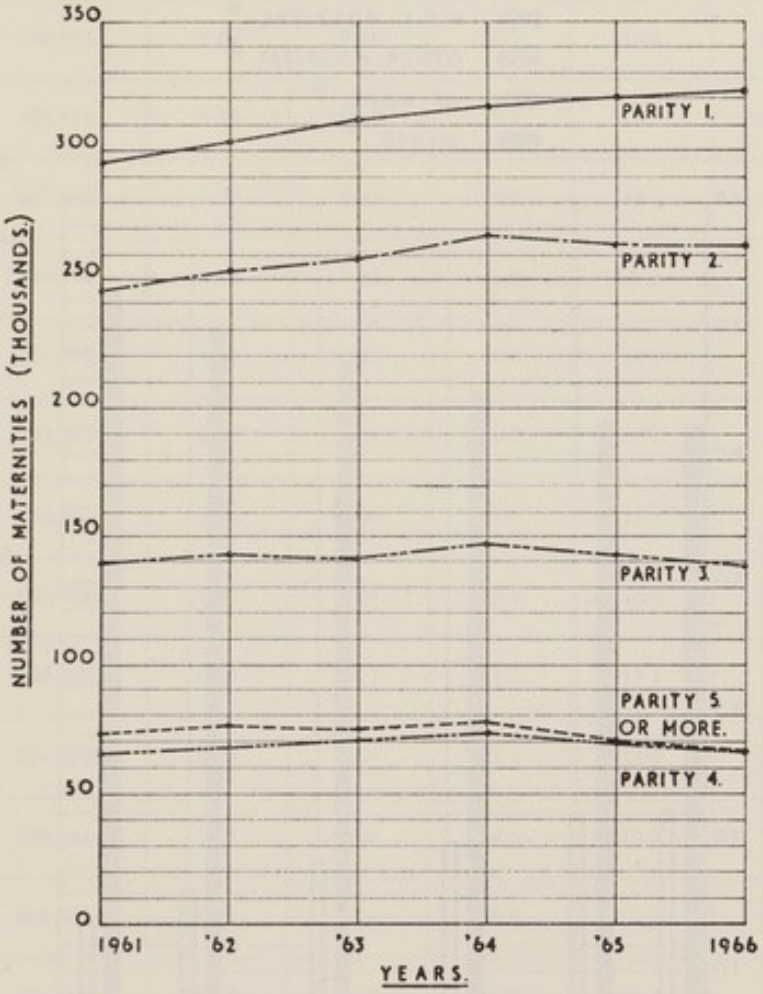


Maternities in women over 29 years of age have shown a downward trend since 1961 whereas in women of 25 to 29 years of age the decrease did not start until 1965. Maternities in women having a first child have increased during 1964–66, the number having second babies has shown little change, but the numbers of women having their third or later children have decreased during the period so that there were 27,274 less maternities in 1966 than in 1964 to women having their fourth or later children.

The reduction in births to women having four or more children, the increase in births to younger women, the reduction in births to older women, and the

FIGURE 3.

NUMBER OF MATERNITIES TO WOMEN BY PARITY.



steady increase in the proportion of births taking place in hospital are all factors which tend to reduce the number of deaths due to or associated with pregnancy and childbirth.

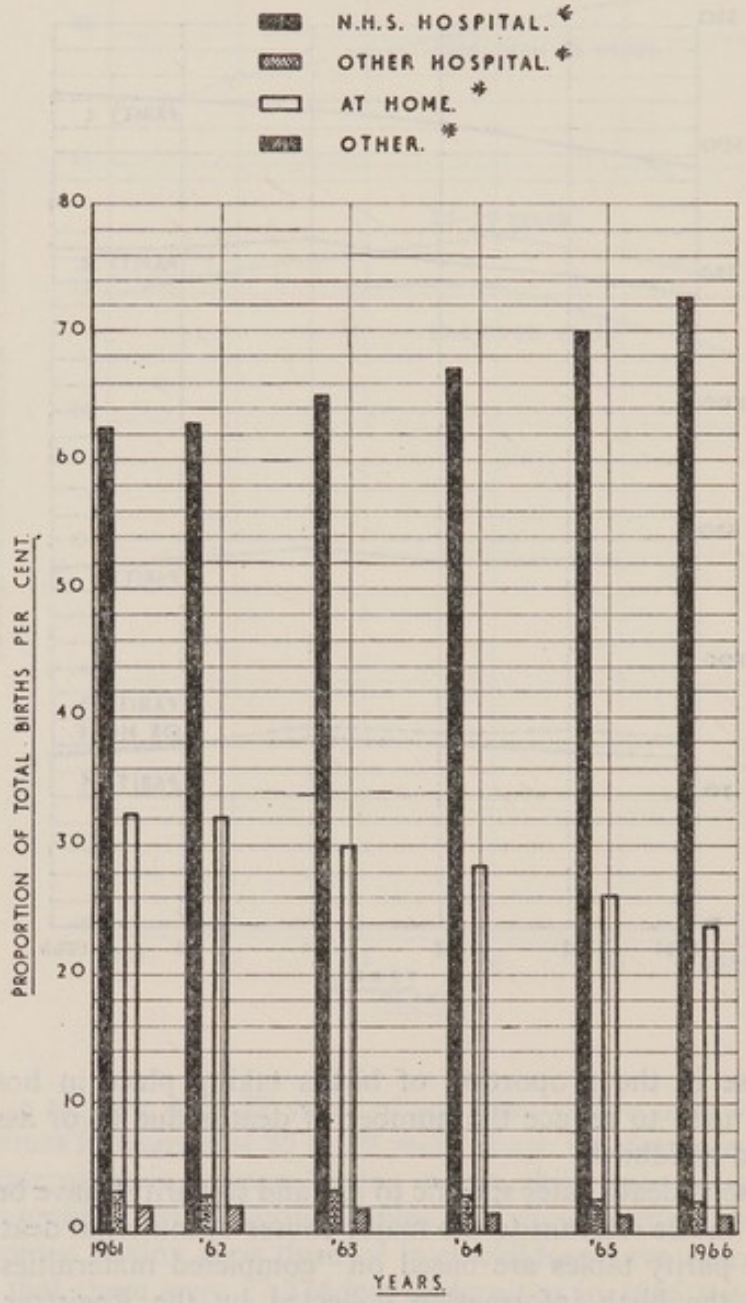
For these reasons death rates specific to age and to parity* have been presented in each of the tables relevant to the major causes of maternal deaths. Rates for both age and parity tables are based on "completed maternities". These are derived from the birth information collected by the Registrar General. A "completed maternity" being one which has ended in the birth of at least one live or dead infant which is in due course registered as a live or still birth. The

* For definition of parity in this report, see page 7.

parity of mothers who register illegitimate births is not asked for at registration so throughout the report the illegitimate maternities have been distributed proportionally through all parity groups, and illegitimate maternities to girls under 16 years old allocated to parity 1.

The number of births and the death rates related to births during the years of the enquiry series are shown in Table I.

FIGURE 4.
PLACE OF DELIVERY.



*N.H.S. hospital, i.e. hospitals and homes under the National Health Service, except psychiatric hospitals;
Other hospitals, which are mainly maternity homes not under the National Health Service;
At home, i.e. at the usual place of residence of the mother;
Other, places of confinement which include all psychiatric institutions, homes for unmarried mothers, remand homes, reception centres, private houses (other than mother's usual residence), etc.

TABLE I

Number of births and related death rates for the years 1952–66.

Year	Total births in England and Wales	Maternal mortality (excluding abortion) per 1,000 total births	Maternal mortality from abortion per 1,000 total births	Neonatal mortality (under 4 weeks) per 1,000 live births	Early neo-natal mortality (under 1 week) per 1,000 live births	Perinatal mortality (still-births plus infants under 1 week) per 1,000 total births	Stillbirths (foetal) deaths at or over 28 weeks gestation) per 1,000 total births
1952	689,371	0·54	0·13	18·3	15·2	37·5	22·7
1953	700,053	0·60	0·11	17·7	14·8	36·9	22·4
1954	689,851	0·54	0·11	17·7	14·9	38·1	23·5
1955	683,640	0·50	0·10	17·3	14·6	37·4	23·2
1956	716,740	0·42	0·10	16·8	14·2	36·7	22·9
1957	739,996	0·37	0·08	16·5	14·1	36·2	22·5
1958	757,003	0·35	0·08	16·2	13·8	35·0	21·5
1959	764,402	0·32	0·06	15·9	13·6	34·1	20·8
1960	800,824	0·31	0·08	15·5	13·3	32·8	19·8
1961	827,008	0·27	0·07	15·3	13·3	32·0	19·0
1962	854,200	0·28	0·07	15·1	13·0	30·8	18·1
1963	869,044	0·22	0·06	14·3	12·3	29·3	17·2
1964	890,518	0·20	0·06	13·8	12·0	28·2	16·3
1965	876,566	0·19	0·06	13·0	11·3	26·9	15·8
1966	863,066	0·20	0·06	12·9	11·1	26·3	15·3

The proportion of operative deliveries in hospital is also of interest and is shown in Table II.

TABLE II

Proportion per cent of Caesarean sections and Forceps deliveries among deliveries in N.H.S. Hospitals

(Figures from Hospital In-patient Enquiry)

	1953	1955	1957	1959	1961	1963	1965
Caesarean Sections	4·3	3·8	3·8	4·4	4·5	4·7	5·0
Forceps Deliveries	7·1	7·2	6·9	7·3	7·8	8·2	8·3
Both	11·4	11·0	10·7	11·7	12·3	12·9	13·3

The Method of Confidential Enquiry

The enquiry is initiated by the medical officer of health of the local health authority who usually learns of the death through local hospitals or local health authority staff or through the death certification, either from the local registrar or the General Register Office. He obtains as much information as he can, where possible by personal discussion, from those in the domiciliary service concerned with the care of the patient including general practitioners, midwives, health visitors and local authority medical staff. He then forwards the form to the consultant obstetrician of the hospital who provides full clinical details of any care which the patient has received including where possible the post-mortem report. The consultant also adds any extra information himself which may be of value in assessing the death. The form is then returned to the medical officer of health for his final summing up before he sends it to the regional assessor who is a senior obstetrician in the area of each Regional Hospital Board. The regional assessor records his views as to the cause of death and as to whether there was any avoidable factor in the clinical care or administrative management of the case. Should the information be insufficient he may refer back to the reporting consultant obstetrician or the medical officer of health for further details. The regional assessor then sends the complete report with his comments to the Chief Medical Officer of the Ministry of Health. The final assessment and classification of the report rests with the Ministry's Consultant Advisers on Obstetrics and, in appropriate cases, Anaesthetics.

The enquiries cover deaths directly due to pregnancy and childbirth, and deaths due to other causes occurring in association with pregnancy and childbirth (referred to in each of the reports as "associated deaths"). The purpose of the enquiry is to discover facts together with the considered comment of experienced obstetricians, and it is the pooled information obtained over a three-year period which forms the basis for each report. At every stage the reports are regarded as strictly confidential and are scrutinized and analysed only by the regional assessors, the consultant advisers and a medical officer of the Ministry of Health.

Assessment of Avoidable Factors

One of the chief features of the investigation is the assessment of the presence of an avoidable factor or factors in the circumstances of the maternal death, that is, some departure from the accepted standards of satisfactory care, which may have played a part in the ensuing death. It is not suggested that in all cases in which avoidable factors are considered present, death could certainly have been prevented, but the presence of an avoidable factor is regarded as an indication that the risk of death could have been, at least, materially lessened.

It must be recognized that with improvement in maternity care the number of deaths with avoidable factors may be reduced, but on the other hand the views of assessors on the avoidable factors become more strict, so that comparison with previous years is not necessarily significant.

In this report, and in previous reports there has been great reluctance to assess failures in diagnosis or clinical mismanagement as avoidable factors. However, in this report an attempt has been made to draw attention to such errors, without wishing to blame the individuals concerned. It is our view that deaths directly due to pregnancy or childbirth are capable of further reduction, even though deaths from associated causes cannot always be prevented.

In no case has a doctor's failure to recommend or a patient's refusal to accept sterilization, termination of pregnancy or to practise contraception been regarded as an avoidable factor, but it is perhaps not generally realized that family planning advice and prescriptions may now be obtained from general medical practitioners; and hospital authorities may provide family planning advice and supplies as part of the general provision for medical care of their patients. The National Health Service (Family Planning) Act which came into operation in 1967 enabled local health authorities to make arrangements (either directly or through voluntary bodies such as the Family Planning Association) for the giving of advice on contraception, and for the medical examination of persons seeking advice or contraception for the purposes of determining what advice to give, and the supply of contraceptive appliances not only to women to whom a pregnancy would be detrimental to health but also for social reasons. No distinction is drawn in the Act between the married and the unmarried.

Definition of Parity

As in previous reports on the confidential enquiries into maternal deaths, parity is defined as the number of previous pregnancies of twenty-eight weeks or more duration no matter what the outcome, plus the fatal pregnancy whatever its duration. Previous pregnancies of less than twenty-eight weeks gestation are ignored. Thus a woman with one previous child who dies from an ectopic pregnancy when pregnant for the second time would be listed as para 2, and a woman who had been pregnant three times, each pregnancy ending with an abortion, and subsequently died as a result of her fourth pregnancy whatever its duration would be listed as para 1.

The 1964–66 Enquiry Series

For the three years 1964, 1965 and 1966 confidential reports were received on 579 deaths directly due to pregnancy and childbirth, and 176 deaths due to associated causes, a total of 755 deaths.

Table III compares the number of deaths with those in previous reports on

confidential enquiries and the corresponding figures recorded by the Registrar General. It shows that there has been a steady increase in the percentage of cases included in the enquiry series.

TABLE III

Number of deaths in the confidential enquiry compared with those recorded by the Registrar General.

	Deaths directly due to pregnancy and childbirth			Deaths due to associated causes		
	R.G.	Enquiry series		R.G.	Enquiry series	
	No.	No.	Per cent	No.	No.	Per cent
1952–54	1,403	1,094	78·0	409	316	77·3
1955–57	1,112	861	77·4	368	339	92·1
1958–60	928	742	78·0	255	254	99·6
1961–63	816	692	84·8	215	244	113·5
1964–66	671	579	86·3	159	176	110·7

It must be explained that the deaths in the enquiry series do not always correspond with the categories of deaths in the Registrar General's reports, and deaths occurring more than one year after childbirth are excluded from both. In addition the enquiry series includes deaths associated with pregnancy and childbirth which are not recorded as such by the Registrar General because the fact of pregnancy has not been recorded on the death certificate. Furthermore careful appraisal of the detailed records available to the assessors may result in deaths being reclassified and transferred from deaths directly due to pregnancy and childbirth to deaths due to associated causes, or less frequently, the other way round.

This enquiry series deals with 755 deaths due to or associated with pregnancy or childbirth compared with 830 deaths recorded by the Registrar General, which suggests that 75 deaths have not been included in the enquiry series, but in fact comparison with death certificates reveals that in the three years 1964–66 there were 135 maternal deaths and 41 associated therewith concerning which confidential enquiry forms were not obtained.

During the fifteen years covered by the five reports there has been a very marked reduction in the number of maternal deaths, and the rate in 1966 was only 0·26 per 1,000 total births. In his Rhys-Williams Memorial Lecture Sir Arnold Walker said that "it now seems that we may well have reached a point where deaths of women who are pregnant or who have recently given birth are fewer than the deaths among all women in the same age groups".

There can be little doubt that the publication of these reports and the careful assessment of each death by the doctors concerned and by the regional assessor has contributed in no small measure to the reduction in maternal mortality. In writing the confidential report the consultant has an opportunity to consider errors of management or faults in the organization of the maternity services, and he may then take steps to prevent deaths from similar causes.

The new authors of this report have been reluctant to make any substantial

alteration in the nature of these reports on confidential enquiries, so that the numbers of deaths in each category can be compared with previous years. The principle that each death is attributed to one and only one cause has been continued, although deaths with multiple causes have been considered in other chapters.

New chapters have been written on deaths from ectopic pregnancy, on deaths from sepsis, and on miscellaneous causes of maternal death, including suicide.

Tables will be found in Appendix I giving figures for the enquiry series and for registered maternal deaths, analysing the causes of death in accordance with the International Classification of Diseases. Tables are given for the three-year period 1964–66, and in the 1961–63 report tables were given for the twelve years 1952–63.

The four major causes of maternal deaths which show a considerable reduction in each group except abortions are shown in Table IV but the figures for 1952–54 are not included as they are not strictly comparable.

TABLE IV

Major causes of Maternal Deaths directly due to pregnancy and childbirth included in the enquiry, 1955–66.

	1955–57	1958–60	1961–63	1964–66
Abortion	141	135	139	133
Pulmonary embolism	157	132	129	91
Haemorrhage ..	138	130	92	68
Toxaemia	171	118	104	67
All other causes ..	254	227	228	220
Total ..	861	742	692	579

Although it is important to record abortion as a major cause of maternal death, the actual cause of deaths from abortion may be sepsis, haemorrhage, pulmonary embolism or air embolism. If abortion is not classified as a major cause, deaths could be classified as follows:

1. Haemorrhage, including haemorrhage from abortions, ectopic pregnancy, rupture of uterus and from Caesarean section 152
2. Sepsis, including septic abortion, puerperal sepsis and post operative sepsis 123
3. Pulmonary embolism, including pulmonary embolism after abortion and ectopic pregnancy 95
4. Toxaemia 67

This table emphasizes the importance of sepsis as a major cause of maternal death, and justifies a new chapter on sepsis. The frequency of death from haemorrhage deserves comment, and many of these deaths are surely preventable.

If the value of these reports on confidential enquiries is to be maintained we

must plead for reports to be filled in on all maternal deaths, and they can be initiated by the consultant or other practitioner concerned.

We are also concerned that in some reports the facts relating to the death are not given in sufficient detail, and this is especially true in deaths associated with anaesthesia because in the absence of a report from the anaesthetist it is virtually impossible to assess the presence or absence of avoidable factors. It is particularly valuable to include a copy of the post-mortem report. Pathologists are not always aware of the particular problems which the clinician wants to elucidate, and it is noticeable and helpful when the cause of death has been discussed by the consultant and pathologist. Efforts should be made to obtain a post-mortem in every maternal death.

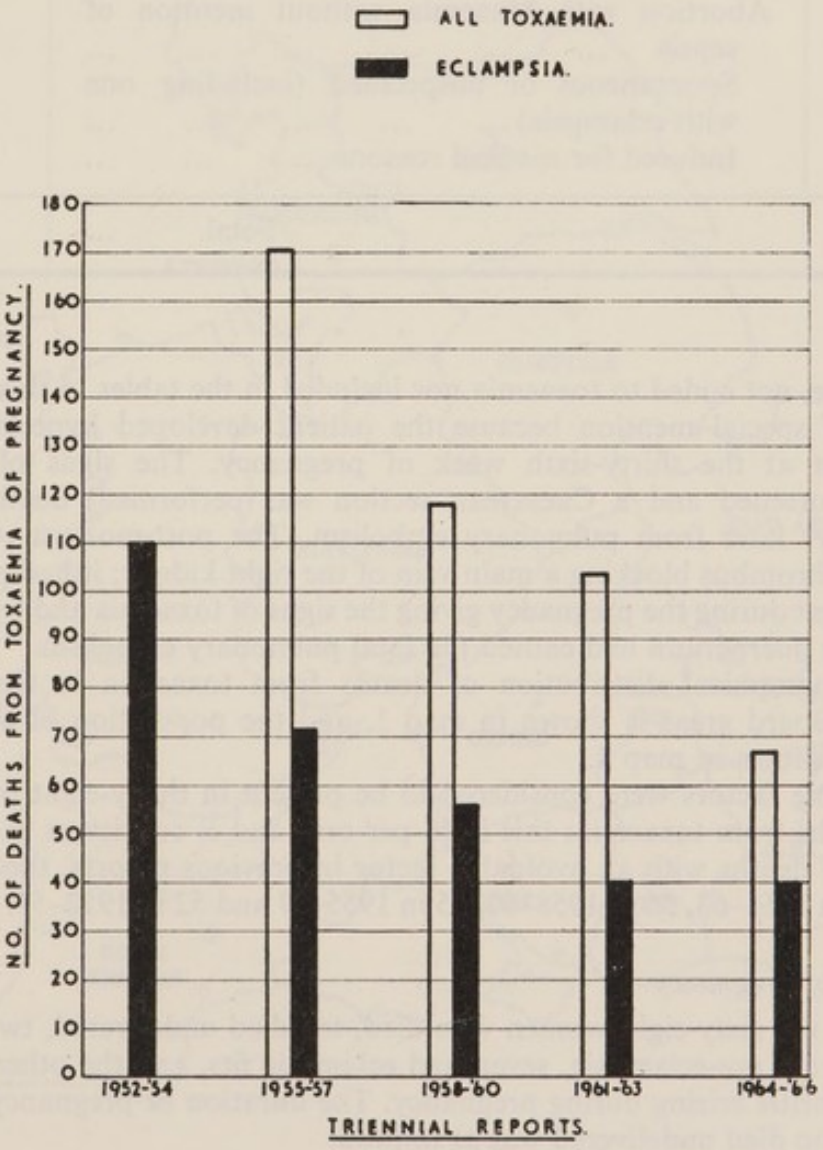
2. TOXAEMIA OF PREGNANCY

There were sixty-seven deaths included in Appendix I, table 1, under deaths from toxaemias of pregnancy. This figure contrasts with 171 in 1955–57, 118 in 1958–60 and 104 in 1961–63. The improvement since the previous report has been due to the fall in deaths caused by pre-eclampsia of pregnancy, the number being half that recorded in the report of 1961–63, whereas the number of deaths due to eclampsia remains precisely the same.

Three deaths from hyperemesis gravidarum (I.C.D. 642·4) and one from "other toxaemias of pregnancy" (I.C.D. 642·5) are included in Appendix I, table 1 under toxaemias of pregnancy and in the figures for comparison with

FIGURE 5.

DEATHS FROM TOXAEMIA OF PREGNANCY.



previous reports, but have been excluded from the clinical discussion and tables in this chapter because none of the assessors considered them pregnancy toxaemias in the accepted sense of the term. Five deaths coded to 652 (abortion with toxaemia) are counted in the abortion tables for purposes of comparison with previous reports, and in the discussion and tables in this chapter because clinically the women suffered from toxaemia but pregnancy terminated before the twenty-eighth week. The clinical discussion and tables are therefore based on the following sixty-eight deaths:

I.C.D. No.	Cause of Death	Number
642·0	Hypertensive disease arising during pregnancy ...	1
642·1	Renal disease arising during pregnancy ...	1
642·2	Pre-eclampsia of pregnancy	22
642·3	Eclampsia of pregnancy	37
685	Puerperal eclampsia	2
652	Abortion with toxaemia without mention of sepsis	
652·0	Spontaneous or unspecified (including one with eclampsia)	3
652·1	Induced for medical reasons	2
	Total ...	68

One case, not coded to toxaemia nor included in the tables in this section, is worthy of special mention because the patient developed hypertension and proteinuria at the thirty-sixth week of pregnancy. The signs of toxaemia rapidly worsened and a Caesarean section was performed; death occurred fifteen days later from pulmonary embolism. The post-mortem revealed an adherent thrombus blocking a main vein of the right kidney; it had presumably been present during the pregnancy giving the signs of toxaemia and by extending during the puerperium had caused the fatal pulmonary embolism.

The geographical distribution of deaths from toxaemia in the Regional Hospital Board areas is shown in map 1, and the population of the hospital regions is shown in map 2.

Avoidable factors were considered to be present in thirty-eight of the sixty-eight deaths from toxaemia; this is 56 per cent and is consistent with the proportion of deaths with an avoidable factor in previous reports, these being 49 per cent in 1961–63, 56 in 1958–60, 55 in 1955–57 and 52 in 1952–54.

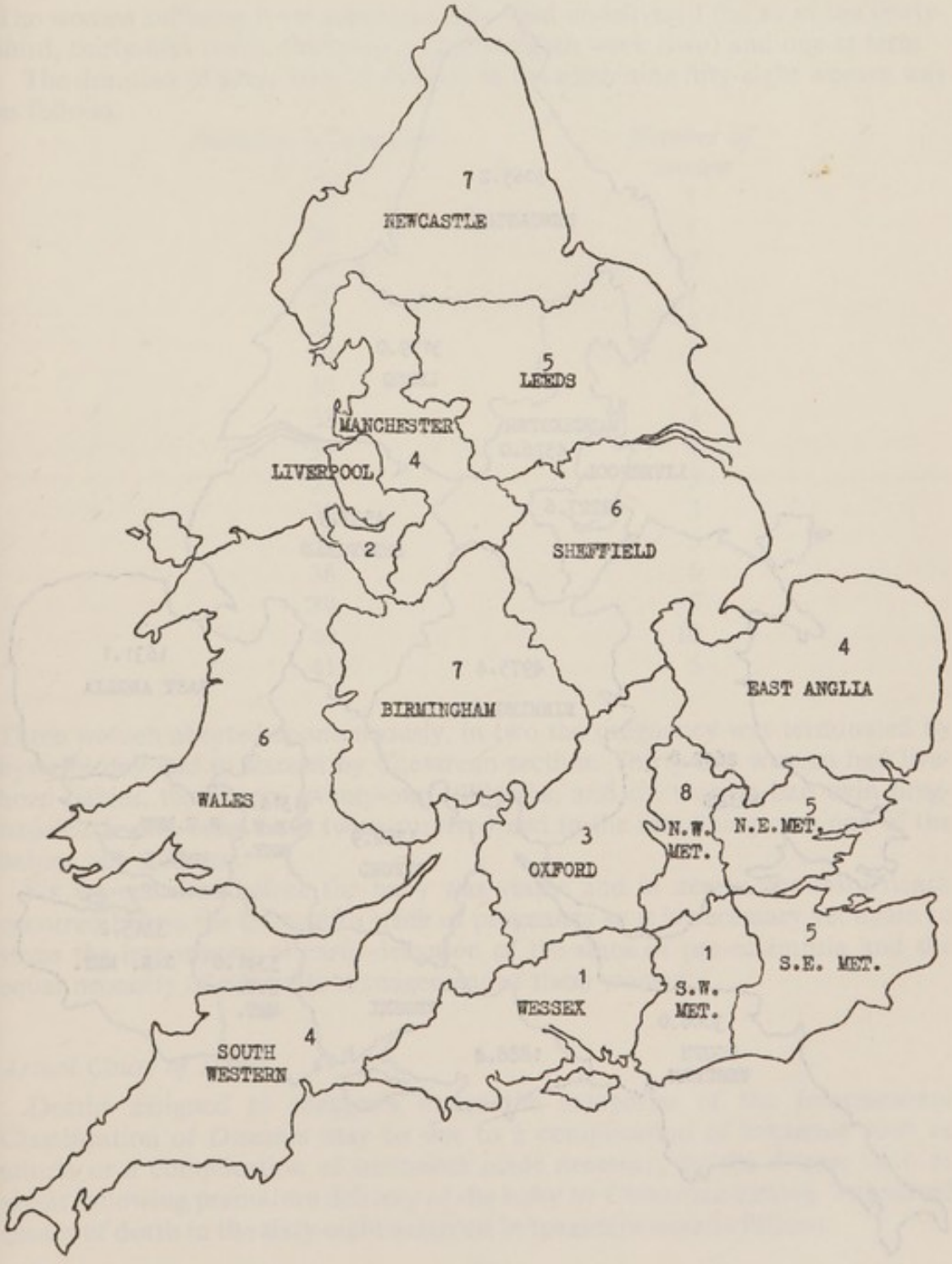
Duration of pregnancy

Among the sixty-eight women who died, ten died undelivered, two of whom suffered from pre-eclampsia, seven had eclamptic fits, and the other died from acute nephritis arising during pregnancy. The duration of pregnancy in the ten women who died undelivered was as follows:

MAP 1

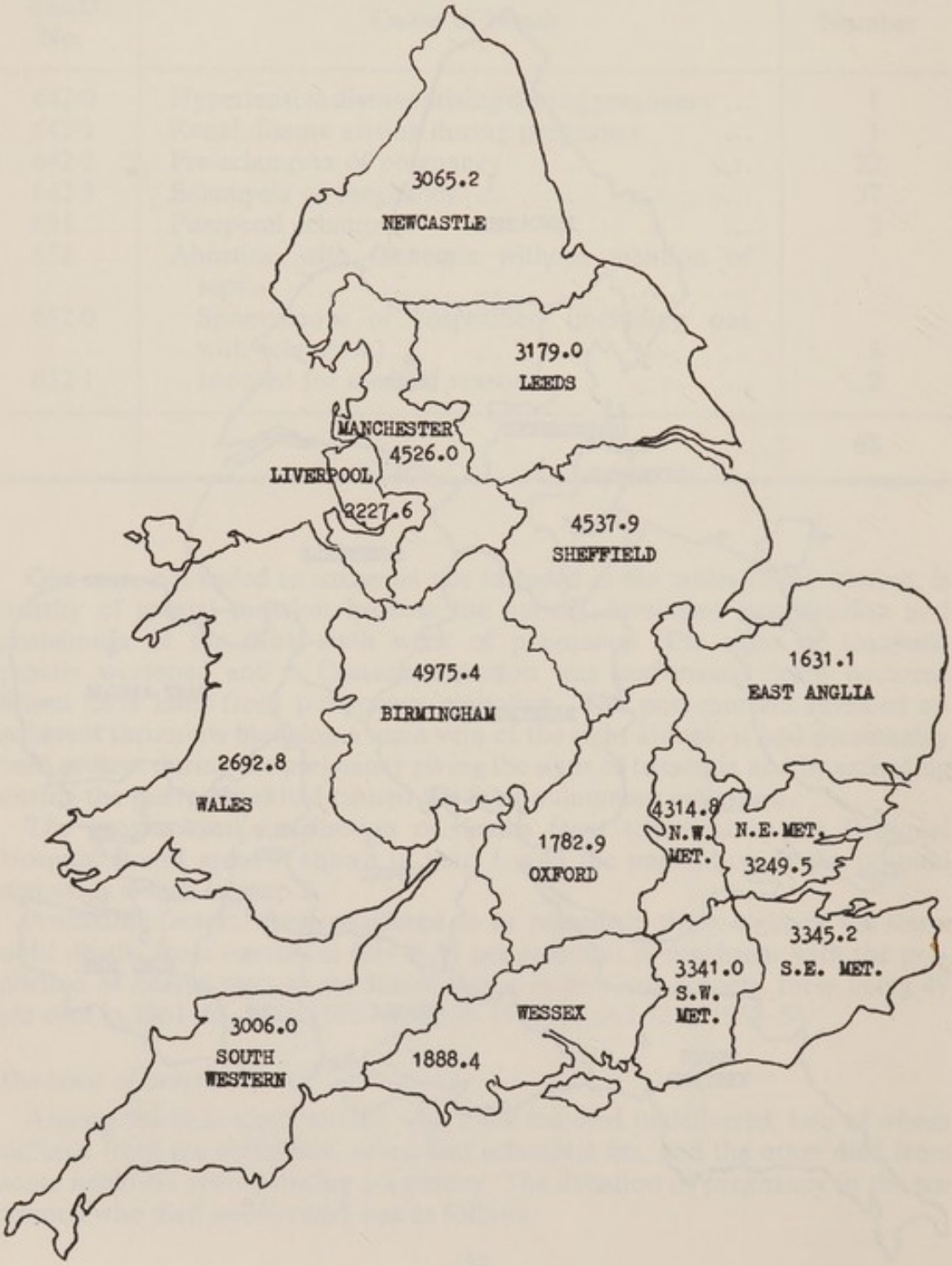
THE GEOGRAPHICAL DISTRIBUTION OF DEATHS FROM TOXAEMIA IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES

1964 - 66



MAP 2

THE GEOGRAPHICAL DISTRIBUTION OF THE HOME POPULATION in thousands (as at 30th June, 1965) IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES



Duration of pregnancy in weeks	*Number of women*
26	1
33	1
35	2
36	2
37	1
38	2
40	1

The women suffering from eclampsia who died undelivered did so at the thirty-third, thirty-fifth (two), thirty-sixth, thirty-eighth week (two) and one at term.

The duration of pregnancy at delivery in the remaining fifty-eight women was as follows:

Duration of pregnancy in weeks	*Number of women*
17	1
20	1
24	2
26	1
28	1
29	1
30	1
33	4
34	7
35	3
36	3
37	5
38	6
39	7
40	10
41	5

Three women aborted spontaneously, in two the pregnancy was terminated by hysterotomy and in sixteen by Caesarean section. Thirty-one women had live-born babies, there were twenty-one stillbirths, and six women had twin pregnancies. In five cases both twins survived and in the remaining case one of the babies was stillborn.

Six women died before the baby was viable and in nearly one-third death occurred before the thirty-fifth week of pregnancy so it is necessary yet again to stress the importance of early detection of the signs of pre-eclampsia and the equal necessity of adequate management of these women.

Actual Cause of Death

Deaths assigned to toxaemia under the categories of the International Classification of Diseases may be due to a complication of toxaemia such as anuria or a complication of treatment made necessary by the disease such as sepsis following premature delivery of the baby by Caesarean section. The actual causes of death in the sixty-eight assigned to toxaemia were as follows:

Eclampsia		40
Complicated by intra-cranial haemorrhage ...	14	
„ „ renal failure	5	
„ „ hepato-renal failure	3	
„ „ hepatic necrosis	1	
„ „ broncho-pneumonia	1	
Pheochromocytoma	1	
Bleeding from a tracheo-bronchial fistula following treatment of eclampsia	1	
No additional complication stated	14	
All other toxaemia		28
Complicated by intra-cranial haemorrhage ...	5	
„ „ renal failure	3	
„ „ liver failure	1	
„ „ anaesthetic misadventure ...	3	
„ „ haemorrhage during Caesarean section	3	
„ „ puerperal sepsis	2	
„ „ broncho-pneumonia	2	
No additional complications stated	9	
		68

When considering toxaemia of pregnancy as a cause of maternal death, it is important to remember that in addition to the deaths coded to this cause, toxaemia may well be the prime mover in the sequence of events which end in death from other causes. In this enquiry series, ten women who subsequently died from pulmonary embolism and were coded as having died from that cause had symptoms of such severity that Caesarean section was carried out in six instances at times in pregnancy varying from the thirty-third week to term. The youngest women aged eighteen was also a diabetic. Three of these deaths were associated with an avoidable factor, in one case it was the patient's own responsibility because she failed to seek ante-natal care. She had eclampsia following a stillbirth at home and died from pulmonary embolism. These ten women, of whom nine had pre-eclampsia and one eclampsia, are not counted in the tables in this section because the cause of death was not toxaemia of pregnancy but pulmonary embolism.

TABLE V

Number of women, by age, who died from Toxaemia of Pregnancy.

Age (years)	1964–1966		All toxaemia			
	† Eclampsia (1)	All other toxaemia (2)	1961–1963		1964–1966	
	Number	Number	Number	Rate per million maternities	Number	Rate per million maternities
Under 16	—	—	—	—	—	—
16–19	6	1	5	25·2	7	28·7
20–24	11	—	28	35·8	11	13·0
25–29	6	8	23	29·8	14	17·7
30–34	8	7	21	45·4	15	34·4
35–39	6	7	18	78·1	13	60·1
40–44	2	4	10	145·8	6	94·7
45 and over	1	1	1	243·7	2	483·6
All	40	28	106	42·1	68	26·2

TABLE VI

Number of women, by parity, who died from Toxaemia of Pregnancy.

Parity*	1964–1966		All toxaemia			
	† Eclampsia (1)	All other toxaemia (2)	1961–1963		1964–1966	
	Number	Number	Number	Rate per million maternities	Number	Rate per million maternities
1	23	3	52	57·1	26	27·2
2	4	8	16	21·1	12	15·1
3	3	5	12	28·3	8	18·6
4	1	3	9	44·3	4	19·3
5–9	8	8	11	48·9	16	84·6
10 or more	—	1			1	
Not stated	1	—	6		1	
All	40	28	106	42·1	68	26·2

* For definition of parity, see page 7.

(1) I.C.D. Nos., 642·3, 685 (†one case allocated to 652·0 which was regarded as eclampsia).

(2) I.C.D. Nos. 642·0, 642·1, 642·2, 652·0, 652·1.

The age and parity distribution of women who died from toxaemia of pregnancy is shown in Tables V and VI. They show the greatly increased risk of death in older women and in the fifth and subsequent pregnancies, although in the case of eclampsia the primigravida is also at much greater risk than women in the second, third and fourth pregnancies.

Avoidable Factors

In this series of sixty-eight deaths from toxaemia an avoidable factor was present in thirty-eight. In the great majority responsibility for the avoidable factor or factors was shared by more than one person. Of the four categories, consultant obstetrician, general practitioner, midwife and patient, responsibility was shared as follows:

Consultant alone	3
Consultant and general practitioner ...	4
Consultant and patient	2
General practitioner alone	8
General practitioner and midwife	2
General practitioner and patient	4
Midwife and patient	1
Patient alone	14

It will be seen that the consultant was involved in nine cases, the general practitioner in sixteen and the midwife in three. The patient herself was involved in nineteen, but in many instances it seemed, from the limited information supplied on the enquiry form, that she may have been mentally subnormal and incapable of appreciating the advice given to her.

When responsibility for avoidable factors was attributed to the *Consultant and his supporting staff* in almost all cases it was because they provided inadequate ante-natal care; in seven this was by failure to see the patient sufficiently often, and in one by delay in admission to hospital and treatment of the patient. In a further death the consultant was responsible for an unsuitable "early discharge" from hospital.

The *General Practitioner* was responsible for avoidable factors in three ways. Firstly, four patients were wrongly booked for delivery at home or in a general practitioner maternity home in disregard of previous history such as toxaemia or of age or parity. Secondly, ante-natal care was inadequate in eleven cases; and thirdly, failure to seek consultant opinion and admission to hospital led to disaster on ten occasions. The avoidable factor may be complex and this is illustrated by the case of a woman over 35 years of age, with six previous pregnancies, the last three of which were associated with hypertension and in one of which pre-eclampsia occurred at the thirty-fourth week of pregnancy, labour then being induced and resulting in a stillbirth. In the seventh and fatal pregnancy she was booked by a general practitioner for delivery in a general practitioner maternity home. She was grossly obese. She was never referred for the opinion of a consultant obstetrician. The ante-natal care was desultory and examinations infrequent. Oedema developed which worried the patient and her husband. The pregnancy was allowed to progress over one week beyond term and the general practitioner considered inducing labour himself in a maternity home for normal midwifery. When the patient developed fits she was put in an ambulance and she had more fits during the journey.

The *Patient* was considered responsible for the avoidable factor which contributed to her own death when she

(i) concealed the fact that she was pregnant;
(ii) concealed a previously abnormal pregnancy and labour and so misled her doctor into booking her for delivery either at home or in a general practitioner maternity home;
(iii) failed to attend for ante-natal supervision, or was away from home repeatedly when the doctor and midwife called to examine her;
(iv) refused to accept advice as to the safest place for the delivery;
(v) refused admission to hospital for observation and treatment.

The doctor may be faced with the problem of the woman who is at great risk with the signs of severe pre-eclampsia and refuses hospital admission. In the present series a woman aged 36, pregnant for the seventh time and having had two abortions and two neo-natal deaths, at the thirty-third week of pregnancy developed a blood pressure of 170/120 mm Hg, albuminuria ++ and marked oedema of the legs. She refused to continue attending the hospital where she was booked for delivery and her family doctor visited her at home, constantly urging her to be admitted to hospital. At the thirty-seventh week of pregnancy she had eclamptic fits and died in hospital of cerebral haemorrhage. The reason for her failure to follow her doctor's advice was not stated. Better and more vigorous health education of both parents might help to overcome irrational fears about hospitals, and assistance in arranging for the care of the home and other children and visiting by the children to see their mother in hospital may make it easier for women to accept in-patient treatment.

Pheochromocytoma

Six deaths occurred in which this condition was diagnosed at post-mortem examination and they are mentioned in this chapter because of the presenting signs of intermittent hypertension and albuminuria which mimicked toxaemia of pregnancy. One woman developed "eclamptic fits" and so her death is coded to I.C.D. No. 642·3 and included as a "toxaemia death" in the tables, whilst the others have been excluded from these tables and are coded as associated deaths. In three instances the possibility of a pheochromocytoma was considered in the differential diagnosis during pregnancy. The ages of the women varied from 27 years to 39 years; two of them had previously had two children and all of the pregnancies had been complicated by "toxaemia" and the remaining four women had had one or more abortions. One death was considered to have avoidable factors for despite the history of "toxaemia" in two previous pregnancies the patient was booked for delivery at home; she received inadequate ante-natal care and the help of a consultant was not requested until too late.

Summary and Conclusions

1. There were 67 deaths from toxaemia of pregnancy from 1964–66 compared with 104 from 1961–63, 118 from 1958–60 and 171 from 1955–57.
2. Avoidable factors were present in 56 per cent.
3. Patients treated by rest in bed in the management of toxaemia of pregnancy may be more prone to develop a pulmonary embolism especially when a Caesarean section has been performed, but the figures in this enquiry series do not show a statistically significant association.
4. Six deaths due to pheochromocytoma are mentioned because signs of pre-eclampsia were mimicked in five and eclampsia in one.

3. HAEMORRHAGE

Sixty-eight deaths have been classified under haemorrhage and are included in Appendix I, Table 1 under the following categories of the International Classification of Diseases:

I.C.D. No.	Cause of Death	Number
	(1) Accidental haemorrhage	
644	Other haemorrhage of pregnancy	14
Part of 670	Delivery complicated by placenta praevia or ante-partum haemorrhage	13
		27
	(2) Placenta praevia	
643	Placenta praevia	4
Part of 670	Delivery complicated by placenta praevia or ante-partum haemorrhage	12
		16
	(3) Post-partum haemorrhage	
671	Delivery complicated by retained placenta	11
672	Delivery complicated by post-partum haemorrhage ...	14
		25
	Total	68

The sixty-eight deaths contrast with those discussed in previous reports and it will be seen that deaths from haemorrhage have been considerably reduced; in the enquiry series they remain the third of the major causes of maternal deaths; but it must be remembered that confidential reports are received in only about 86 per cent of the maternal deaths directly due to pregnancy and childbirth. Table VII shows the comparison in each of the triennial reports.

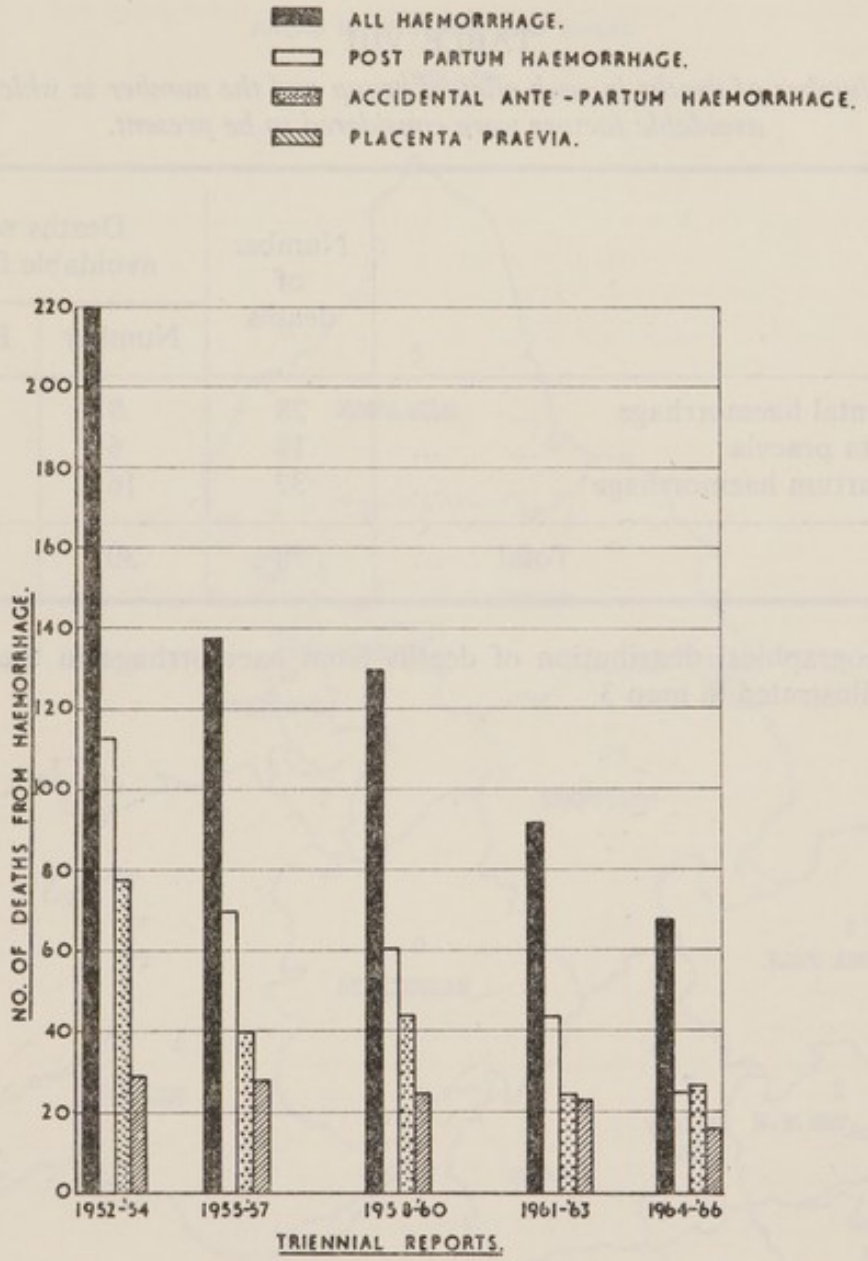
TABLE VII

Deaths from haemorrhage in each of the triennial reports.

	1952–54	1955–57	1958–60	1961–63	1964–66
Accidental ante-partum haemorrhage ...	78	40	44	25	27
Placenta praevia	29	28	25	23	16
Post-partum haemorrhage ...	113	70	61	44	25
Total ...	220	138	130	92	68

FIGURE 6.

DEATHS FROM HAEMORRHAGE.



As in previous reports, deaths from haemorrhage due to abortion, ectopic pregnancy or ruptured uterus have not been included in this chapter but are discussed elsewhere. There were also six deaths from haemorrhage resulting from Caesarean section which are not included, but they are discussed in the chapter on Caesarean section.

There was one death from accidental haemorrhage, two from placenta praevia, and seven deaths from post-partum haemorrhage, which have been classified under other causes of death and are not counted in Tables VII, IX and X. These deaths are however included in Table VIII and in the following

discussion which is therefore concerned with a total of seventy-eight cases of which 30 or 38·5 per cent were considered to have avoidable factors. Table VIII shows the number of deaths in each clinical group in which avoidable factors were considered to be present:

TABLE VIII

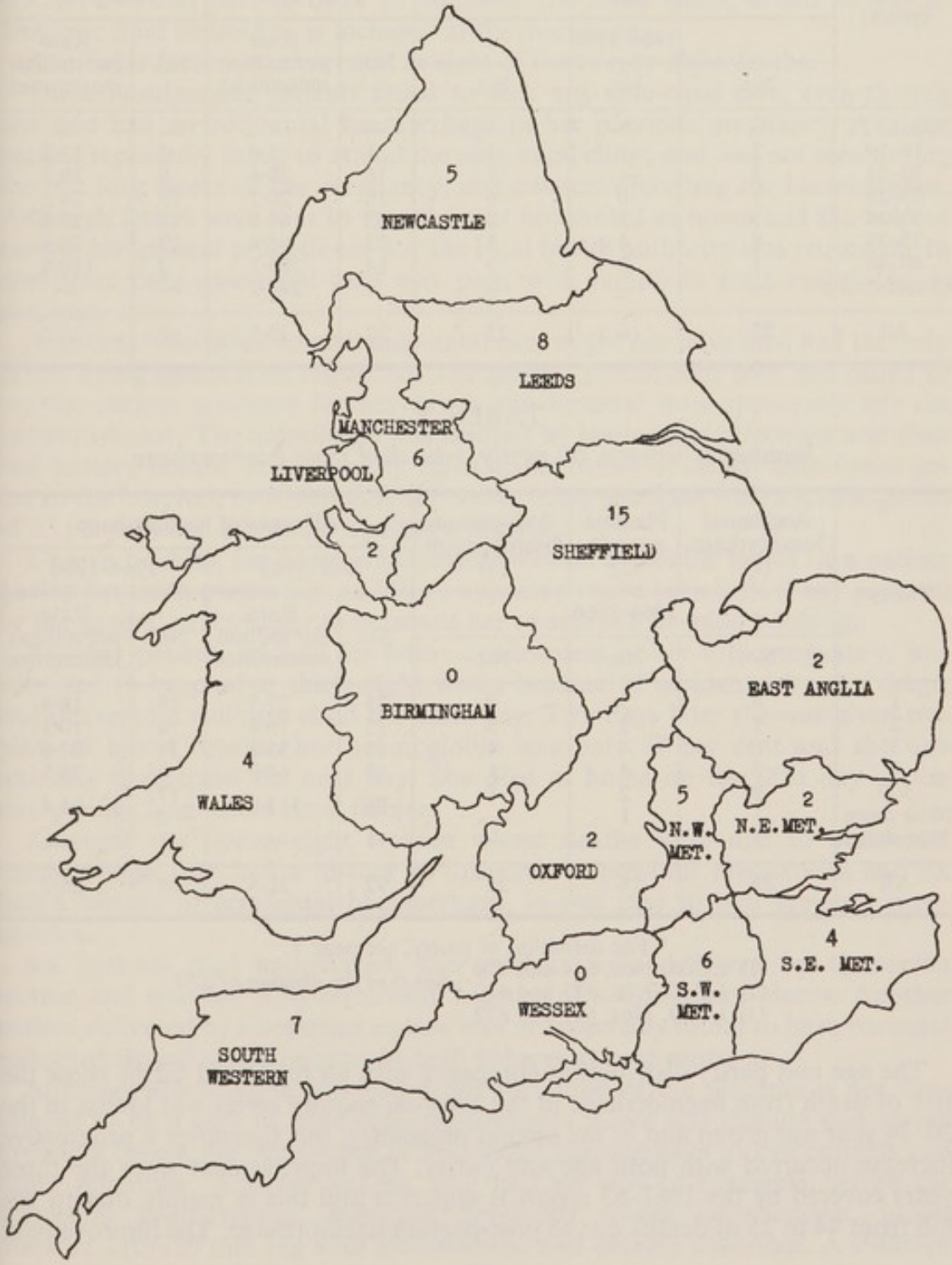
Number of deaths in each clinical group and the number in which avoidable factors were considered to be present.

	Number of deaths	Deaths with avoidable factor	
		Number	Per cent
Accidental haemorrhage	28	8	28·6
Placenta praevia	18	6	33·3
Post-partum haemorrhage	32	16	50·0
Total ...	78	30	38·5

The geographical distribution of deaths from haemorrhage in the enquiry series is illustrated in map 3.

MAP 3

THE GEOGRAPHICAL DISTRIBUTON OF DEATHS FROM HAEMORRHAGE IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES 1964 - 66



Age and Parity

The age and parity distributions of the women who died from haemorrhage are shown in Tables IX and X.

TABLE IX

Number of women, by age, who died from haemorrhage.

Age (years)	Accidental haemorrhage (1)	Placenta praevia (2)	Post-partum haemorrhage (3)	All types of haemorrhage			
				1961–1963		1964–1966	
	1964–1966						
	No.	No.	No.	No.	Rate per million maternities	No.	Rate per million maternities
Under 16	—	—	—	—	—	—	—
16–19	2	—	1	1	5·0	3	12·3
20–24	2	—	7	16	20·4	9	10·7
25–29	7	6	6	16	20·7	19	24·1
30–34	7	3	3	22	47·6	13	29·8
35–39	8	4	5	22	95·4	17	78·6
40–44	1	3	3	14	204·2	7	110·5
45 and over	—	—	—	1	243·7	—	—
All	27	16	25	92	36·5	68	26·2

TABLE X

Number of women, by parity, who died from haemorrhage

Parity*	Accidental haemorrhage (1)	Placenta praevia (2)	Post-partum haemorrhage (3)	All types of haemorrhage			
				1961–1963		1964–1966	
	1964–1966						
	No.	No.	No.	No.	Rate per million maternities	No.	Rate per million maternities
1	6	3	9	25	27·5	18	18·8
2	1	2	5	12	15·8	8	10·1
3	6	4	4	15	35·3	14	32·6
4	3	4	1	13	64·0	8	38·5
5–9	9	2	6	26	115·6	17	91·4
10 or more	1	1	—			2	
Not stated	1	—	—	1	—	1	—
All	27	16	25	92	36·5	68	26·2

* For definition of parity, see page 7.

(1) I.C.D. Nos. 644 and 670
(2) I.C.D. Nos. 643 and 670 } *See text for division of 670*
(3) I.C.D. Nos. 671 and 672

The age and parity distribution compared with all registered births show the risk of death from haemorrhage in the 1964–66 enquiry series was lowest in the 20–24 year age group and in the second pregnancy, but thereafter a progressive increase occurred with both age and parity. The improvement since the three years covered by the 1961–63 report is apparent and this is mainly due to the fall from 44 to 25 of deaths due to post-partum haemorrhage. The improvement

is most marked among the older women and those in the higher parities and may well be the result of the increasing tendency to deliver those women who are more likely to suffer from post-partum haemorrhage, in hospital where facilities for blood transfusion are immediately available.

Accidental Haemorrhage

There were twenty-seven deaths due to accidental ante-partum haemorrhage (I.C.D. 644 and part of 670). In addition one other death, coded as due to amniotic fluid embolism, is included in the discussion.

Avoidable factors were present in eight of the twenty-eight deaths.

Three multiparous patients failed to seek any ante-natal care, even though one had had an accidental haemorrhage in her previous pregnancy. Another patient repeatedly failed to attend the ante-natal clinic, and was not seen during the last four weeks of her pregnancy, immediately preceding the haemorrhage. Although letters were sent to her, she was not visited at home and the help of neither her general practitioner nor the local health authority was requested. In one other case ante-natal care was poor with failure to treat megaloblastic anaemia.

A patient who failed to seek ante-natal care might not have died had the help of the flying squad been requested. The general practitioner who was called to see the patient arranged for her to go into hospital then apparently left the patient's house. The ambulance was delayed by inadequate directions and then had battery failure. It was nearly three hours before a second ambulance got her to the hospital, by which time she was severely shocked, with a haemoglobin of 33 per cent and a blood coagulation disorder.

Unwise booking for home confinement was an avoidable factor in a patient having her tenth pregnancy, and there appears to have been little if any pressure by her general practitioner to persuade her to accept a hospital booking.

Another patient, booked for home confinement in her fifth pregnancy, was admitted to hospital at thirty-eight weeks because of accidental haemorrhage, and delivered a stillborn child the same day. Two days later she was given two pints of blood because her haemoglobin was only 57 per cent and she was unwisely discharged the next day. She died at home on the fifth day of the puerperium from acute renal failure.

Amongst the twenty-eight women whose deaths were due to accidental haemorrhage, four had a history of toxaemia in previous pregnancies and six had a history of accidental haemorrhage, in one case in two previous pregnancies.

Six patients died undelivered, five patients were delivered by Caesarean section and one had a hysterectomy because of a Couvelaire uterus. Another patient delivered by Caesarean section was unexpectedly found to have bacterial endocarditis and septic infarcts in both kidneys at post-mortem.

Although albuminuria resulting from abruption of the placenta is not considered to be a sign of pre-eclamptic toxaemia, there was definite and severe toxaemia before the occurrence of accidental haemorrhage in five patients one being eclamptic. Another patient who had no sign of toxaemia before the accidental haemorrhage, suddenly developed severe hypertension, blood pressure 210/150 mm Hg with albuminuria, and became comatose. A stillborn

child was delivered by forceps and the patient died soon after from a massive cerebral haemorrhage.

Blood coagulation failure was recognized in fourteen patients at least eight of whom had post-partum haemorrhage. Acute renal failure from cortical necrosis of the kidneys was present in seven women who died and one of these also had massive infarction of the liver. The records suggest that in some of these patients blood was not given early enough or in sufficient quantity.

Placenta Praevia

There were sixteen deaths classified as due to placenta praevia (I.C.D. 643 and part of 670) and two other deaths are included in this discussion, one coded as caused by puerperal pulmonary embolism and the other by influenzal pneumonia, because in both a major degree of placenta praevia was also present. Six of these sixteen cases were considered to have avoidable factors.

Three patients died undelivered from severe haemorrhage, and avoidable factors were present in all three cases. One patient was booked for a home confinement and consultant advice was never sought in spite of a high presenting part. Severe bleeding occurred at thirty-eight weeks and she was taken to hospital where a transfusion was given, but no attempt was made to control the bleeding and apparently a consultant was not called to see the patient. The second patient was admitted to hospital because of uterine contractions at about twenty-eight weeks. One week later she had severe haemorrhage, treated by transfusion of eight pints of blood and two pints of plasma. The consultant was informed, but did not see the patient, who might have been saved if something had been done to stop the bleeding. The third patient was a multipara who apparently concealed the fact of her pregnancy, and did not seek medical advice even though she had slight blood loss for two weeks before the fatal haemorrhage at thirty-seven weeks.

Yet another patient, an elderly grand multipara, was admitted to hospital at thirty-four weeks because of severe bleeding. The assistance of the flying squad was not requested to resuscitate her before transfer, and after admission several hours elapsed before blood was obtained for transfusion. A further torrential haemorrhage occurred and the placenta was delivered vaginally, followed by a stillborn foetus.

Altogether fourteen patients were treated by Caesarean section, and three of these were followed by hysterectomy because of continued bleeding. Only two of these fourteen deaths were considered to have avoidable factors. One was a multipara with a bad obstetric history, and severe anaemia in every pregnancy. Although correctly booked for hospital confinement, she did not see a consultant ante-natally, but was admitted to hospital at thirty-six weeks because of a transverse lie. After a small ante-partum haemorrhage she was examined under anaesthesia by a registrar who found a placenta praevia, and she again started to bleed. Blood transfusion was started, and an immediate Caesarean section was performed by the registrar. Hysterectomy became necessary because of persistent vaginal bleeding, and further energetic attempts to resuscitate her were unsuccessful. Although this registrar was undoubtedly competent it is reasonable to expect that such a case would be dealt with by the consultant himself.

The other death with avoidable factors was an elderly primigravida, who was admitted to hospital at thirty-nine weeks because of some ante-partum haemorrhage. Three days later labour was induced with buccal pitocin, the membranes ruptured spontaneously and fairly free bleeding occurred. Caesarean section was performed by the consultant, producing a stillborn foetus, and the diagnosis of a placenta praevia was confirmed. Further bleeding occurred after the operation, but no blood was given. She collapsed an hour later and died. At post-mortem some intestinal haemorrhage was found from a gastric erosion, the cause of which was obscure, but it was thought that her death was primarily due to haemorrhage from placenta praevia.

Although in the remaining twelve deaths of women treated by blood transfusions and Caesarean section avoidable factors were not considered to be present, it is fair comment to say that these cases, which so often prove difficult and hazardous, do call for consultant help. Two patients, found to have placenta praevia accreta necessitating hysterectomy, were operated on by unsupervised registrars, one in a teaching hospital. Another patient, operated on by an experienced registrar, died because of uncontrollable bleeding from the lower segment incision. Furthermore it was apparent that in many deaths from placenta praevia there was considerable delay in performing Caesarean section. Vaginal procedures such as pulling down a leg or the use of Willetts forceps should not be necessary in this country where delay in access to operating facilities should not occur. If an operating theatre is not always immediately available or is situated at some distance from the delivery room, facilities for Caesarean section should be present in a delivery room. There should be no delay in obtaining blood for transfusion and an experienced anaesthetist should be readily available at all times for such emergencies.

Post-partum Haemorrhage

There were twenty-five deaths from post-partum haemorrhage, including eleven in which delivery was followed by a retained placenta (I.C.D. 671) and fourteen in which labour was followed by a post-partum haemorrhage (I.C.D. 672). Although post-partum haemorrhage also occurred in eight patients with coagulation disorder associated with accidental ante-partum haemorrhage, these deaths are not included again here.

Seven deaths classified as due to other causes are also included in this discussion because these deaths were partly due to post-partum haemorrhage. These include a death from pulmonary embolism one month after delivery, a death from puerperal sepsis following manual removal of the placenta, two deaths from heart disease in which severe haemorrhage necessitated blood transfusion, one death from haemorrhage due to coagulation disorder in a patient with bacteraemia, one death from eclampsia with renal failure, and one death apparently due to inhalation of vomit, although unassociated with anaesthesia.

Thirteen of the twenty-five deaths directly due to post-partum haemorrhage and three of the seven other deaths had avoidable factors, that is 50 per cent. An unwise booking for home confinement or for a general practitioner maternity home was an avoidable factor in twelve cases, of which at least three were due to the patient herself refusing to accept hospital booking; a midwife was responsible for the wrong booking in three, and a general practitioner in the

remainder. Inadequate ante-natal care, with failure to check the haemoglobin was a factor in four deaths.

Failure to call the flying squad or other help was a factor in the death of four patients, who arrived in hospital in a moribund state, having bled severely at home or on the journey. Failure or delay in calling in a consultant was a factor in six other cases. One of these patients, delivered in a general practitioner maternity home was apparently not given any oxytocic drug, and no attempt at resuscitation was made for two hours after the haemorrhage had occurred. When the consultant arrived the patient was suffering from irreversible shock. Another bled from an extensive vaginal tear, but consultant help was not requested until the patient was moribund.

An elderly multipara with a bad obstetric history, delivered in a general practitioner maternity home suffered from severe post-partum haemorrhage and was treated by blood transfusion and by two attempts at packing the uterus. The consultant who was then telephoned asked to be kept informed of the patient's progress. Two hours later he was sent for because of further bleeding, and he performed a hysterectomy, but the patient did not survive.

Another patient, an elderly grand multipara whose labour was induced by artificial rupture of the membranes and buccal pitocin was delivered in a general practitioner maternity home. An hour later she bled and was given intravenous fluids and her uterus was packed. Blood for transfusion and consultant help arrived from the parent hospital fifteen miles away five minutes after her death. Two patients for whom help from the flying squad had been obtained were transferred to hospital with a retained placenta *in situ*.

Another patient, who should never have been booked for home confinement because of two previous labours with retained placenta and post-partum haemorrhage, was safely delivered by a midwife who failed to recognize or failed to report that she delivered only a small portion of the placenta, possibly a succenturiate lobe. The patient collapsed and died from haemorrhage after the midwife had left the house.

Two patients who were delivered in hospital died from post-partum haemorrhage without the consultant being informed until irreversible shock had set in, and the consultant must be held responsible for his team in such cases. One patient had her placenta removed manually by a senior house officer, and the other, which was dealt with by a registrar, apparently had a placenta accreta. One patient died from severe laceration of the vaginal vault after manual removal of the placenta by an inexperienced house officer.

In this group there were five cases of post-partum haemorrhage in which coagulation disorder was apparent, one due to sepsis, one to virus hepatitis, one to "acute cirrhosis of the liver" and two for which no cause was found. The diagnosis and treatment of coagulation defects is admittedly difficult, but should always be considered in dealing with post-partum haemorrhage.

Summary and Conclusions

1. Despite the increased number of births, deaths from haemorrhage fell from 92 to 68, but the percentage with avoidable factors was 38·5.
2. Deaths from accidental haemorrhage have not been reduced. Routine investigation of blood coagulability should be carried out in all cases of

accidental haemorrhage; and early and adequate blood transfusion should help to prevent the onset of acute renal failure.

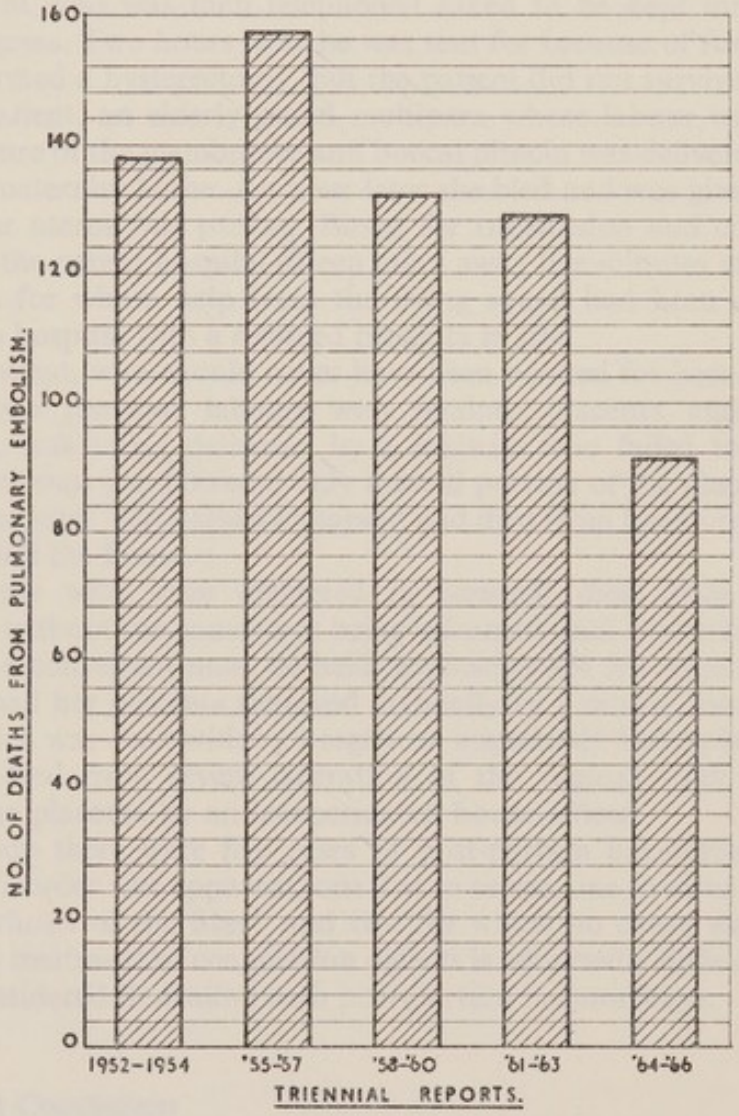
3. Facilities should be made available for immediate emergency Caesarean section to treat severe bleeding from placenta praevia, and consultant help should be called upon in these cases.
4. Although deaths from post-partum haemorrhage have been greatly reduced, avoidable factors were present in 50 per cent.

4. PULMONARY EMBOLISM

There were ninety-one deaths from pulmonary embolism. Twenty-four occurring during pregnancy and sixty-seven in the puerperium. These 91 deaths contrast with 138 in 1952–54, 157 in 1955–57, 132 in 1958–60, and 129 in 1961–63. This is a considerable reduction in spite of an increase in the birth rate and is illustrated in figure 7.

FIGURE 7.

DEATHS FROM PULMONARY EMBOLISM.



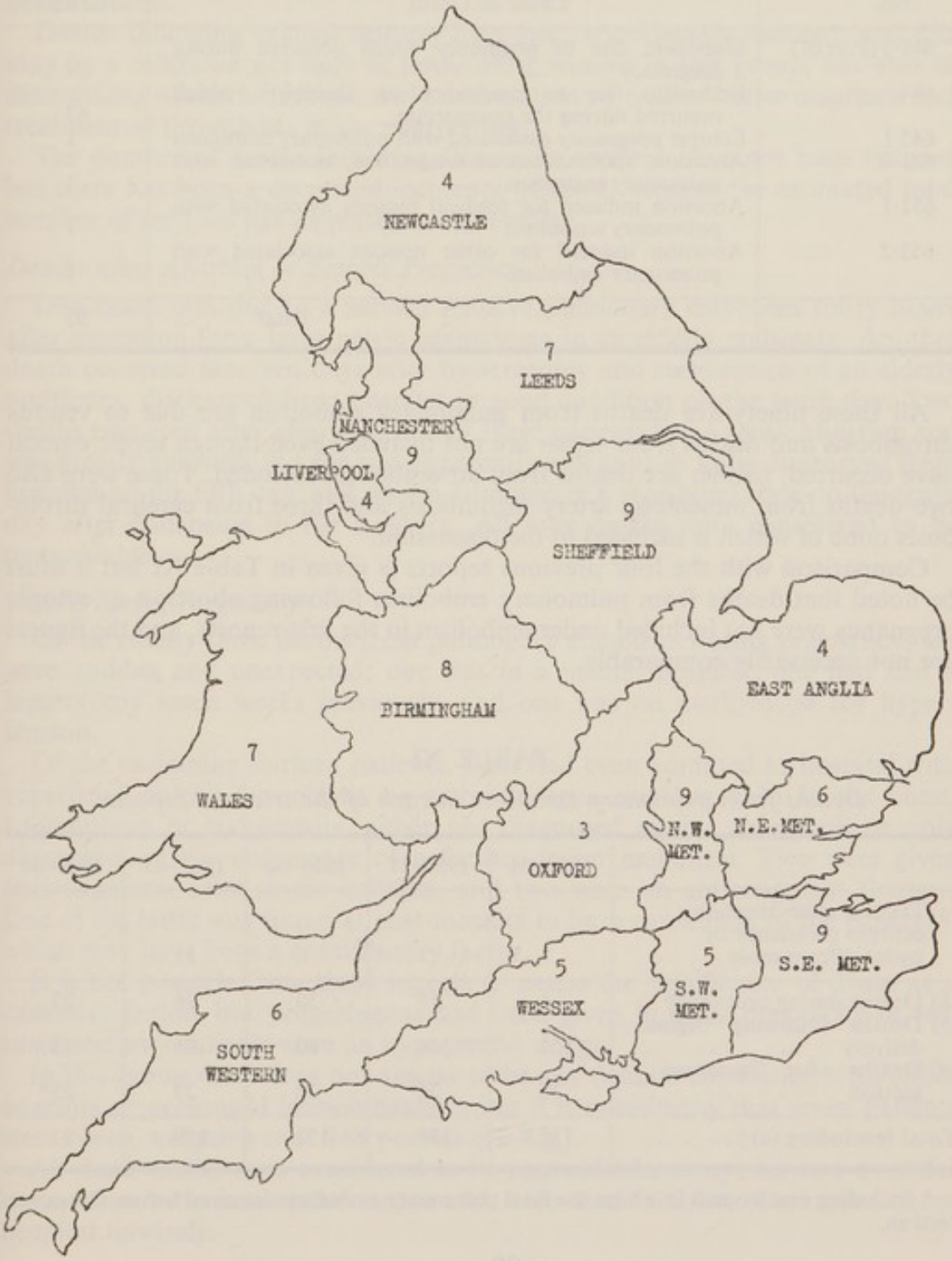
The geographical distribution of deaths from pulmonary embolism is shown in map 4.

The figures in Table IV on page 9 show that pulmonary embolism continues to be the second commonest cause of maternal death.

MAP 4

THE GEOGRAPHICAL DISTRIBUTION OF DEATHS FROM PULMONARY EMBOLISM IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES

1964 - 66



In addition to these ninety-one deaths, there was one death following ectopic pregnancy and three deaths associated with abortion. These four deaths are included in the discussion and tables although they appear in Appendix I, Table 1 under the International Classification of Diseases as ectopic pregnancy or abortion. The clinical discussion and tables are therefore based on the following ninety-five deaths.

I.C.D. No.	Cause of Death	Number
648·3 (Part of)	Embolism due to pregnancy which occurred during pregnancy	24
684	Embolism due to pregnancy or childbirth which occurred during the puerperium	67
645·1	Ectopic pregnancy associated with pulmonary embolism	1
651·0	Abortion, spontaneous or unspecified, associated with pulmonary embolism	1
651·1	Abortion induced for medical reasons associated with pulmonary embolism	1
651·2	Abortion induced for other reasons associated with pulmonary embolism	1
	Total ...	95

All these ninety-five deaths from pulmonary embolism are due to venous thrombosis and deaths from sepsis are not included even though septic emboli have occurred, neither are deaths from air embolism included. There were also two deaths from mesenteric artery thrombosis and three from cerebral thrombosis none of which is included in the discussion.

Comparison with the four previous reports is given in Table XI but it must be noted that deaths from pulmonary embolism following abortion or ectopic pregnancy were not included under embolism in the first reports, and the figures are not necessarily comparable.

TABLE XI

Deaths from pulmonary embolism in each of the triennial reports.

	1952–54	1955–57	1958–60	1961–63	1964–66
(*a*) Deaths after abortion, ectopic pregnancy or hydatidiform mole ...	?	7	6	11	4
(*b*) Deaths during pregnancy...	4	17	30	36	23
(*c*) Deaths following vaginal delivery	104	114	80	66	43
(*d*) Deaths after Caesarean section	30	26	22	27	25*
Total (excluding (*a*))	138	157	132	129	91

* Including one woman in whom the fatal pulmonary embolism occurred before Caesarean section.

It must also be admitted that we have no accurate knowledge of the total number of maternal deaths due to embolism, only of those deaths for which confidential reports are received, and it is possible that a higher proportion of cases, especially those occurring during pregnancy, are reported on now in comparison with the earlier years, and if so the reduction is greater than appears.

It will be noted that deaths from pulmonary embolism during pregnancy have diminished and this may be partially due to fewer maternities occurring in women over the age of twenty-nine years (see Appendix I, Table 4), but there is no reason to believe that the incidence of venous thrombosis in pregnancy has been reduced.

Deaths following vaginal delivery have been considerably reduced, and this may be a reflection not only of fewer older women in this group, but also of diminishing obstetric trauma, early ambulation as well as better diagnosis and treatment of thrombosis in the puerperium.

The number of deaths following Caesarean sections have not been reduced but there has been a decreased incidence of death because the estimated total number of sections has increased considerably.

Deaths after Abortion or Ectopic Pregnancy

One death was due to a sudden massive pulmonary embolism thirty hours after operation for a large pelvic haematoma in an elderly multipara. Another death occurred nineteen days after hysterotomy and sterilization of an elderly multipara, discharged from hospital in good condition on the tenth day. Two deaths occurred after abortion, one of these patients had a septic abortion and was grossly anaemic, but she was apparently well enough to be discharged from hospital on the fifth day, and was re-admitted in a moribund state on the tenth day after collapsing in the lavatory. All four deaths were considered to be unavoidable.

Deaths during Pregnancy

Of the twenty-three deaths from pulmonary embolism during pregnancy, ten were sudden and unexpected; one was in a mental hospital, one had had a laparotomy seven weeks previously, and one was on methyldopa for hypertension.

Of the remaining thirteen patients, eight had been admitted to hospital with superficial phlebo-thrombosis or warning signs, such as pain in the chest, haemoptysis or tachycardia, either not diagnosed as due to emboli or only diagnosed on the occurrence of a further major embolism. Two were given anticoagulants after severe collapse, and two were on anticoagulant therapy. One of the latter was found at post-mortem to have carcinoma of the pancreas, which may have been a contributory factor.

It is not possible from these reports to assess the significance of drugs as a causative factor, but progestogens had been given in early pregnancy in two cases and two patients were on hypotensive drugs.

In this group there does not appear to be any definite correlation with either anaemia or prolonged immobilization, but it is noteworthy that seven patients were obese, weighing over 168 pounds (76 Kg.).

All these deaths were considered to be unavoidable, except for two doubtful cases, one with inadequate ante-natal care and another discharged from hospital unwisely.

Post-mortem examinations were performed on twenty-two of the twenty-three women who died, but the origin of the fatal embolus was not always determined. It was thought to have arisen in pelvic veins in five cases, the remainder probably arising from a femoral vein.

Deaths following Vaginal Delivery

Of the forty-three deaths following vaginal delivery, twenty-five were sudden and unexpected. Four of these had toxaemia, including one eclamptic. One had had an abdominal operation five weeks before delivery, and one was sterilized twenty-four hours after delivery of twins, having had seven previous pregnancies. One was on cortisone for Addison's disease, and another suffered from pyonephrosis resulting from a renal calculus.

In the remaining eighteen women with phlebo-thrombosis or warning signs such as chest pain, haemoptysis or tachycardia, the diagnosis was either not made or the condition inadequately treated, except for one woman, treated with anticoagulants, who died five months later. Only two other patients were given anticoagulant drugs shortly before death. Four of the eighteen patients suffered from toxaemia or hypertension and one from cardiac disease.

Spontaneous vaginal delivery occurred in thirty-two patients, assisted delivery, forceps or breech, in ten, one of which was associated with a cervical tear, adequately sutured. Manual removal of the placenta was necessary in three women.

In twelve cases there was no indication of haemoglobin estimations, although this does not mean they were not done. Some degree of anaemia was noted in three women, one of whom was a patient with sickle-cell anaemia, pregnant with twins. Weight was not always recorded, but twelve of the forty-two were obese, 168 pounds (76 Kg.) or over.

Death occurred within two weeks of delivery in twenty-four women, but in seven death occurred over one month after delivery. The majority were ambulant, but eight were kept at bed rest for proper reasons, and there was no case in which the patient had been kept in bed unnecessarily.

Thirty-five deaths were considered to be unavoidable; avoidable factors were present in eight, such as failure of ante-natal care, wrong booking, or allowing discharge from hospital before the patient was fit. Even so, these factors may not have been greatly responsible for the deaths. Failure to give anticoagulant drugs has not been regarded as an avoidable factor, but we must comment that in several cases deep vein thrombosis or warning signs of embolism were ignored, and the use of anticoagulant drugs might have saved life.

Post-mortem examinations were performed in thirty-eight of the forty-three women who died, and in five of these the origin of the embolus was not looked for. In twenty women the embolus was thought to have originated in pelvic veins, and in the remaining twelve from the leg veins and in one other woman thrombosis of the vena cava was found at post-mortem, undiagnosed during life, but a laparotomy had been performed on the day before delivery because of acute abdominal symptoms.

Deaths after Caesarean Section

Of the twenty-five deaths after Caesarean section, seventeen were sudden and unexpected. In most cases death was too sudden for anything but emergency resuscitation procedures, but one patient was given heparin a few hours before

death. Five patients died suddenly after they had returned home, one of them being discharged from hospital on the seventh day, but this has not been regarded as an avoidable factor.

One patient had had a fractured tibia and fibula, and it is probable that the fatal embolism was due to this rather than to the Caesarean section.

In eight patients venous thrombosis or warning signs were present, but one patient concealed the fact that she had pain in her calf, because she feared she would not be allowed home. Anticoagulants were given to four of the eight patients, in two for superficial thrombo-phlebitis and in two for pulmonary embolism. One patient who had a pulmonary embolism on the second day, was not given anticoagulants because it was considered too soon after operation and she died on the eighth day. Another patient had had pyrexia and a raised pulse rate, and only complained of tightness under the sternum and dyspnoea on the day before she died.

Only three deaths in this group were considered to have avoidable factors, namely inadequate ante-natal care and failure to admit to hospital; one other elderly primigravida had received no ante-natal care because she had concealed her pregnancy.

It may be noted that in this group of twenty-five patients, there were no less than eleven with hypertension or toxaemia, two of the patients with hypertension were diabetic, and one of the toxaemic patients was eclamptic; one other had toxaemic signs due to thrombosis of a renal vein, which was undoubtedly the origin of the fatal embolism. Of course these patients had been treated by bed rest, but it is not possible to say that this was an important factor in the causation of thrombosis.

In only one case was it possible that anaemia or blood loss was a factor. An elderly multipara admitted at thirty-four weeks because of ante-partum haemorrhage, had a sudden severe collapse. Resuscitation allowed a Caesarean hysterectomy, because of placenta accreta, but she died a few hours later.

Obesity was noted in eleven of these twenty-five patients.

In sixteen women the operation was performed before the onset of labour, although in five of these the membranes had been ruptured. In two cases there is no record, and in seven the operation was performed after labour had started; in three of these the labour was prolonged for over twenty-four hours.

In two cases resuture of a burst abdomen was necessary and in two other women some post-operative sepsis was noted.

Post-mortem examinations were performed on twenty-three women who died, but in two of these the origin of the embolism was not looked for. In eleven women the origin appeared to be from pelvic veins, in one case from the left renal vein, and in nine femoral veins.

Puerperal pulmonary embolism

Sixty-eight women died from puerperal pulmonary embolism. Thirty-eight of the forty-three women who were delivered vaginally had live babies including one pair of twins and six (including one pair of twins) babies were stillborn. Twenty-four of the twenty-five women who had Caesarean sections had live born babies (including one pair of twins) and one a stillborn baby.

The time which elapsed after delivery before the fatal embolism occurred is shown in Table XII.

TABLE XII

Onset of fatal embolism after delivery.

Day after delivery	Vaginal delivery		Caesarean section	
	Deaths with no warning	Deaths with warning signs	Deaths with no warning	Deaths with warning signs
Under 24 hours ...	1	—	1	—
2–7 days	7	—	5	5
8–14 days	9	7	5	1
15–28 days	5	6	5	2
Over 28 days	2	5	1	—
Not stated	1	—	—	—
Total	25	18	17	8

Age and Parity

The age and parity and age/parity analysis of the women who died from pulmonary embolism during pregnancy or following delivery is shown in Tables XIII, XIV, XV and XVI.

TABLE XIII

Number of women, by age, who died from pulmonary embolism.

Age (years)	Deaths from pulmonary embolism			
	1961–1963		1964–1966	
	Number	Rate per million maternities	Number	Rate per million maternities
Under 16	1	452·3	—	—
16–19	6	30·2	5	20·5
20–24	24	30·6	18	21·3
25–29	33	42·8	24	30·4
30–34	28	60·6	21	48·2
35–39	26	112·8	19	87·8
40–44	20	291·7	7	110·4
45 and over	1	243·7	1	241·8
Not stated	1	—	—	—
All	140	55·5	95	36·5

TABLE XIV

Number of women, by parity, who died from pulmonary embolism.

Parity*	Deaths from pulmonary embolism†			
	1961–1963		1964–1966	
	Number	Rate per million maternities	Number	Rate per million maternities
1	48	52·7	28	29·3
2	27	35·7	24	30·3
3	21	49·5	16	37·2
4	14	68·9	8	38·5
5–9	25	111·1	18	89·3
10 or more			1	
Not stated	5	—	—	—
All	140	55·5	95	36·5

† I.C.D. Nos. 648·3, 684, 645·1, 651·0, 651·1, 651·2.

TABLE XV

Deaths due to pulmonary embolism.
Age and parity of 95 deaths.

Age	Parity*						
	1	2	3	4	5–9	10+	All
Under 16	—	—	—	—	—	—	—
16–17	1	—	—	—	—	—	1
18–19	4	—	—	—	—	—	4
20–24	8	7	3	—	—	—	18
25–29	7	10	4	2	1	—	24
30–34	4	4	3	1	9	—	21
35–39	3	2	5	2	7	—	19
40–44	1	1	—	3	1	1	7
45 and over	—	—	1	—	—	—	1
All	28	24	16	8	18	1	95

* For definition of parity, see page 7.

TABLE XVI

Deaths due to pulmonary embolism by age and parity, rates per million maternities.

Age	Parity*				
	1	2	3	4	5+
Under 20 ...	25	—	—	—	—
20–	18	25	33	—	—
25–	32	34	25	29	21
30–	58	32	27	16	131
35–	125	47	99	53	113
40 and over ...	184	111	78	249	71

* For definition of parity, see page 7.

The rates shown in these tables give an estimate of the risk of dying from pulmonary embolism during pregnancy and childbirth. It will be seen that the risk increases with age, but appears to be independent of parity.

Association between puerperal pulmonary embolism, suppression of lactation and the administration of oestrogens

Following publication of a report* in the *Lancet* on August 5th 1967 suggesting an association between pulmonary embolism and the suppression of lactation with oestrogens, a retrospective survey was made of the 91 deaths from puerperal pulmonary embolism which were reported in the 1961–63 enquiry series and the 67 in the 1964–66 enquiry. (Deaths following hysterotomy and late abortion were excluded.) Relevant information could not be obtained concerning 73 of the deaths but reports were received for 85. Eighteen women were still lactating on the seventh day, 18 had died before the seventh day and 49 were not lactating. Oestrogens had been administered to 49 of the women who died and probably to three others, and 33 women had not taken oestrogens. Forty of the women received stilboestrol, 32 of them taking at least 45 mg over a three-day period, and in the other eight the dosage was not recorded. One woman had an intramuscular injection of hexoestrol dipropionate 15 mg in addition to stilboestrol. Four women received hexoestrol dipropionate 15 mg daily, one an intramuscular injection of oestradiol benzoate 10 mg, one took dienoestrol 10 mg three times daily, one ethinyl oestradiol 50 mg three times daily and one was given enavid 10 mg daily for three days followed by 5 mg daily.

Summary and Conclusions

1. Death from pulmonary embolism occurred during pregnancy or the puerperium in 91 cases, which is a considerable reduction from previous years. Four other deaths from pulmonary embolism followed abortion or ectopic pregnancy and are included in the discussion.
2. The special enquiry form for the investigation of death from pulmonary embolism was completed in 76 of the 95 deaths.

* Daniel, D. G.; Campbell, H. and Turnbull, A. C., 1967. *Lancet*, ii, 287.

3. In 30 of the 95 women who died obesity was noted; the weight was not always recorded but a weight of over 168 pounds (76 Kg) was taken to indicate obesity.
4. In 54 of the 95 patients death was sudden and unexpected, and it is difficult to see how such deaths can be prevented. It is possible that in many of these women, symptoms and signs may have been present, but been ignored by the patient or by her medical attendants. Attention is drawn to the fact that elderly primigravidae, women over 34 years of age, obese women, and patients who have had trauma at delivery or a Caesarean section are at special risk.
5. In previous reports comments have been made on the occurrence of pulmonary embolism in patients who have had a surgical operation in the puerperium. In this series two patients had had a burst abdomen re-sutured and one patient was sterilized twenty-four hours after delivery. It is probable that puerperal sterilization will be performed more frequently in future, so the danger of pulmonary embolism if sterilization is performed soon after delivery must not be forgotten, particularly in patients who are at considerable risk of thrombo-embolism.
6. Comments have also been made in previous reports on the small number of patients treated by anticoagulant therapy, and in the present group it may be that about twenty patients could have been so treated. There has been no mention in any of the reports of a maternal death from haemorrhage due to anticoagulant therapy although the risk of haemorrhage is well known.

5. ABORTION

A glance at Table IV on page 9 indicates that whilst the other major causes of maternal death each show a quite dramatic decline there has been an insignificant fall in the number of maternal deaths considered to be due to abortion in the present series, although it must be remembered that there were almost eighty thousand more total births in the three-year period surveyed in this report compared with the previous three years. The current figure of 133 contrasts with 153 during 1952–54, 141 in 1955–57, 135 in 1958–60 and 139 in 1961–63. The maternal mortality from abortion fell from an average of 0·55 per 10,000 maternities in 1961, 1962 and 1963 to an average of 0·51 in 1964, 1965 and 1966.

The 133 deaths in this section are included in Appendix I, Table 1 under the following categories of the International Classification of Diseases:

I.C.D. No.	Cause of Death	Number
650	Abortion without mention of sepsis or toxaemia	
0·0	Spontaneous or unspecified	7
0·1	Induced for medical or legal reasons	3
0·2	Induced for other reasons	45
0·3	Other—carneous mole	3
	hydatidiform mole	1
651	Abortion with sepsis, thrombosis or embolism	
0·0	Spontaneous or unspecified	11
0·1	Induced for medical or legal reasons	4
0·2	Induced for other reasons	53
0·3	Other—hydatidiform mole	1
652	Abortion with toxaemia without mention of sepsis	
0·0	Spontaneous or unspecified	3
0·1	Induced for medical or legal reasons	2
	Total	133

Ninety-eight deaths were classified as due to illegal interference with the pregnancy by the patient or by some other person. This is 73·7 per cent of the total abortions and is the highest ratio reported in any of the enquiry series, and can be compared with 55·4 per cent in 1961–63, 61 per cent in 1958–60, 64·5 per cent during 1955–57 and 70·6 per cent in 1952–54. In all these cases the death was considered to have an avoidable factor due in nearly all instances to a social problem rather than a medical factor. A charge of manslaughter was brought in twenty-one cases.

The post-mortem reports describe twenty-four of the women as "coloured" and a further two originated from the Eastern Mediterranean. Twenty-two of the "coloured" women died following procured abortion.

TABLE XVII

Number of women by age, who died from abortion and death rates per million women.

Age (years)	Number of women (mid-year population 1965) thousands	Number of maternities 1964–1966	Procured abortions				Other abortions*				All abortions			
			1961–1963		1964–1966		1961–1963		1964–1966		1961–1963		1964–1966	
			Number	Death rate per million	Number	Death rate per million	Number	Death rate per million	Number	Death rate per million	Number	Death rate per million	Number	Death rate per million
Under 16	5,654·2	3,553	1	0·06	1	0·06	—	—	—	—	1	0·06	1	0·06
16–17	737·1	243,565	7	1·75	—	1·12	2	0·05	—	—	9	2·25	—	1·12
18–19	746·8				5				—	—			5	
20–24	1,582·2	843,910	21	4·75	28	5·88	11	2·49	9	1·89	32	7·24	37	7·78
25–29	1,478·7	789,747	13	3·05	24	5·44	18	4·22	7	1·59	31	7·27	31	7·02
30–34	1,424·6	435,756	18	4·09	21	4·91	13	2·95	7	1·64	31	7·04	28	6·55
35–39	1,487·4	216,327	13	2·76	15	3·36	13	2·76	10	2·24	26	5·51	25	5·60
40–44	1,660·8	63,373	4	0·83	3	0·60	5	1·04	2	0·40	9	1·86	5	1·00
45 and over	9,764·0	4,136	—	—	1	—	—	—	—	—	—	—	1	0·03
All	24,535·8	2,600,367	77	1·07	98	1·33	62	0·86	135	0·48	139	1·93	133	1·81

* Includes 9 cases of therapeutic abortion

TABLE XVIII

Number of women, by parity, who died from abortion included in the enquiry and proportion of deaths to maternities.

Parity*	Procured abortions				Other abortions†				All abortions			
	1961–1963		1964–1966		1961–1963		1964–1966		1961–1963		1964–1966	
	Number	Proportion per 10,000 maternities	Number	Proportion per 10,000 maternities	Number	Proportion per 10,000 maternities	Number	Proportion per 10,000 maternities	Number	Proportion per 10,000 maternities	Number	Proportion per 10,000 maternities
1	18	0·20	24	0·25	7	0·08	9	0·09	25	0·27	33	0·34
2	12	0·16	12	0·15	10	0·13	4	0·05	22	0·29	16	0·20
3	10	0·24	14	0·33	14	0·33	3	0·07	24	0·57	17	0·40
4	8	0·39	14	0·67	6	0·30	5	0·24	14	0·69	19	0·91
5–9	12	0·53	20	1·03	21	0·93	11	0·52	33	1·47	31	1·55
10 or more			2				—				2	
Not stated	17	—	12	—	4	—	3	—	21	—	15	—
All	77	0·31	98	0·38	62	0·25	35	0·13	139	0·55	133	0·51

* For definition of parity see page 7
† Includes 9 cases of therapeutic abortion

TABLE XIX

Number of women, by age, who died from abortion with sepsis.

Age (years)	All deaths from abortion	Deaths from abortion with sepsis†	
		Number	Proportion of all abortion deaths per cent
Under 16	1	—	0
16–17	—	—	—
18–19	5	3	60
20–24	37	16	43
25–29	31	17	55
30–34	28	17	61
35–39	25	12	48
40–44	5	3	60
45 and over	1	1	100
All	133	69	52

TABLE XX

Number of women, by parity, who died from abortion with sepsis.

Parity*	All deaths from abortion	Deaths from abortion with sepsis†	
		Number	Proportion of all abortion deaths per cent
1	33	16	48
2	16	5	31
3	17	12	71
4	19	15	79
5–9	31	17	55
10 or more	2	—	—
Not stated	15	4	27
All	133	69	52

* For definition of parity, see page 7.

† Includes all cases from I.C.D. Nos. 651·0, 0·1, 0·2 and 0·3 of which three deaths were from pulmonary embolism.

Marital status

TABLE XXI

Marital Status of patients who died from Abortion.

	Procured abortions	Other abortions	All abortions
Married	58	30	88
Unmarried	33	5	38
Not stated	7	0	7
All	98	35	133

Marital Status

Sixteen of the unmarried patients having procured abortions were parous, five of them having had three or more children and two patients, both "coloured", had each had seven children before the fatal abortion. Knowledge of the marital status becomes less reliable with the population change due to immigration.

Therapeutic abortion

There were ten maternal deaths resulting from an abortion induced for medical reasons. In seven, the abortion induced for psychiatric reasons was the cause of death, two died from toxaemia which was the reason for terminating the pregnancy and in another not coded to abortion the cause of death was asthma. Five pregnancies were terminated by hysterotomy, one at the tenth week of pregnancy, one at the fourteenth, two at the twentieth and one at the twenty-fourth week. Two of these five women died from toxaemia, one from pulmonary embolism, one from peritonitis due to infection by *Clostridium welchii* and the other from post-operative intestinal obstruction followed by peritonitis. The patient whose pregnancy was terminated in an attempt to relieve her status asthmaticus was twenty-six weeks pregnant and was treated by subtotal hysterectomy. Two pregnancies, one at the fifteenth and the other at the sixteenth week, were terminated by the introduction of paste into the uterine cavity. One died from hepato-renal failure due to septicaemia and the other because of a uterine infection which gave rise to pulmonary septic emboli. Two women, one when fifteen weeks and the other twenty weeks pregnant, were treated by the injection of hypertonic saline solution into the amniotic space. Both died from cerebral infarction. Other methods of terminating pregnancy may have been contra-indicated, but these deaths show that both the injection of paste into the uterine cavity and the intra-amniotic injection of hypertonic saline are not without risk. No maternal death was reported from therapeutic termination of an early pregnancy by vaginal evacuation of the uterus.

Illegally procured abortion

It is notoriously difficult to obtain information about the mode of interference from a patient and her friends and relatives in a case of suspected criminal abortion before death and more difficult after death. The confidential enquiries cannot therefore offer a reliable guide as to the trends at present in vogue; all the traditional methods are recorded, the insertion of instruments, slippery elm, the injection of soapy fluids, antiseptic agents and even the injection of parsley. In many cases the agents were multiple: one patient took quinine, pennyroyal, apiol and female capsules and in another instance the woman's handbag was full of boxes of different pills.

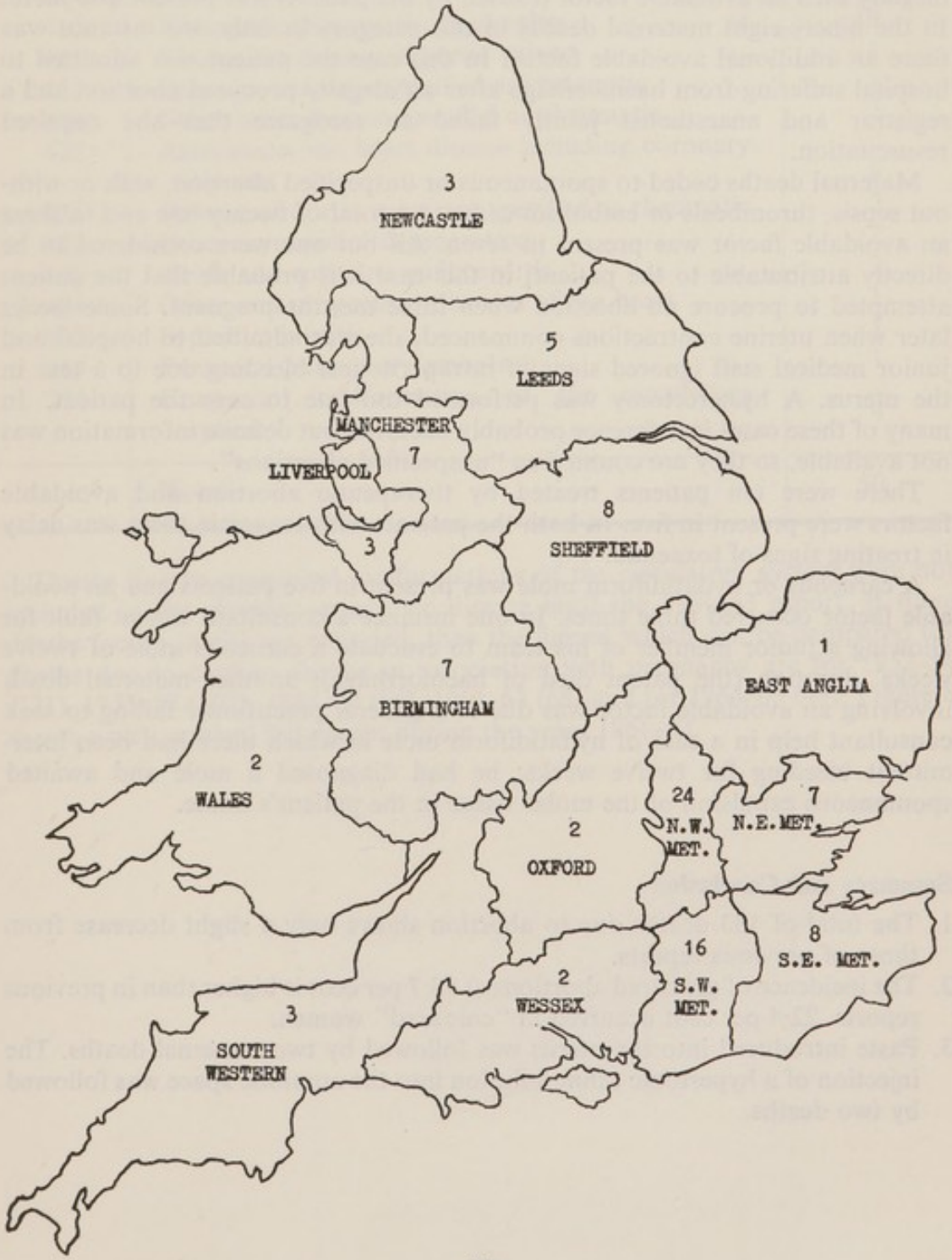
In the series of ninety-eight maternal deaths due to procured abortion the pregnancy had progressed to twelve weeks or less in forty-four patients, in forty-nine it was over twelve weeks and in five the duration of pregnancy was not known. The most advanced pregnancy was at the twenty-sixth week, the patient syringing herself with carbolic soap solution.

In those deaths from procured abortion without sepsis or toxaemia, a total of forty-five, air embolism was the cause in twenty-nine instances. One patient died of probable poisoning by chloroform, not administered by a medical

MAP 5

THE GEOGRAPHICAL DISTRIBUTION OF DEATHS FROM PROCURED ABORTIONS IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES

1964 - 66



practitioner. When the abortion was complicated by sepsis, a total of fifty-three, a diagnosis of *Clostridium welchii* infection was mentioned in thirty-four.

The geographical distribution of women who died from procured abortion is shown in map 5. It will be seen that fifty-five or 57·3 per cent occurred in the four metropolitan regions where one-third of the total population of England and Wales live.

The Avoidable Factors

It has previously been stated that in all cases where the abortion was procured illegally then an avoidable factor (caused by the patient) was present *ipso facto*. In the ninety-eight maternal deaths in this category in only one instance was there an additional avoidable factor. In this case the patient was admitted to hospital suffering from haemorrhage after an illegally procured abortion and a registrar and anaesthetist jointly failed to recognize that she required resuscitation.

Maternal deaths coded to spontaneous or unspecified abortion, with or without sepsis, thrombosis or embolism came to a total of twenty-one and in these an avoidable factor was present in seven. All but one were considered to be directly attributable to the patient; in this case it is probable that the patient attempted to procure an abortion when three months pregnant. Some weeks later when uterine contractions commenced, she was admitted to hospital and junior medical staff ignored signs of intraperitoneal bleeding due to a tear in the uterus. A hysterectomy was performed too late to save the patient. In many of these cases interference probably occurred but definite information was not available, so they are counted as "unspecified abortions".

There were ten patients treated by therapeutic abortion and avoidable factors were present in five. In both the patients with toxaemia there was delay in treating signs of toxaemia.

A carneous or hydatidiform mole was present in five patients and an avoidable factor occurred three times. In one instance a consultant was at fault for allowing a junior member of his team to evacuate a carneous mole of twelve weeks' duration (the patent died of haemorrhage); another maternal death involving an avoidable factor was due to a general practitioner failing to seek consultant help in a case of hydatidiform mole in which there had been intermittent bleeding for twelve weeks; he had diagnosed a mole and awaited spontaneous expulsion of the molar tissue in the patient's home.

Summary and Conclusion

1. The total of 133 deaths due to abortion shows only a slight decrease from those of previous reports.
2. The incidence of procured abortions at 73·7 per cent is higher than in previous reports. 22·4 per cent occurred in "coloured" women.
3. Paste introduced into the uterus was followed by two maternal deaths. The injection of a hypertonic saline solution into the amniotic space was followed by two deaths.

6. CARDIAC DISEASE ASSOCIATED WITH PREGNANCY

In this section fifty deaths occurred in the years 1964–66. Forty-nine are included in Appendix I ,Table 2, and one patient who had mitral stenosis but died from pulmonary embolism is included in Appendix I, Table 1 of the International Classification of Diseases.

I.C.D. No.	Cause of Death	Number
410	Rheumatic disease of mitral valve	19
411	Rheumatic disease of aortic valve	1
415	Other myocarditis specified as rheumatic ...	1
416	Other heart disease specified as rheumatic ...	2
420	Arteriosclerotic heart disease including coronary disease	6
421	Disease of aortic valve not specified as rheumatic	7
422	Other myocardial degeneration	2
430	Acute and subacute endocarditis	2
434	Other and unspecified diseases of the heart ...	1
023	Syphilitic aortitis	1
684	Puerperal pulmonary embolism	1
754	Congenital malformation of the circulatory system	7
	Total	50

Deaths due to congenital malformations of the circulatory system were not included in the chapter on cardiac disease until the 1961–63 report. If these deaths (seven in all) are excluded, then the figures which can be compared for deaths due to cardiac disease in association with pregnancy are for 1952–54 (121), 1955–57 (102), 1958–60 (66), 1961–63 (68) and for 1964–66 (43). Figure 8 shows a well marked fall except during the years 1961–63.

FIGURE 8.

DEATHS FROM ACQUIRED HEART DISEASE ASSOCIATED WITH PREGNANCY.

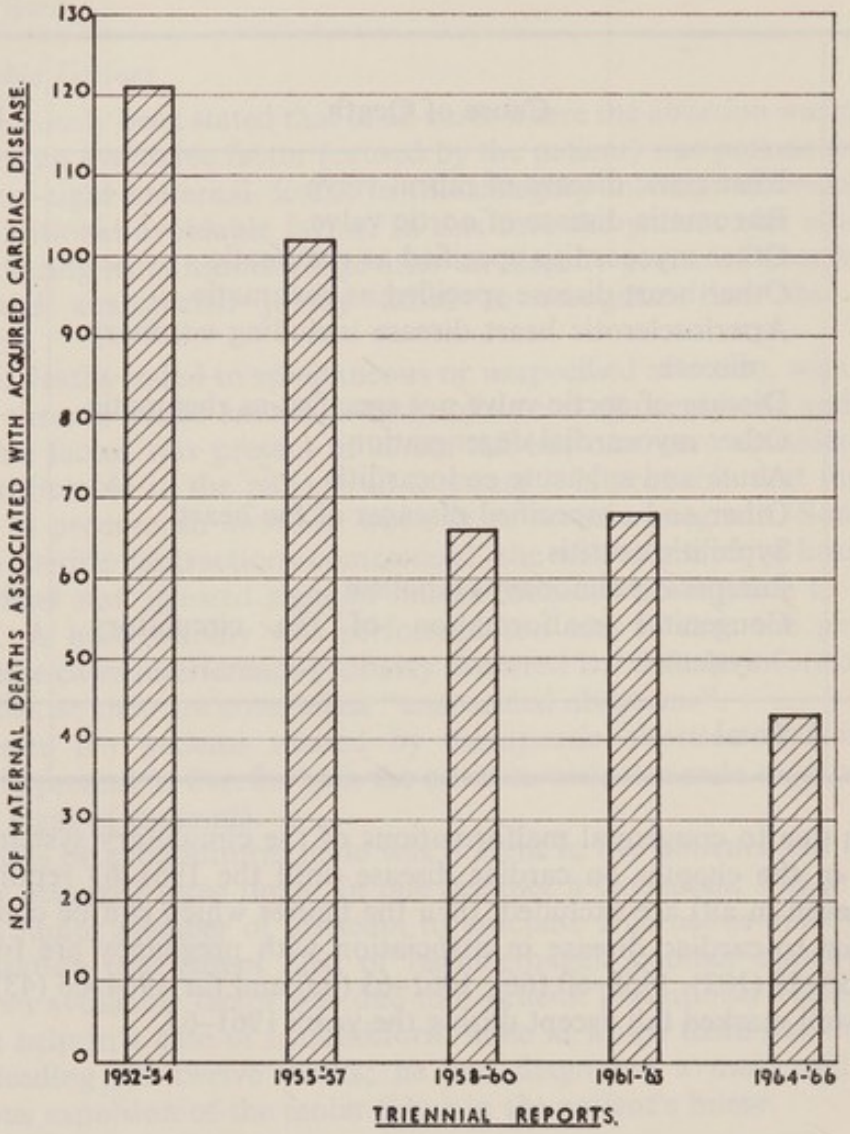


TABLE XXII

Number of women, by age, who died from cardiac disease.

Age (years)	Deaths from congenital cardiac disease (1)		Deaths from acquired cardiac disease (2)		Deaths from all cardiac disease			
					1961–1963		1964–1966	
	1961–1963	1964–1966	1961–1963	1964–1966	Number	Rate per million maternities	Number	Rate per million maternities
Under 16	—	—	—	—	—	—	—	—
16–19	2	1	1	1	3	15·1	2	8·2
20–24	4	2	10	3	14	17·9	5	5·9
25–29	6	3	18	14	24	31·1	17	21·5
30–34	1	1	13	10	14	30·3	11	25·2
35–39	—	—	17	8	17	73·7	8	37·0
40–44	—	—	7	6	7	102·1	6	94·7
45 and over	—	—	2	1	2	487·3	1	241·8
All	13	7	68	43	81	32·1	50	19·2

(1) I.C.D. No. 754.
(2) I.C.D. Nos. 410, 411, 415, 416, 420, 421, 422, 430, 434, 023, 684.

TABLE XXIII

Number of women, by parity, who died from cardiac disease.

Parity*	Deaths from congenital cardiac disease (1)		Deaths from acquired cardiac disease (2)		Deaths from all cardiac disease			
					1961–1963		1964–1966	
	1961–1963	1964–1966	1961–1963	1964–1966	Number	Rate per million maternities	Number	Rate per million maternities
1	12	4	20	16	32	35·1	20	20·9
2	1	3	12	8	13	17·2	11	13·9
3	—	—	17	11	17	40·1	11	25·6
4	—	—	5	3	5	24·6	3	14·4
5–9	—	—	11	5	11	48·9	5	23·5
10 or more	—	—		—			—	
Not stated	—	—	3	—	3		—	
All	13	7	68	43	81	32·1	50	19·2

* For definition of parity see page 7.

(1) I.C.D. No. 754.
(2) I.C.D. Nos. 410, 411, 415, 416, 420, 421, 422, 430, 434, 023, 684.

Age and Parity

The age and parity distribution of the women who died from cardiac disease is shown in Tables XXII and XXIII. The figures emphasize the reduction in maternal mortality from this cause, but once again confirm the increased risk of death as age increases. Pregnancy associated with heart disease is clearly a risk whatever the parity of the mother, but in acquired heart disease this appears greater in the higher parities although this may merely be due to the fact that these women are also older. All the deaths from congenital cardiac malformation both in this series and during 1961–63 occurred in women in their first or second pregnancies.

Deaths due to acquired cardiac disease associated with pregnancy

TABLE XXIV

Time of Death from Acquired Heart Disease in relation to Confinement.

	Number	Percentage
Died in pregnancy	22	51·2
Died in labour	1	2·3
Died within 24 hours of completion of labour ...	0	0
Died in puerperium (excluding first 24 hours) ...	19	44·2
Died at operation of Caesarean section ...	1	2·3
Total ...	43	100·0

Compared with the three-year period 1961–63, the number of deaths in pregnancy in the present enquiry series is almost halved, and only one death occurred in labour and the immediate post-partum twenty-four hours as against nine in the previous three years. The number of deaths in the puerperium show little change and those dying during Caesarean section is the same in both enquiry series. It is of interest to compare the time of death in relation to confinement in women having an acquired heart disease with those having a congenital heart lesion. In the latter group one died in pregnancy, four died immediately post-partum at twenty minutes, one hour, two hours and three hours respectively, one died nine days after delivery and one on the sixteenth day of the puerperium. Thus of the seven women dying of a congenital heart lesion in association with pregnancy, four died within three hours of delivery.

Valvotomy had been performed in four women who died. One death occurred in a woman aged 32 and having her second baby; she died five hours after the valvotomy operation in the twenty-ninth week of pregnancy. Two women died after valvotomy operations performed four and six years before their current pregnancies. One woman had had two valvotomy operations seven and eleven years previously; she was aged 35 and died two weeks after a normal delivery having been pregnant four times.

A post-mortem Caesarean section had been made in eight patients out of the forty-three with acquired heart disease and all the babies were stillborn.

TABLE XXV

Duration of pregnancy when death occurred.

Duration of pregnancy when death occurred (weeks)	Previous four reports	Present report	Total
16–19	22	2	24
20–23	26	2	28
24–27	24	2	26
28–31	32	6	38
32–35	28	8	36
36–39	28	18	46
Between 40 and 41	—	3	3
Not stated	—	2	2
Total ...	160	43	203

The 1961–63 report pointed out that only one-fifth of the deaths occurred at between the twenty-eighth and thirty-second weeks of pregnancy and in the present report the ratio is one in seven. This may be due to greater care being given to the patient at this time in her pregnancy, resulting in fewer deaths. The enquiry series figures indicate that the woman with a heart disease in pregnancy is also at great risk in the last eight weeks of pregnancy for over three-quarters of the deaths occurred after the thirty-second week, and it is clear that these patients require great care throughout their pregnancy.

Marital status

All the women with an acquired heart lesion were married. One unmarried woman with a patent ductus arteriosus died.

Anaesthesia

No death was reported as being due to an anaesthetic agent.

The Avoidable Factors

One or more avoidable factors, involving the patient, general practitioner and/or consultant alone or in combination were present in twelve of the forty-three deaths of acquired heart disease and in one of the seven deaths due to congenital heart disease in association with pregnancy.

The responsibility for the avoidable factor was:
the general practitioner alone in 5 cases
the general practitioner and the patient in 2 cases
the patient alone in 3 cases
the patient and the consultant in 1 case
the consultant alone in 3 cases

In every instance the diagnosis of a heart lesion was known. Despite this knowledge, in six cases, the *general practitioner* failed to obtain consultant

advice and unwisely booked the woman for delivery in her home or in a general practitioner maternity home. In the two cases incolving the *general practitioner* and the *patient* the former appeared to have been unduly influenced by the patient's wish not to go to hospital; one patient in this category was grossly obese, anaemic and developed pre-eclampsia in her first and fatal pregnancy. The general practitioner continued to supervise her pregnancy, at times she failed to attend and no follow-up was instigated; she died at the thirty-seventh week of pregnancy in acute cardiac failure.

When a *patient* alone was concerned in an avoidable factor it was invariably by concealing her pregnancy and by neglecting to seek medical advice until late in the pregnancy. This happened in a woman with a patent ductus arteriosus who had been told to report to her doctor when she became pregnant; this she failed to do. She had no ante-natal care and died one hour after delivery of a foetus weighing three pounds (1·36 Kg.).

The *consultant* was responsible for inadequate care in two deaths. In one, labour was induced in a patient on the verge of cardiac failure in an unsuitable maternity home, the patient not having had any ante-natal care at all (her own fault). The consultant was considered solely responsible in a case in which junior hospital staff discharged home at the thirty-first week of pregnancy a patient admitted for rest and the general practitioner was not informed; she was not seen again by a doctor for four weeks, went into labour and died on the ninth day of the puerperium having been sent home on the eighth day; no one with a status higher than house surgeon had seen the patient.

Deaths due to Congenital Malformations of the Circulatory System associated with Pregnancy

These were first noted in the report of 1961–63 and they then totalled thirteen. In the present survey the number is seven and they are described as:

Patent ductus arteriosus	2
Eisenmenger's complex	1
Fallot's tetralogy	1
Stenosis of conus arteriosus of right ventricle ...	1
Familial cardiomegaly	1
Transposition of pulmonary artery and aorta with interventricular septal defect	1

It has already been pointed out that in this series these patients appear to be at greatest risk immediately after delivery, four deaths occurring within three hours; but in the 1961–63 period the majority died either during pregnancy or over twenty-four hours after delivery. The ages of the patients varied from 19 to 32, the average age being 24½ years. All the patients were married except for one girl whose parents had steadfastly refused operation for her patent ductus arteriosus. The married women were all of low parity, three were primigravidae and three were primiparae. There was one instance of an avoidable factor in this group of women, the woman with a patent ductus arteriosus who failed to attend for ante-natal care.

The time of death in relation to the confinement was as follows:

Died in pregnancy (24th week)	1
Died within 3 hours of delivery	4
Died in puerperium (9th and 16th days)	2

Summary and Conclusions

1. The number of deaths due to cardiac disease associated with pregnancy continues to fall in both acquired and congenital heart disease.
2. Women over 34 years of age are at greatest risk. The risk is greater after the second confinement but this may merely be due to the fact that these women are also older.
3. Three-quarters of the deaths occurred after the thirty-second week of pregnancy.
4. No deaths were caused by an anaesthetic agent.
5. One or more avoidable factors were present in thirteen of the fifty maternal deaths (26 per cent). Failure of the general practitioner to seek consultant advice and to book the patient in a suitable place were the commonest faults together with neglect on the part of the patient to seek ante-natal care.

7. CAESAREAN SECTION

The number of deaths associated with, but not necessarily due to Caesarean section or hysterotomy was 145 during 1964–66. This contrasts with 143 deaths in 1961–63, 130 in 1958–60, 184 in 1955–57 and 183 in 1952–54. Table XXVI shows the estimated percentage of Caesarean section operations for all births and lists the estimated number of Caesarean sections performed in England and Wales and the estimated rate.

An estimate can be made of Caesarean section operations per 1,000 confinements from the Hospital In-patient Enquiry conducted by the Ministry of Health and the General Register Office. It is from this figure that we have made the estimate of the number of Caesarean sections performed in England and Wales and the fatality rate (based on deaths in the enquiry series) which has been calculated to be 1·5 per 1,000 Caesarean sections during the years 1964–66.

The geographical distribution of the estimated number of Caesarean sections in the Regional Hospital Board Areas is shown in map 6, and the deaths associated with Caesarean section are shown in map 7.

Immediate Cause of Death

Table XXVII indicates the immediate causes of death and as in previous reports attention is drawn to the fact that the list of deaths does not correspond with those given in Appendix I, Tables 1 and 2 in which many deaths are classed under the conditions for which the operation was undertaken. The figures do not necessarily correspond with those in other chapters in this report, for example, ten deaths discussed in chapter 8 because they were associated with anaesthesia are listed under cardiac failure in Table XXVII and two are included under "other causes" because death was the result of post-operative bronchopneumonia.

TABLE XXVI

Estimated number of Caesarean Sections performed in England and Wales and estimated death rates per thousand

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Total births in N.H.S. hospitals ...	448,176	457,206	464,293	490,622	515,274	536,495	566,068	597,438	612,127	624,967
Total births in non N.H.S. hospitals	27,620	26,765	26,384	27,186	27,168	26,653	26,644	26,163	23,773	22,277
Total births in all hospitals in England and Wales	475,796	483,971	490,677	517,808	542,442	563,148	592,712	623,601	635,900	647,244
Percentage of Caesarean Sections in N.H.S. hospitals (In-patient sample)	3·8	3·9	4·4	4·5	4·5	4·8	4·7	4·9	5·0	4·7
Estimated number of Caesarean Sections in all hospital deliveries ...	17,950	18,680	22,630	23,300	24,570	26,770	27,860	30,560	31,800	30,420
Total births in England and Wales ...	739,996	757,003	764,402	800,824	827,008	854,200	869,044	890,518	876,566	863,066
Estimated proportion of Caesarean Sections among all births per cent	2·4	2·5	3·0	2·9	3·0	3·1	3·2	3·4	3·6	3·5
Deaths after Caesarean Section (true maternal and associated deaths from enquiry series)	60	46	46	48	40	61	42	39	52	54
Estimated fatality rate per thousand Caesarean Sections	3·3	2·5	2·0	2·1	1·6	2·3	1·5	1·3	1·6	1·8

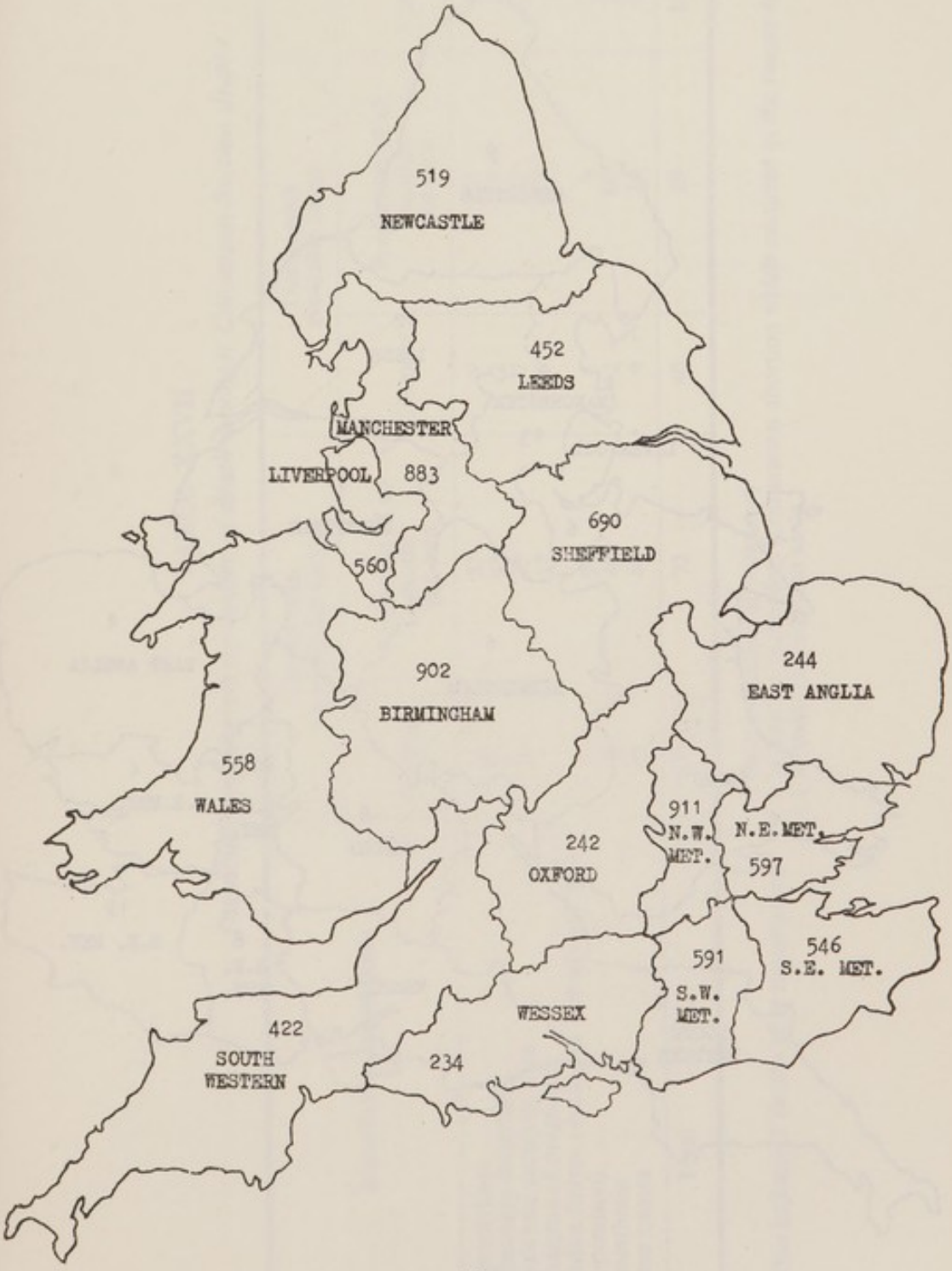
MAP 6

THE GEOGRAPHICAL DISTRIBUTION OF CAESAREAN SECTIONS

in the HOSPITAL IN-PATIENT ENQUIRY
(10 per cent sample of deaths and discharges)

in THE REGIONAL HOSPITAL BOARD AREAS in ENGLAND AND WALES

1964-66



MAP 7

THE GEOGRAPHICAL DISTRIBUTION OF DEATHS FROM CAESAREAN SECTION IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES

1964 - 66

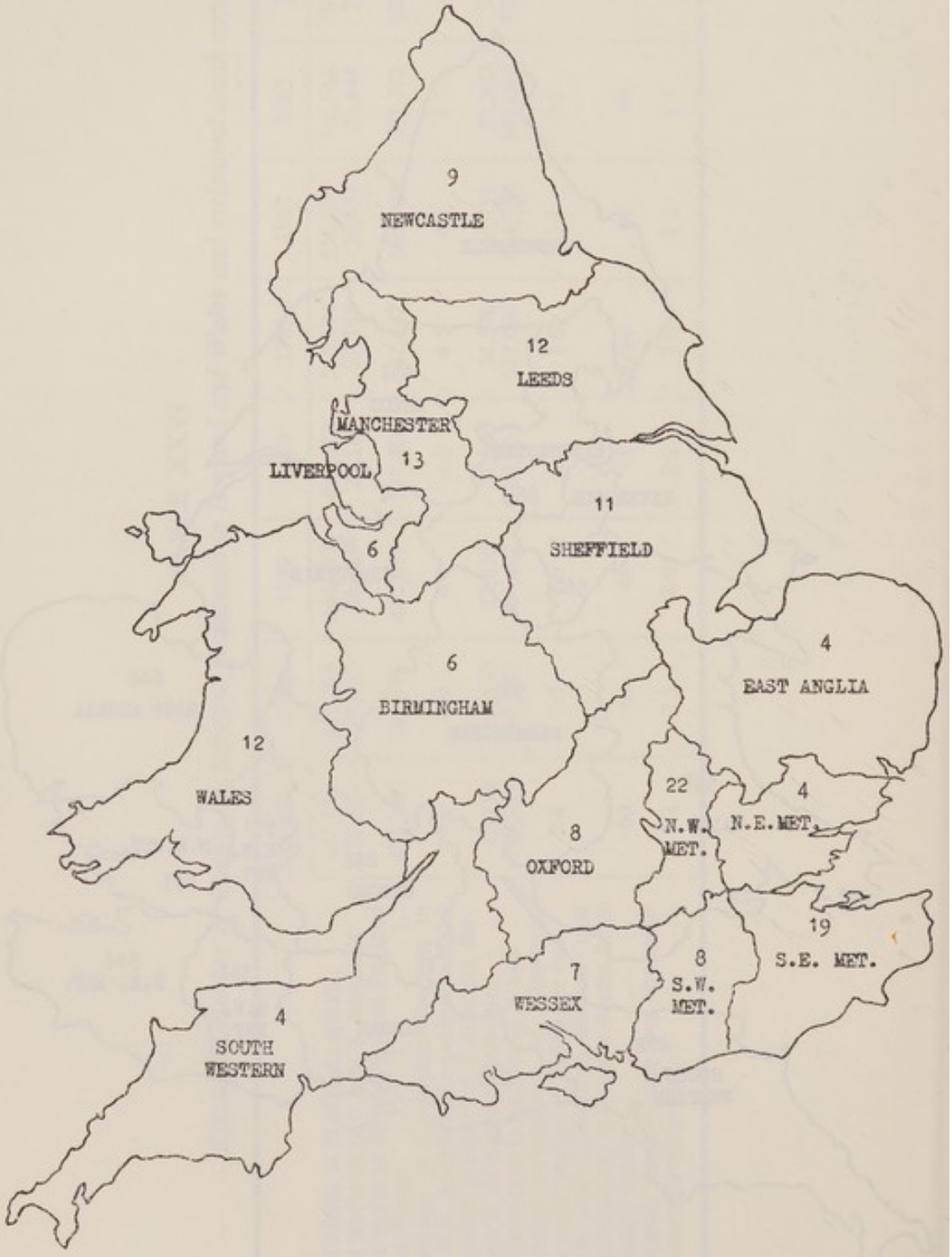


TABLE XXVII

Distribution of immediate causes of death amongst Caesarean Section deaths.

Immediate cause of death	Deaths with no avoidable factor		Deaths with avoidable factor		All deaths	
	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent	Number	Proportion of all deaths after Caesarean Section
Haemorrhage	12	57	9	43	21	14·5
Pulmonary embolism	25	93	2	7	27	18·6
Sepsis and paralytic ileus	19	73	7	27	26	17·9
Toxaemia of pregnancy	1	17	5	83	6	4·1
Cardiac failure (during or immediately after operation)	15	94	1	6	16	11·0
Anaesthesia	8	40	12	60	20	13·8
Other causes	25	86	4	14	29	20·0
Total	105	72	40	28	145*	99·9

* This includes 7 deaths after hysterotomy.

- 5 for termination of pregnancy
- 1 to treat an incomplete spontaneous abortion which occurred at the twenty-fourth week of pregnancy
- 1 to treat hydatidiform mole

TABLE XXVIII

Proportion of deaths according to immediate cause in Caesarean Section.

	Distribution of all deaths by cause after Caesarean Section, per cent					Proportions of deaths with avoidable factors within each cause groups per cent				
	1952–54	1955–57	1958–60	1961–63	1964–66	1952–54	1955–57	1958–60	1961–63	1964–66
Haemorrhage	37·1	24·4	43·8	23·8	14·5	33·8	34·1	56·2	26·5	42·8
Pulmonary embolism	18·3	18·3	20·9	20·3	18·6	12·5	30·3	7·4	17·2	7·4
Sepsis and paralytic ileus	14·9	16·7	17·7	13·3	17·9	38·5	36·7	26·1	15·8	26·9
Cardiac failure (during or immediately after operation)	3·4	8·3	2·3	9·1	11·0	A	26·7	—	21·4	6·3
Toxaemia of pregnancy	B	6·1	6·9	9·8	4·1	B	63·6	—	15·3	83·3
Anaesthesia	6·9	6·1	3·8	13·3	13·8	41·7	36·4	20·0	42·1	60·0
Other causes	19·4	20·0	4·6	10·5	20·0	27·5	5·6	—	13·3	13·8
Total	100·0	99·9	100·0	100·0	99·9	29·7	29·4	31·5	22·4	27·6

A Figures are not available for the 1952–54 report.
B These figures are included with "Other causes" for 1952–54.

It is instructive to analyse the results of Table XXVIII in order to compare and contrast the results with those of previous years and at the same time to consider Table XXVII.

1. *Haemorrhage*

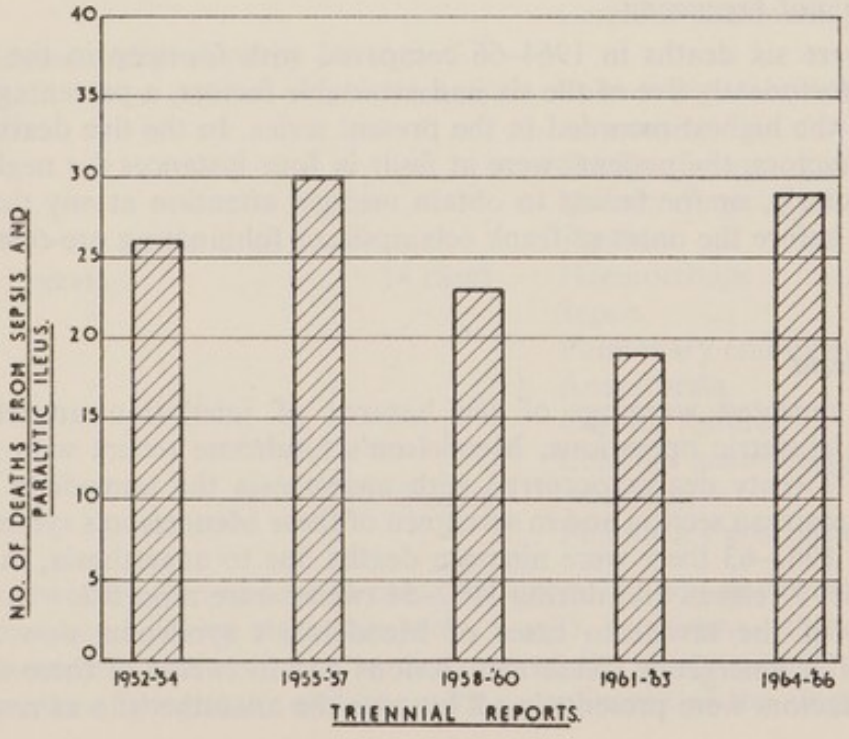
There was a fall from thirty-four to twenty-one deaths in 1964–66 compared with 1961–63 and the percentage of deaths from haemorrhage fell from 23·8 to 14·5 in the same period of time and this figure of 14·5 is the lowest in the series from 1952 onwards. Many of these deaths, amounting to 42·8 per cent, had one or more avoidable factors, the highest in this series.

2. *Pulmonary embolism*

There is no significant improvement in the proportion of deaths due to this cause despite the fact that the average age of women having children has fallen since the enquiry series began. There was a fall from twenty-nine to twenty-seven from 1961–63 to 1964–66 and this is to be compared with twenty-seven deaths in 1958–60, thirty-three in 1955–57 and thirty-two during 1952–54. The percentage of deaths due to pulmonary embolism after Caesarean section and the percentage of deaths with avoidable factors have shown no consistent trend from 1952–66.

FIGURE 9.

SEPSIS AND PARALYTIC ILEUS AS THE IMMEDIATE CAUSE OF DEATH AFTER CAESAREAN SECTION.



3. *Sepsis and paralytic ileus*

Eighteen of these deaths were due to sepsis, seven to paralytic ileus associated with sepsis and one to paralytic ileus in which associated sepsis was not reported.

As Figure 9 shows, there had been a satisfactory fall from 1955–57 (30 deaths) through 1958–60 (23 deaths) and 1961–63 (19 deaths) until the present report. But the proportion of cases of sepsis and paralytic ileus as an immediate cause of death in Caesarean section is the highest recorded at 17·9 per cent. The number of cases with avoidable factors was seven, which gives a percentage of 26·9; this contrasts with 15·8 per cent in 1961–63, 26·1 per cent in 1958–60, 36·7 per cent in 1955–57 and 38·5 per cent during 1952–54 (see Table XXVIII). Only one death occurred in early pregnancy, due to *Cl. welchii* infection after hysterotomy and sterilization at the tenth week of pregnancy. All the remaining deaths occurred at or near term. There were two classical Caesarean sections and two Caesarean hysterectomies, one patient had a lower segment Caesarean section followed by total hysterectomy and after that a laparotomy was performed. One woman who died in whom avoidable factors were present had had fourteen vaginal examinations. Twenty-two of the twenty-six patients were operated on as emergency cases in labour. The status of the surgeon performing the operation was not always recorded and in those reports in which this was mentioned, a consultant operated in one-third.

4. *Cardiac Failure*

The number of deaths under this heading associated with Caesarean section has varied quite markedly in the reports. Thus in 1952–54 six women died from this cause, in 1955–57 fifteen, in 1958–60 three, in 1961–63 thirteen and in the present report a total of sixteen deaths only one of which had avoidable factors.

5. *Toxaemia of Pregnancy*

There were six deaths in 1964–66 compared with fourteen in the previous report; unfortunately five of the six had avoidable factors, a percentage of 83·3 which was the highest recorded in the present series. In the five deaths having avoidable factors, the patients were at fault in four instances for neglecting to attend regularly, or for failing to obtain medical attention at any time in the pregnancy before the onset of frank eclampsia or fulminating pre-eclampsia of pregnancy.

6. *Anaesthesia*

Despite repeated warnings of the hazards of inhalation anaesthesia in emergency obstetric operations, Mendelson's syndrome recurs with alarming frequency. Twenty deaths occurred with anaesthesia the immediate cause of death in Caesarean section and in seventeen of these Mendelson's syndrome was proven. In 1961–63 there were nineteen deaths due to anaesthesia, in 1958–60 five, in 1955–57 eleven and during 1952–54 twelve were reported.

Thirteen of the seventeen cases of Mendelson's syndrome now recorded occurred after emergency Caesarean sections and in twelve of these seventeen avoidable factors were present; in all but one the anaesthetist was responsible.

Indications for operation

In previous reports a list has been tabulated of five or six of the major indications for Caesarean section and the cause of death in each instance. In presenting a similar list, the proviso must be made that it is inevitably subject to errors and that it is to some extent artificial because often the indications for operation were multiple e.g. a patient might have diabetes, pre-eclampsia and a transverse lie of the foetus.

Principal Indication for Operation		*Cause for Death*	
Uterine Inertia	24 cases	Sepsis	8
		Pulmonary embolism ...	6
		Anaesthesia	4
		Haemorrhage	2
		Cardiac failure	2
		Chronic nephritis ...	1
		Air embolism	1
Malpresentation and Disproportion	36 cases	Haemorrhage	9
		Sepsis	8
		Pulmonary embolism ...	5
		Anaesthesia	8
		Cardiac failure	3
		Amniotic fluid embolism	2
		Renal failure	1
Toxaemia ... ... (including 6 cases of eclampsia)	19 cases	Toxaemia	6
		Pulmonary embolism ...	3
		Haemorrhage	4
		Sepsis	2
		Cardiac failure	3
		Cerebral haemorrhage ...	1
Foetal distress and prolapsed cord	11 cases	Pulmonary embolism ...	2
		Anaesthesia	4
		Cardiac failure	1
		Haemorrhage	2
		Sepsis	2
Placenta Praevia	14 cases	Haemorrhage	6
		Sepsis	4
		Pulmonary embolism ...	1
		Anaesthesia	1
		Cardiac failure	1
		Cerebral haemorrhage ...	1
Diabetes	2 cases	Anaesthesia	1
		Pulmonary embolism ...	1

It is noteworthy that in several cases the operation was performed with the patient moribund. There were two women with carcinoma of the ovary in whom Caesarean sections were carried out at the thirty-second and thirty-seventh weeks of pregnancy and one with a carcinoma of the stomach had a

Caesarean section at the thirty-second week. Two patients with a pheochromocytoma had elective Caesarean sections at the thirty-eighth and thirty-ninth weeks. Three patients were probably dead (in two cases resulting from the induction of anaesthesia) before the surgeon made an incision, the causes of death being reported as "vagal inhibition", "bronchospasm" and amniotic fluid embolism. There were three deaths due to sub-arachnoid haemorrhage.

Status of Surgeon

The status of the surgeon who performed the operation was as follows:

Consultant obstetrician	43
Obstetric registrar	48
Clinical assistant in obstetrics	1
Junior hospital medical officer	1
Senior house officer	1
General practitioner	1
Not recorded	50
	145

Age and Parity

FIGURE 10.

NUMBER OF WOMEN BY AGE GROUP, WHO DIED DURING OR AFTER DELIVERY BY CAESAREAN SECTION.

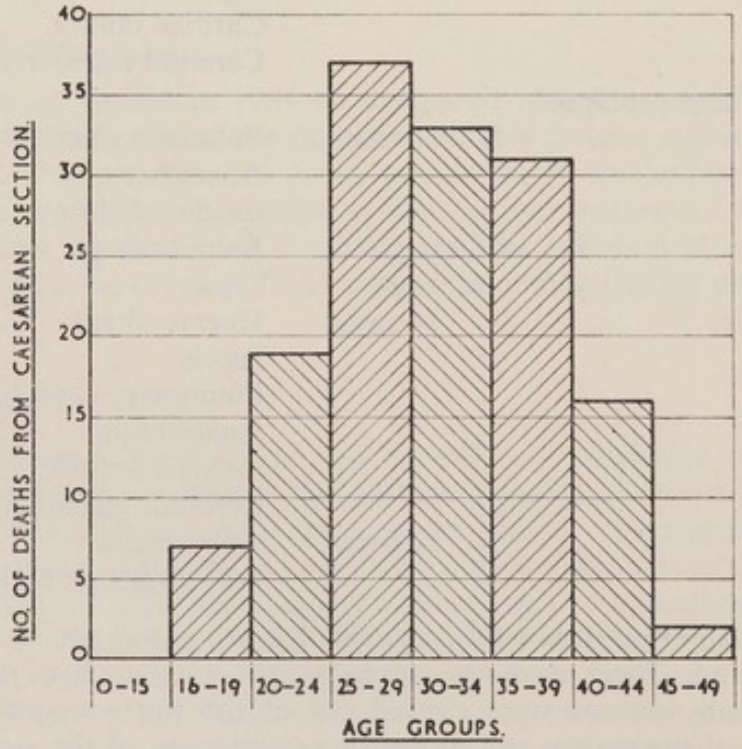
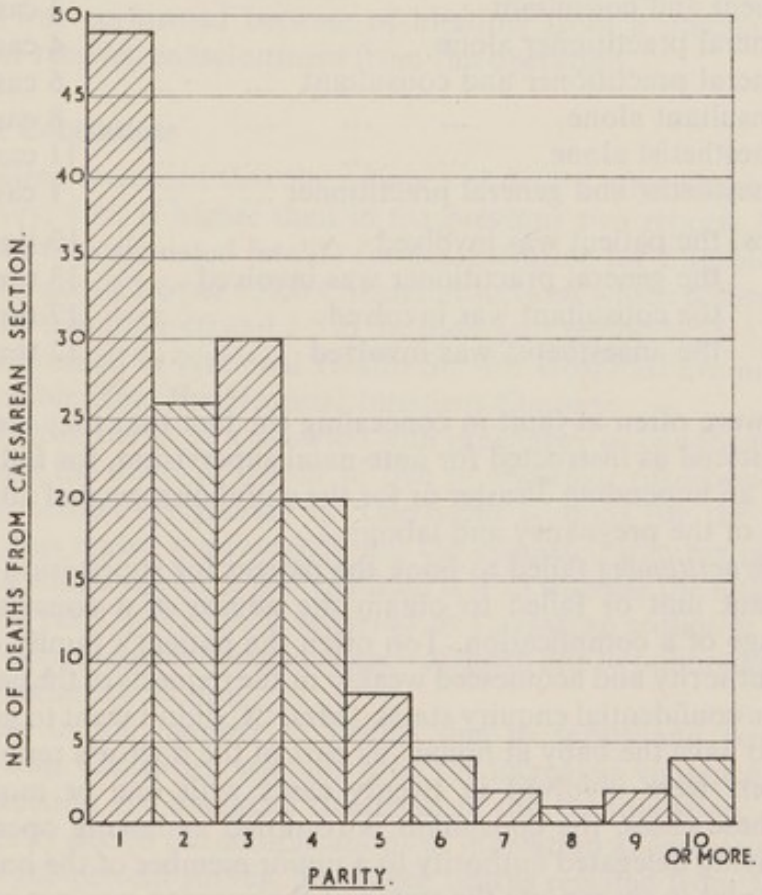


FIGURE 11.

NUMBER OF WOMEN, BY PARITY, WHO DIED DURING OR AFTER DELIVERY BY CAESAREAN SECTION.



For definition of parity, see page 7.

The age and parity of the women delivered by Caesarean section included in the enquiry series shown in Figures 10 and 11.

Avoidable factors

The assessors considered that in forty cases (27·6 per cent) one or more avoidable factors were present and this is about the same incidence as in previous reports with the exception of that of 1961–63 in which an incidence of 22·4 per cent was recorded.

The responsibility for the avoidable factors in 1964–66 was:

Patient alone	5 cases
Patient and general practitioner	2 cases
Patient and consultant	3 cases
General practitioner alone	4 cases
General practitioner and consultant	6 cases
Consultant alone	8 cases
Anaesthetist alone	11 cases
Anaesthetist and general practitioner	1 case
Thus, the patient was involved	10 times
the general practitioner was involved ...	13 times
the consultant was involved	17 times
the anaesthetist was involved	12 times

(1) *Patients* were often at fault in concealing the fact that they were pregnant, in failing to attend as instructed for ante-natal supervision, for failing to report symptoms of an impending disaster or for the wilful disregard of advice as to the management of the pregnancy and labour.

(2) *General practitioners* failed to book the patient for supervision and delivery in a consultant unit or failed to obtain the advice of a consultant until an advanced stage of a complication. Too often the patient's family doctor failed to exert his authority and acquiesced weakly in the requests of the patient. All too frequently the confidential enquiry states "Mrs. 'X' didn't want to go to hospital, she wanted to have the baby at home" as part of the doctor's report.

(3) *Consultants* were involved in twenty cases with one or more avoidable factors. In these cases, the consultant is recorded as having operated himself in four, as having delegated authority to a junior member of the hospital staff in ten instances and in six reports the status of the surgeon was not recorded. It is evident that too often the junior staff lacked the necessary experience to deal with a difficult case; the consultant was called in too late or could not be consulted when a point of no return had been reached in the resuscitation of the patient.

(4) *Anaesthetists* were involved in ten cases of Mendelson's syndrome and another case when the anaesthetist left the patient to return to another hospital and she failed to recover from the anaesthetic drugs used. These cases will be mentioned in the chapter on deaths due to complications in anaesthesia but here it must be stressed that the hazards of an anaesthetic given for a major obstetric operation are all too frequently forgotten. The inhalation of gastric contents are usually preventable.

The following case illustrates many of the pitfalls which may lead to a death

following a Caesarean section. A patient aged 38 was pregnant for the ninth time. At least seven pregnancies had proceeded to term. There had been one retained placenta and the seventh and eighth pregnancies had been complicated by pre-eclamptic toxaemia of pregnancy. She lived in a remote rural area and wished to be confined at home. Her weight was over 280 pounds (127 Kg.). She was treated in a general practitioner maternity home for pre-eclampsia at the thirty-seventh week of pregnancy and a week later went into labour. After eight hours in labour she was found to have a large baby impacted as a breach presentation and a Caesarean section was performed in the maternity home by a clinical assistant. The baby weighed 9 pounds 14 ounces (4·48 Kg.). A secondary haemorrhage occurred on the twenty-fourth day of the puerperium and the obstetric flying squad was sent to the maternity home. An abdominal hysterectomy was performed because of bleeding from a uterine artery. The patient did not recover consciousness from the operation.

Summary and Conclusions

1. It is depressing to record that the number of deaths after Caesarean section in this survey, 145, is higher than in the previous two reports 1961–63 and 1958–60, but the calculated fatality for the operation for England and Wales in 1964–66 is about 1·6 per 1,000 Caesarean sections which contrasts with 1·8 in 1961–63, 2·0 in 1958–60 and 3·5 in the three year period 1955–57. Caesarean Sections performed in National Health Service Hospitals are judged by the figures available from the Hospital Inpatient Enquiry.
2. Maternal deaths due to or associated with pregnancy or childbirth (excluding deaths before the onset of labour or due to abortion, carneous or hydatidiform mole, ectopic pregnancy or Caesarean section) for the three years covered by this report number 303 and the estimated number of deaths per 1,000 births which occurred per vaginum is 0·16 whereas the estimated number of deaths per 1,000 women delivered by Caesarean section is 1·6.
3. There is no improvement in the incidence of death due to pulmonary embolism following Caesarean section.
4. The increase in the number of deaths due to sepsis and paralytic ileus associated with Caesarean sections calls for increased vigilance in the prevention, detection and energetic treatment of this complication.
5. Deaths directly due to the complications of inhalation anaesthesia were more common in the present survey. Seventeen deaths resulted from Mendelson's syndrome and ten of these had an avoidable factor, the anaesthetist alone being responsible.
6. The incidence of avoidable factors, whilst higher than in the report of 1961–1963, remains less than the reports up to 1960 at 27 per cent. In each case in which a maternal death has occurred the decision to perform a Caesarean section was sound. The avoidable factors were often concerned with circumstances preceeding the operation such as wrong booking, poor ante-natal care or delay in recognizing the need for operation. However, administrative failure to provide facilities for immediate operation, blood transfusion or anaesthetic services also constituted avoidable factors.

8. DEATHS DUE TO COMPLICATIONS OF ANAESTHESIA

There were fifty deaths associated with complications of anaesthesia and in Appendix I, Tables 1 and 2 they appear under the condition for which the anaesthesia was undertaken. They are included under the following categories of the International Classification of Diseases:

I.C.D. No.	Cause of Death	Number
260	Diabetes mellitus	1
642·2	Pre-eclampsia of pregnancy	3
645	Ectopic pregnancy	3
650	Abortion	3
670	Delivery complicated by placenta praevia ...	3
671	Delivery complicated by retained placenta ...	1
674	Delivery complicated by disproportion or malpresentation of foetus	22
675	Delivery complicated by prolonged labour of other origin	8
677	Delivery with other trauma (ruptured uterus) ...	1
678	Delivery with other complications of childbirth (foetal distress)	5
		50

The operative procedures were:

Elective lower segment Caesarean section	6
Lower segment Caesarean section because of failed trial of labour	4
Other emergency lower segment Caesarean section ...	22
Repair of ruptured uterus	1
Laparotomy because of ectopic pregnancy	2
Repair of burst abdomen (after ectopic pregnancy) ...	1
Forceps delivery	8
Internal version and breech extraction	1
Manual removal of placenta	1
Repair of episiotomy	1
Dilatation and curettage because of incomplete abortion	3
	50

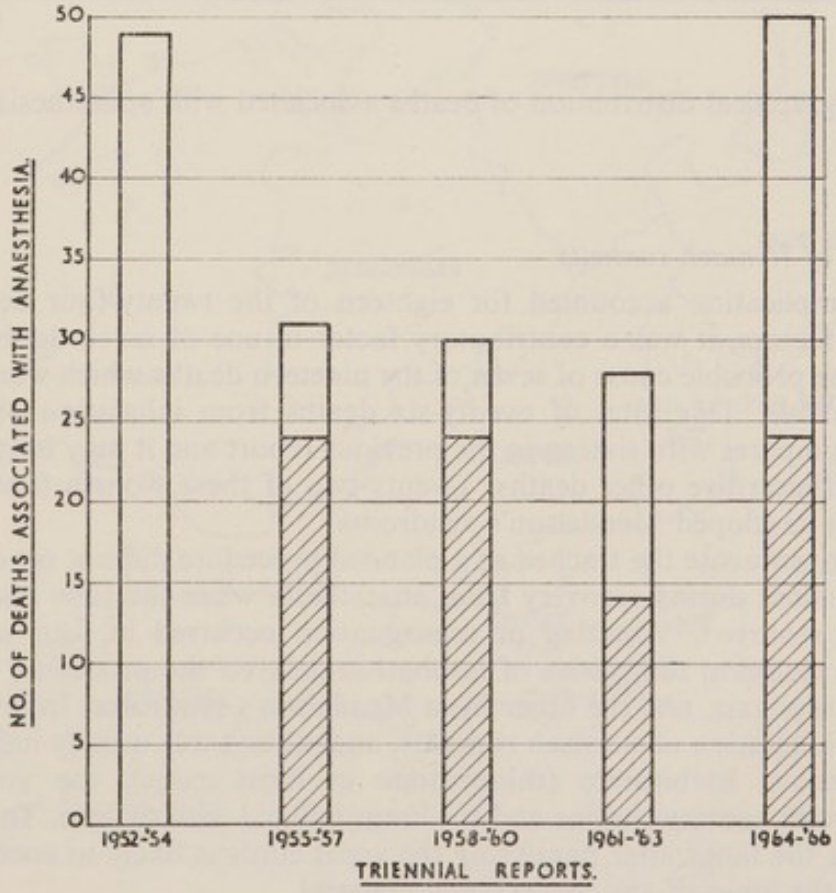
The number of deaths and those assessed as having avoidable factors are illustrated in figure 12 and shown in the following table:

1952–54	49 deaths
1955–57	31 deaths of which 24 had avoidable factors
1958–60	30 deaths of which 24 had avoidable factors
1961–63	28 deaths of which 14 had avoidable factors
1964–66	50 deaths of which 24 had avoidable factors

FIGURE 12.

DEATHS ASSOCIATED WITH ANAESTHESIA.

(SHADED AREA REPRESENTS NUMBER WITH AVOIDABLE FACTORS)



During the years covered by the confidential enquiries into maternal deaths the proportion of deaths due to or associated with pregnancy or childbirth associated with anaesthesia has increased from 3·5 per cent to 6·6 per cent, and the rate of anaesthetic deaths compared with total maternities is greater than a decade ago. The figures are shown in Table XXIX.

TABLE XXIX

Deaths associated with complications of anaesthesia compared with all deaths in the enquiry series and with total maternities.

	Total maternities	Deaths		Deaths associated with complications of anaesthesia in the enquiry series	Rate per 1,000 maternal deaths in the enquiry series	Rate per million maternities
		Due to pregnancy or child-birth	Associated with pregnancy or childbirth			
1952–54	2,052,953	1,094	316	49	34·8	23·9
1955–57	2,113,471	861	339	31	25·8	14·7
1958–60	2,294,414	742	254	30	30·1	13·1
1961–63	2,520,420	692	244	28	29·9	11·1
1964–66	2,600,367	579	176	50	66·2	19·2

The geographical distribution of deaths associated with anaesthesia is shown in map 8.

Inhalation of stomach contents

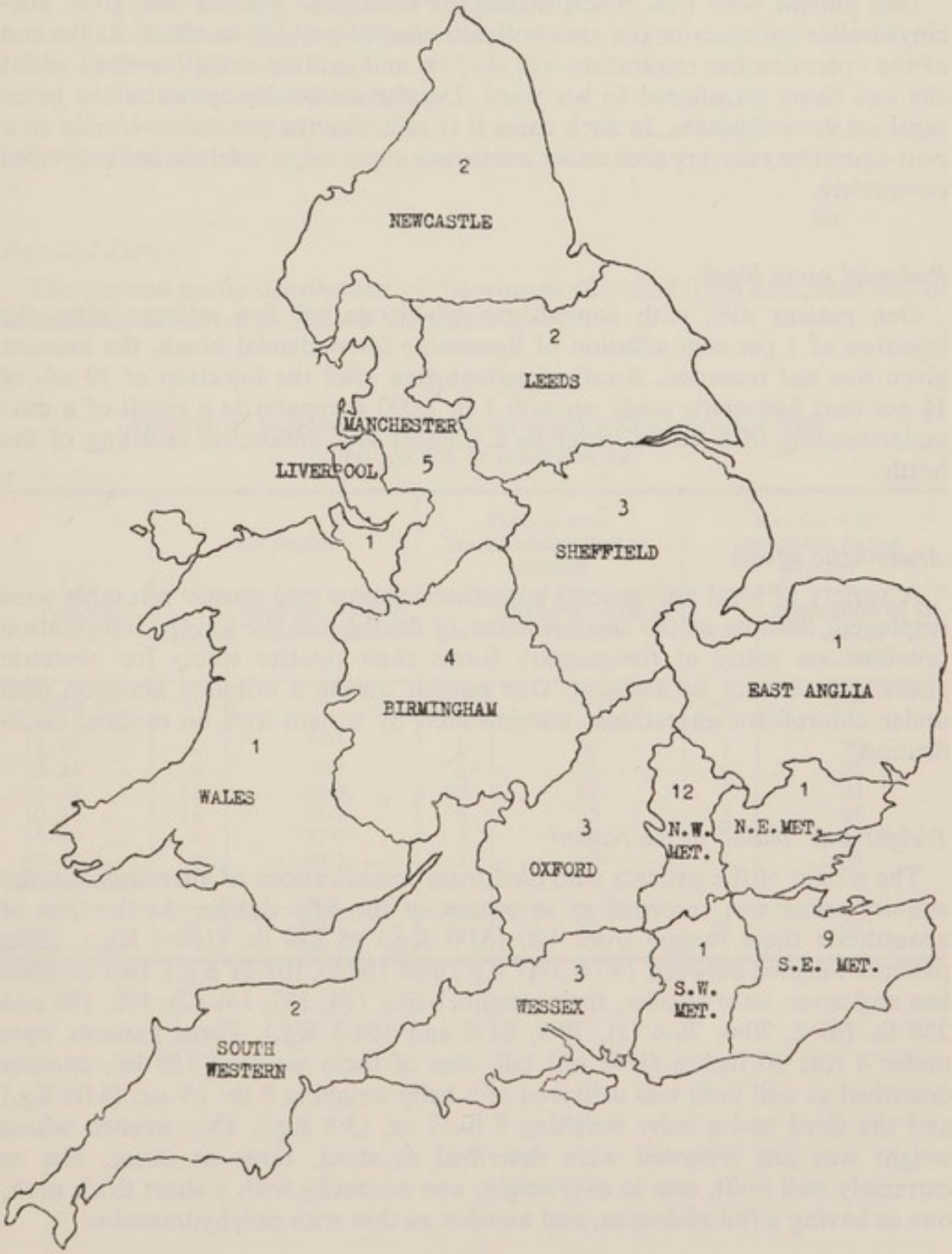
This complication accounted for eighteen of the twenty-four deaths with avoidable factors, it was a contributory factor in one of seven doubtful cases and was the probable cause of seven of the nineteen deaths which were assessed as unavoidable. This total of twenty-six deaths from inhalation of stomach contents compares with sixteen in the previous report and it may have been the cause of at least five other deaths. Twenty-two of these women (and possibly four more) developed Mendelson's syndrome.

Failure to intubate the trachea as a planned procedure did not occur but one patient vomited during recovery from anaesthesia when the tube had presumably been removed. Vomiting or regurgitation occurred in four patients in whom the technical difficulties of intubation delayed the procedure and three died from asphyxia, and the other from Mendelson's syndrome. In these deaths caused by inhalation of stomach contents, anaesthesia was usually induced with an intravenous barbiturate (thiopentone in most cases), the vocal cords paralysed with succinylcholine and the lungs inflated with oxygen. This practice of inflating the lungs after paralysing the vocal cords is likely to encourage the entry into the lungs of any regurgitated material.

MAP 8

THE GEOGRAPHICAL DISTRIBUTION OF DEATHS ASSOCIATED WITH COMPLICATIONS OF ANAESTHESIA IN THE REGIONAL HOSPITAL BOARD AREAS IN ENGLAND AND WALES

1964 - 66



Massive collapse of the lungs

Two patients who were anaesthetised for Caesarean section apparently died from massive collapse of the lungs, one of whom was found at post-mortem to have muco-pus in the trachea and bronchi. In the other case thiopentone 400 mg followed by succinylcholine 50 mg had been given but it was found impossible to inflate the lungs even after intubation presumably because of bronchospasm.

Persistent muscle weakness

One patient who was anaesthetised for Caesarean section was given succinylcholine with tacrine (an anticholinesterase) to prolong its effect. At the end of the operation her respiration was shallow and cardiac arrest occurred whilst she was being transferred to her ward. Despite artificial respiration she never regained consciousness. In such cases it is safer for the patient to remain in a post-operative recovery area under immediate supervision until she has recovered completely.

Pudendal nerve block

One patient died with convulsions which started five minutes after the injection of 1 per cent solution of lignocaine for pudendal block, the amount given was not recorded. Another patient died after the injection of 10 ml. of 1½ per cent lignocaine made up with 1 in 1,000 adrenalin as a result of a misunderstanding of a verbal order to a chemist and unfamiliar labelling of the bottle.

Anaesthetic agents

A variety of local and general anaesthetic agents and muscle relaxants were employed. Because of the small number of deaths and the limited information provided on many of the enquiry forms their relative safety for obstetric anaesthesia cannot be assessed. One patient during a criminal abortion died under chloroform anaesthesia administered by a man with no medical qualification.

Weight and "build" of the patient

The weight of the patients who died from complications of anaesthesia in the enquiry series was recorded in seventeen of the fifty deaths. At the time of anaesthesia these ranged from 120 (54·4 Kg.) to 230 lb. (104·4 Kg.). Eight patients weighed between 140 (63·47 Kg.) and 150 lb. (67·41 Kg.), two weighed less and seven were heavier, their weights being 154, 157, 168 (2), 176, 180 and 230 lb. (69·2, 70·6, 76·4 (2), 79·9, 82·6 and 104·3 Kg.). Three patients were under 4 feet 10 inches (1·47 m.) tall; one of them weighed 150 lb., another described as well built was delivered of a baby weighing 8 lb. 15 oz. (4·05 Kg.) and the third had a baby weighing 8 lb. 7 oz. (3·8 Kg.). Two women whose weight was not recorded were described as stout, three as obese, one as extremely well built, one as overweight, one as stocky with a short thick neck, one as having a full abdomen, and another as thin with polyhydramnios.

Weight and fate of the baby

Among the fifty mothers whose death was associated with anaesthetic misadventures, thirty-six were delivered of a live baby, one of live twins, and seven of stillborn babies. Three patients had ectopic pregnancies and three an abortion. The weights of the babies were as follows:

Under 5½ lb. (2·5 Kg.)	2
5 lb. 9 oz.—6½ lb. (2·52—2·95 Kg.)	5
6 lb. 9 oz.—7½ lb. (3·0—3·4 Kg.)	15
7 lb. 9 oz.—8½ lb. (3·4—3·9 Kg.)	9
8 lb. 9 oz.—9½ lb. (3·9—4·3 Kg.)	9
Over 9½ lb. (4·3 Kg.)	2
Twins (weight not stated)	1
Abortion and ectopic	6
Not stated	1
	50

Age and Parity

The age and parity distribution of the women who died from complications of anaesthesia is shown in Tables XXX and XXXI.

TABLE XXX

Number of women, by age, whose death was associated with complication of anaesthesia.

Age (years)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
	No.	Rate per million maternities	No.	Proportion of all deaths per cent	No.	Proportion of all deaths per cent
Under 16	—	—	—	—	—	—
16–17 ...	—	82·1	—	—	—	—
18–19 ...	2		1	50	1	50
20–24 ...	8	9·5	2	25	6	75
25–29 ...	15	19·0	10	67	5	33
30–34 ...	11	25·2	6	55	5	45
35–39 ...	8	37·0	3	38	5	62
40–44 ...	6	94·7	4	67	2	33
45 and over	—	—	—	—	—	—
All ...	50	19·2	26	52	24	48

TABLE XXXI

Number of women, by parity, whose death was associated with complications of anaesthesia.

Parity*	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
	No.	Rate per million maternities	No.	Proportion of all deaths per cent	No.	Proportion of all deaths per cent
1 ...	24	25·1	10	42	14	58
2 ...	9	11·4	5	56	4	44
3 ...	3	7·0	1	33	2	67
4 ...	4	19·3	3	75	1	25
5–9 ...	9	47·0	66	67	3	33
10 or more	1		1	100	—	—
All ...	50	19·2	26	52	24	48

* For definition of parity, see page 7.

It will be seen that there is an increased risk with first and again after the fourth pregnancy. This is likely to be due to the distribution of anaesthetics associated with delivery and not to a susceptibility to anaesthetics.

Duration of labour

Six women had elective Caesarean sections and six abortion or ectopic pregnancy. The duration of labour in the other thirty-eight who were anaesthetised was as follows:

Under 12 hours	10
12–24 hours	9
25–36 hours	7
37–48 hours	3
49–60 hours	2
61–90 hours	2
Not stated	5
	38

The status of the anaesthetist

The person who administered the anaesthetic was as follows:

	Death with avoidable factor present	Death with no avoidable factor	Total
Consultant anaesthetist	2	3	5
Senior hospital medical officer	2	2	4
Registrar in anaesthetics	4	7	11
Anaesthetic house officer	6	3	9
Obstetric registrar	1	—	1
General practitioner	1	3	4
Not recorded	8	8	16
			50

There is need for more general realization that patients with obstetric emergencies are gravely at risk and need the knowledge and skill of an experienced anaesthetist. In this enquiry series many of these difficult cases were undertaken by junior hospital staff with inadequate experience because those of more senior status were busy elsewhere. In one case a patient requiring Caesarean section was anaesthetised by a senior house officer with only ten weeks experience, all the more senior anaesthetists being occupied at hospitals over ten miles away. In another case there was a delay of forty-five minutes in obtaining an anaesthetist for a woman urgently requiring operation because of haemorrhage. No consultant anaesthetist was attached to the maternity department of this hospital. The consultant anaesthetist cannot be held responsible for staff shortages, but he must assume responsibility for errors made by junior members of his team unless they disobey his instructions, and for seeing that obstetric emergencies are not left to unsupervised junior members of his team. A patient who had bled severely during an abortion died after evacuation of the uterus before blood transfusion was started; the anaesthetist, who did not take blood pressure readings, must share the responsibility for the avoidable factors in this death. Another patient with a ruptured ectopic pregnancy was admitted to hospital with a blood pressure of 60/0 mm. Hg. The consultant anaesthetist (who did not attend) instructed the house officer to give the anaesthetic. In the case of one patient who died from haemorrhage due to ruptured ectopic pregnancy and not from an anaesthetic misadventure, there was considered to be an avoidable factor which was attributed to the anaesthetist because he delayed the operation and attempted to resuscitate the patient before laparotomy, not appreciating that resuscitation should not precede operation but should be coincidental with it.

Summary and Conclusions

1. Fifty deaths occurred associated with complications of anaesthesia, this is a disturbing increase in the rate compared with total maternities. Avoidable factors occurred in 24 of the 50 cases.
2. Over half of these deaths were due to inhalation of regurgitated stomach contents.
3. Patients with obstetric emergencies are gravely at risk and require the knowledge and skill of an experienced anaesthetist who must be readily available.

9. RUPTURED UTERUS

There were thirty deaths from rupture of the uterus, and they are included in Appendix I, Table 1 under category No. 648·3 (other complications arising in pregnancy) of the International Classification of Diseases where rupture occurred before the onset of labour (three deaths), and No. 677 (delivery with other trauma) where rupture occurred as a complication of labour or delivery (twenty-seven deaths) and these include four deaths due to sepsis following uterine rupture.

Comparison with previous reports shows that once again rupture of a uterine scar accounts for only a small proportion of these deaths, and the frequency of rupture due to some kind of obstetric trauma has to be emphasized. The assessors are well aware of the difficulties of diagnosis and management in these tragic cases.

	1955–57	1961–63	1964–66
Uterine scar rupture ...	4	6	3
Traumatic rupture ...	21	13	12
Spontaneous rupture ...	8	19	15
Total ...	33	38	30

There was no chapter on uterine rupture in the first report for 1952–54, and the chapter on Obstructed and Assisted Labour in the 1958–60 report does not give comparable figures.

Twenty-one of these thirty deaths had avoidable factors and in addition there were two doubtful cases.

Age and Parity

TABLE XXXII

Number of women, by age, who died from rupture of the uterus.

Age (years)	Deaths from rupture of the uterus†			
	1961–1963		1964–1966	
	Number	Rate per million maternities	Number	Rate per million maternities
Under 16	—	—	—	—
16–19	1	5·0	1	4·1
20–24	2	2·6	4	4·7
25–29	4	5·2	3	3·8
30–34	7	15·1	10	22·9
35–39	17	73·7	7	32·4
40–44	7	102·1	5	78·9
45 and over	—	—	—	—
Not stated	—	—	—	—
All	38	15·1	30	11·5

TABLE XXXIII

Number of women, by parity, who died from rupture of the uterus.

Parity*	Deaths from rupture of the uterus†			
	1961–1963		1964–1966	
	Number	Rate per million maternities	Number	Rate per million maternities
1	1	1·1	3	3·1
2	6	7·9	8	10·1
3	8	18·8	8	18·6
4	3	14·8	3	14·4
5–9	20	88·9	8	37·6
10 or more			—	
Not stated	—	—	—	—
All	38	15·07	30	11·5

* For definition of parity, see page 7.
† I.C.D. Nos. 648·3 and 677.

The age and parity distribution of the women who died from rupture of the uterus is shown in Tables XXXII and XXXIII. As in the 1961–63 report, the figures suggest that the chance of pregnancy ending in death from ruptured uterus increases with both age and parity.

Uterine Scar Rupture

Rupture of a Caesarean section scar occurred in three cases.

1. One patient had had a lower segment Caesarean section because of toxaemia in her first pregnancy and pyrexia followed the operation. She was admitted to hospital at thirty weeks with slight bleeding and went into premature labour. After forceps delivery, manual removal of the placenta was performed by a relatively inexperienced house surgeon, who either did not look for or recognize a ruptured scar. In spite of continued bleeding and increasing shock the consultant was not called until the patient was moribund.

2. Another patient had had a classical Caesarean section because of toxaemia in her first pregnancy. A repeat Caesarean section was intended, and she was admitted to hospital at thirty-six weeks because of abdominal pain. Some polyhydramnios was present and the foetal heart could not be heard; the patient was very obese. Apparently scar rupture was not suspected and labour was induced by artificial rupture of the membranes. She collapsed and died undelivered after about ten hours of labour. Post-mortem showed gross intra-peritoneal haemorrhage.

3. Another patient had had a lower segment Caesarean section in her previous confinement for foetal distress. On this occasion she was admitted to hospital in labour at term, and in good condition. She was delivered by low forceps and after delivery of the placenta, which was "manually expressed", she had a postpartum haemorrhage and vaginal examination showed that the lower segment scar had ruptured. Packing the uterus and later clamping the vessels was unsuccessful in controlling the haemorrhage, and she died about two hours after delivery.

Traumatic Rupture

Traumatic rupture accounted for twelve deaths, of which ten were considered to have avoidable factors. Six patients were in obstructed labour and five deaths were due to trauma during delivery. One other patient, a grande multipara who had received no ante-natal care, died from multiple lacerations of the vagina and uterus, presumably self inflicted in an attempt to induce labour.

One patient who was *booked for home confinement* for her third child, and in whom labour did not commence until the forty-second week when the head was high and presumably could not engage, was transferred to hospital because of obstructed labour due to a hydrocephalic foetus, but she died before arrival.

Two patients were *booked for delivery in a general practitioner maternity home.* One had refused to take advice to go into hospital when the membranes had ruptured spontaneously. A week later she was admitted to the maternity home with a compound presentation and was transferred to a consultant unit. A stillborn foetus was delivered without difficulty by forceps after pushing up the hands, and a careful examination was made to exclude rupture of the lower segment because she had had such violent contractions. A further examination was made next day because of deterioration in her general condition with signs suggesting peritonitis, and when rupture was found a hysterectomy was performed, but she died from septicaemia.

The other patient had a stillborn foetus weighing 9½ lb. (4·31 Kg.) delivered by forceps as an unrotated occipito-posterior. At post-mortem a large tear was found in the posterior vaginal wall extending upwards into the lower segment of the uterus.

Eight traumatic ruptures *occurred in consultant units.*

1. A grande multipara, who failed to seek any ante-natal care, was admitted to hospital in labour at term. The house surgeon diagnosed a breech presentation, but an arm prolapsed two hours later. There was some delay in getting an anaesthetist, and the patient was severely shocked by the time she reached the operating theatre. A rapid hysterectomy was performed but failed to save her.

2. A breech extraction was performed by a "hospital doctor" before the cervix was fully dilated. The cervix was torn by forceps delivery of the after-coming head. Profuse haemorrhage followed, necessitating laparotomy and hysterectomy, but despite ligation of the internal iliac artery, bleeding could not be controlled.

3. Prolapse of an arm occurred when the cervix was fully dilated in a patient who was thought to have a normal vertex presentation. Internal podalic version was performed under general anaesthesia, and a live child was delivered and was followed by manual removal of the placenta. A torn cervix was found and exploration by the consultant showed that the tear extended upwards into the lower segment. The torn cervix was sutured and later the uterus packed because of continued bleeding. The patient's condition deteriorated and she died before a laparotomy could be done.

4. In her previous confinement this patient had had failed forceps; podalic version and breech delivery, but on this occasion a Caesarean section was not considered necessary as her pelvis appeared to be normal. After a very short labour the head appeared at the vulva, and a manual rotation and forceps delivery was undertaken by a junior house officer, but difficulty was experienced because the head was displaced above the brim during rotation. The con-

sultant was called in because of difficulty in delivering the shoulders and the child was stillborn. It is possible that the uterus had been torn or weakened by the previous podalic version, but with this history she should have been delivered by a more experienced obstetrician.

5. After three attempts to deliver a very large foetus with forceps, internal podalic version was performed and was followed by a difficult breech extraction. The mother was severely shocked but recovered with resuscitation. Peritonitis followed and on the third day of the puerperium she was transferred to another hospital for laparotomy because the operating theatre was closed for repairs. She died from sepsis following ruptured uterus.

6. Obstructed labour due to a brow presentation was not diagnosed by a junior midwife or junior house officer, which was understandable. The patient became shocked and the consultant performed a Caesarean section and sutured a tear in the lower segment, but the patient could not be resuscitated. This death has been assessed as having no avoidable factor.

7. A multipara, with a large foetus in the occipito-posterior position, collapsed after a prolonged first stage of labour. An inexperienced house officer failed to call in help even though he had been instructed to do so. After attempting forceps delivery Caesarean section was eventually performed by a registrar, but the patient died during the operation.

8. A young primipara was re-admitted to hospital because of post-partum haemorrhage. A placental fragment was removed by an "experienced resident". Perforation of the uterus and damage to the small bowel occurred which were not recognized and the patient died from peritonitis.

Spontaneous Rupture

Spontaneous rupture occurred in fifteen cases, in nine of which there were avoidable factors, and one was doubtful.

Five patients had been quite justifiably *booked for home confinement*.

1. One patient had refused a hospital booking, advised because of a ten-year interval since her last confinement. She started bleeding after delivery of the placenta and help from the flying squad was requested. She was transferred to hospital in a poor condition and died during examination under anaesthesia.

2. An unusual case of rupture of a bicornuate uterus occurred in the middle trimester of pregnancy. This patient was admitted to hospital as an emergency with severe shock. A laparotomy was performed five hours after admission, and she died during the operation.

3. A patient had a spontaneous delivery and collapsed with haemorrhage before delivery of the placenta. There was some delay in getting the flying squad. The flying squad attempted manual removal and discovered a ruptured uterus. The patient was transferred to hospital but was moribund on arrival and died during laparotomy.

4. Another patient with post-partum haemorrhage and shock was treated by the flying squad for over three hours. She was eventually transferred to hospital in a moribund state. Her uterus was packed but this did not control the bleeding, so hysterectomy was performed but the shock was irreversible.

5. A patient booked for home confinement was admitted to hospital at thirty-eight weeks because of slight ante-partum haemorrhage. She was examined under anaesthesia and the membranes were ruptured, a small dose syntocinon

drip being set up the next day. After spontaneous delivery she started to bleed and bleeding continued after delivery of the placenta by cord traction. Blood coagulation failure was diagnosed and amniotic fluid embolism suspected, but the diagnosis of ruptured uterus was not made until post-mortem.

Two patients were *booked for general practitioner maternity homes.*

1. An elderly multipara with a history of a previous septic abortion was induced because of prolonged pregnancy by artificial rupture of the membranes followed by intermittent intramuscular injections of pitocin. She collapsed during the first stage of labour. There was difficulty in setting up an intravenous drip and she died undelivered. The foetus had escaped into the peritoneal cavity with profuse intraperitoneal haemorrhage.

2. A multipara, booked for a general practitioner maternity home, was quite properly transferred to a consultant unit because of an unstable lie. After cephalic version the membranes were ruptured but she did not go into labour for three days, during which time she was given two courses of buccal pitocin. The foetal heart became irregular and finally ceased after the first course, but Caesarean section was not considered. The patient's condition gradually deteriorated and when labour started her temperature was 101° F (38·3 C) with rigors and her pulse rate 120. Apparently the consultant was not requested to see her. Death occurred an hour after delivery of a stillborn child. The post-mortem examination revealed a tear five inches long in the lower uterine segment.

Eight patients were *booked for consultant units*, of which four were considered to have avoidable factors.

1. A very obese grande multipara, who had defaulted from ante-natal care at the hospital of her booking during the last three weeks of her pregnancy, arrived in labour at another hospital with severe toxaemia. Caesarean section was performed by the consultant because of failure to progress in the second stage of labour. A 13½ lb. (6·13 Kg.) foetus was found in the peritoneal cavity. Hysterectomy was performed and the patient was transfused. Unfortunately she died some time later from peritonitis. The cause of rupture was obscure, but the failure of co-operation by the patient must be regarded as an avoidable factor.

2. A young primigravida had a Shirodkar stitch inserted at thirty-two weeks to avert premature delivery. She was re-admitted a week later in labour but was not seen by a doctor for four hours even though he had been summoned. She collapsed after delivery and there was undue delay in giving blood transfusion and in calling in consultant help.

3. A patient who died from uncontrollable post-partum haemorrhage from rupture of the lower segment, had had her cervix conised before the pregnancy started, but only cervicitis was found. Buccal pitocin was used to induce labour.

4. A grande multipara had had her cervix conised immediately before this last pregnancy, again apparently for chronic cervicitis. She was delivered by a house surgeon by mid-cavity forceps under pudendal block, and after delivery of the placenta, she had considerable bleeding and collapsed. Laparotomy was performed but the bleeding could not be controlled by hysterectomy and ligation of the internal iliac artery. Delivery of such a patient should have been undertaken or at least supervised by a more experienced obstetrician.

Summary and Conclusions

1. Thirty women died following uterine rupture. Avoidable factors were present in twenty-one. It is recognized that a ruptured uterus may be extremely difficult to diagnose and treat, particularly if it occurs spontaneously without obstructed labour or traumatic delivery.
2. Ruptured uterus due to obstructed labour or traumatic delivery ought not to occur under proper supervision, and yet it is far more common than rupture of a uterine scar.
3. The cause of spontaneous rupture is often obscure, and tearing of the cervix at a previous delivery or abortion may be unsuspected from the history. Two cases following conisation of the cervix makes it necessary to suggest that the most careful supervision in labour is necessary in these patients.
4. The importance of oxytocic drugs as a factor in causing rupture must also be mentioned, as there is no doubt that violent contractions may be produced by either intramuscular injections or buccal pitocin.
5. The diagnosis of blood coagulation failure was made in four patients who died following rupture of the uterus, and the clotting defect may have been due to the release of thrombo-plastin from traumatized uterine muscle, but the association of ruptured uterus and amniotic fluid embolism has also been recorded. In one case the presence of a coagulation disorder diverted attention from the possibility of uterine rupture.

10. AMNIOTIC FLUID EMBOLISM

There were thirty deaths which were thought to be due to amniotic fluid embolism. Seventeen deaths occurred during labour and thirteen after delivery. They are shown in Appendix I, Table 1 under category number 678 (delivery with other complications of pregnancy) of the International Classification of Diseases.

In twenty-three of these thirty deaths the diagnosis was confirmed by histological examination of the lungs. In the 1961–63 report there were twenty-seven deaths of which thirteen were confirmed histologically, and in the 1955–57 report there were eleven histologically proved cases out of forty-four cases of sudden death in labour, not all of which were thought to be caused by amniotic fluid embolism.

Only two babies born to the seventeen patients who died undelivered survived, one delivered by forceps and the other by post-mortem Caesarean section. One other child delivered by forceps after maternal death only survived a few hours. Unsuccessful post-mortem Caesarean sections were performed on five other women. In the thirteen patients who died after delivery seven babies were born alive including a pair of twins, and eight babies were stillborn including another pair of twins. Altogether twenty-three of the thirty-two children died.

Post-mortem examinations were carried out in all thirty women and histological confirmation of amniotic fluid embolism was found in twenty-three. In the seven unconfirmed cases the diagnosis was made on clinical grounds, and the lungs were not examined histologically. Of course it is all too easy to ascribe otherwise unexplained death to amniotic fluid embolism, and it is necessary to repeat that this diagnosis cannot be confirmed by naked eye examination of the lungs. Amniotic material may be seen in pulmonary vessels in sections stained with haematoxylin and eosin, but will be more easily identified by the alcian green phloxin method, which stains foetal squames red and mucin greenish-blue. Fat stains should also be used to demonstrate vernix.

It is possible that death from amniotic fluid embolism may be due to three rather separate causes:

1. Asphyxia due to multiple embolic blockage of pulmonary vessels with amniotic material. The cyanosis may be accompanied by petechial haemorrhages in the upper part of the body and also in internal organs, such as the heart, pleura or brain. In one woman amniotic material was also found microscopically in the cerebral vessels.
2. Shock or collapse, partly due to the above, may also be due to the amniotic fluid in the circulation. In some cases cyanosis and petechial haemorrhages are minimal, and particulate matter in the lungs relatively scarce.
3. Blood coagulation disorder, evidence of which was found in ten of these thirty cases, including all those who survived more than an hour after the collapse. The presence of fibrin emboli in maternal vessels is best shown by the acid picro-Mallory stain, and should not be confused with amniotic material of foetal origin.

Coagulation disorder may be associated with bleeding from the uterus, before or after death, and although in a collapsed patient one would not expect post-partum bleeding to be severe, in some cases it appeared to be the final cause of

death. It is possible that a few of the deaths attributed to post-partum haemorrhage, with unexplained blood coagulation disorder described in the chapter on Haemorrhage, may have been due to undiagnosed amniotic fluid embolism.

Avoidable factors were present in only four of the thirty deaths. Wrong booking for patients of high parity occurred in two cases, failure to accept medical advice in one and failure to call in a consultant in another. Although these were regarded as avoidable factors they probably had little relevance to the fatal outcome. It must be said that in the present state of our knowledge the occurrence of amniotic fluid embolism is both unpredictable and unpreventable.

Oxytocic drips were used in six women who died from amniotic fluid embolism and buccal pitocin was given to three, in all of whom violent or strong contractions were noted. Excessive uterine action was commented upon in several other patients who were not given any oxytocic drug, and this has been described as a factor in causing amniotic fluid embolism. A warning must therefore be given that careful observation of uterine action is always necessary, particularly when oxytocic drugs are given; and an attempt should be made to control such violent uterine contractions.

Artificial rupture of the membrane was performed in eleven patients. In one of these the membranes were ruptured because of accidental haemorrhage in a patient with no sign of shock. Sudden collapse and death occurred over one hour later, and at post-mortem a large piece of clot was found in the pulmonary conus of the heart, microscopic examination of which showed it to be a piece of membrane.

Labour was induced in another patient with an anencephalic foetus by amniocentesis, and the replacement of 200 ml. of liquor with 200 ml. of hypertonic saline. The membranes ruptured spontaneously six hours later with the onset of irregular intense contractions, and twenty minutes later she became cyanosed and collapsed. Some improvement followed vaginal delivery, but she died from post-partum haemorrhage due to blood coagulation failure.

Method of delivery. Spontaneous vaginal delivery occurred in nine patients, often after a short labour, and in one case the patient "shot the baby out". Six women were delivered by forceps, in two cases after they had died. Caesarean section was performed twice, not including post-mortem sections.

In one case the patient was draining blood stained liquor and having vague contractions when the cord prolapsed. A lower segment Caesarean section was performed, but bleeding was difficult to control. She did not come round from the anaesthetic, and post-mortem examination showed marked pulmonary oedema with "evidence of amniotic embolism", but this has not been taken as histological proof.

The other patient delivered by Caesarean section had the membranes ruptured to induce labour for prolonged pregnancy. Four hours later she collapsed in the lavatory, and became unconscious with twitchings. Caesarean section was performed and some blood was found in the peritoneal cavity with a Couvelaire type of uterus, but there was no retro-placental clot. She survived some hours but continued bleeding because of blood coagulation failure. Post-mortem suggested amniotic fluid embolism but histological proof was not obtained.

Although it is clear that amniotic fluid embolism cannot occur with an intact amniotic sac, it is possible that high rupture can cause amniotic fluid embolism before the escape of liquor is evident clinically. A patient was found lying on her side cyanosed and unconscious; the membranes ruptured spontaneously one or two minutes after this. Vaginal bleeding continued and the blood did not clot. This was an undoubted death from amniotic fluid embolism with histological proof.

Six women showed no signs of collapse until after delivery, and in five of the six collapse occurred within half an hour of delivery. The remaining patient was discovered in a state of collapse some three hours after delivery. In four of these six deaths histological proof was obtained. Even if the entry of amniotic fluid into the circulation only occurred as the child was born, it must be noted that the occurrence of shock may be delayed for up to thirty minutes and does not necessarily occur in a matter of seconds.

Clinical Diagnosis. A presumptive clinical diagnosis of amniotic fluid embolism can be justified by the following:

1. Sudden collapse of the patient at some time after rupture of the membrane during labour or very soon after delivery. The liquor amnii is sometimes blood stained and the uterine contractions are often violent. Intra-uterine death of the foetus is considered to be a predisposing factor.
2. The collapse may be accompanied by a fit or muscular twitching and there is usually dyspnoea and progressive cyanosis, sometimes with blood stained frothy mucus coming from the air passages.
3. Blood coagulation failure, which may cause continued bleeding after death or post-partum haemorrhage.

Age and Parity

TABLE XXXIV

Number of women, by age, who died from amniotic fluid embolism.

Age (years)	Deaths from amniotic fluid embolism			
	1961–1963		1964–1966	
	Number	Rate per million maternities	Number	Rate per million maternities
Under 16	—	—	—	—
16–19	—	—	2	8·2
20–24	3	3·8	1	1·2
25–29	6	7·8	8	10·1
30–34	6	13·0	9	20·7
35–39	7	30·4	7	32·4
40–44	5	72·9	2	31·6
45 and over	—	—	1	241·8
All	27	10·7	30	11·5

TABLE XXXV

Number of women, by parity, who died from amniotic fluid embolism.

Parity*	Deaths from amniotic fluid embolism			
	1961–1963		1964–1966	
	Number	Rate per million maternities	Number	Rate per million maternities
1	5	5·5	5	5·2
2	4	5·3	9	11·4
3	8	18·8	3	7·0
4	4	19·7	5	24·1
5–9	6	26·7	7	37·6
10 or more			1	
All	27	10·7	30	11·5

* For definition of parity, see page 7.
† Included in I.C.D. No. 678.

The age and parity distribution of the women who died from amniotic fluid embolism is shown in Tables XXXIV and XXXV. The numbers are small, but the figures suggest that the risk of death from amniotic fluid embolism increases considerably with age, and to a small extent with parity.

Summary and Conclusions

1. Thirty deaths have been ascribed to amniotic fluid embolism, twenty-three of which were confirmed by histological examination. Histological examination of the lungs is essential for a definite diagnosis, and in patients dying undelivered it may be valuable to look for evidence of high rupture of the membranes and separation of the placenta.
2. Two of the thirty patients had twin pregnancies and twenty-three of the thirty-two babies died. One of the ten surviving children was delivered by post-mortem Caesarean section.
3. Avoidable factors were present in four cases, but these were possibly irrelevant to death from amniotic fluid embolism, which is unpreventable in the present state of our knowledge.
4. Violent uterine action may be a factor in causing amniotic fluid embolism, and attempts should be made to control this, particularly when oxytocic drugs are being used.

11. ECTOPIC PREGNANCY

There has not been any special comment in previous reports on ectopic pregnancy as a cause of maternal death. It has been considered worthwhile to scrutinize from the Confidential Enquiries into Maternal Deaths those reports which cited ectopic pregnancy in order to find the avoidable and other factors involved, in an endeavour to decrease the number of these deaths. During the years 1964–66 a total of forty-two deaths occurred as a result of ectopic pregnancy and they are all included in Appendix I, Table 1 under category 645 (Ectopic pregnancy) of the International Classification of Diseases. These 42 deaths contrast with 42 during 1961–63, 28 in 1958–60, 42 in 1955–57 and 59 during 1952–54.

Age and Parity

TABLE XXXVI

Number of women, by age, who died from Ectopic Pregnancy and death rates per million women.

Age (years)	Number of women (mid year population 1965) thousands	Number of maternities 1964–66	Deaths from Ectopic Pregnancy †	
			Number	Death rate per million
under 16 ...	5,654·2	3,553	—	—
16–17	737·1	243,565	—	—
18–19	746·8		—	—
20–24	1,582·2	843,910	7	1·47
25–29	1,478·7	789,747	12	2·72
30–34	1.424·6	435,756	16	3·74
35–39	1,487·4	216,327	4	0·90
40–44	1,660·8	63,373	3	0·60
45+	9,764·0	4,136	—	—
All	24,535·8	2,600,367	42	0·57

† Not coded by age in 1961–1963

TABLE XXXVII

Number of women, by parity, who died from Ectopic Pregnancy.

Parity*	Deaths from ectopic pregnancy†	
	Number	Deaths from ectopic pregnancy as a proportion per 10,000 maternities
1	11	0·115
2	12	0·151
3	5	0·116
4	4	0·193
5–9	5	0·235
10 or more ...	—	—
Not stated ...	5	—
All	42	0·162

* For definition of parity, see page 7.
† Not coded by parity in 1961–1963.

The age and parity of the women who died from ectopic pregnancy are shown in Tables XXXVI and XXXVII. There appears little or no relationship between frequency of occurrence and parity but there is a slight suggestion that frequency of occurrence increases with age.

Racial Status

Relevant information was not available in all cases but at least thirteen patients (that is 30 per cent) were "coloured" and one was a Greek temporarily resident in this country.

Clinical Features

Only one patient had had a previous ectopic pregnancy. In twenty-nine cases no diagnosis of ectopic pregnancy was made before post-mortem examination. Four patients died at home and had not been seen by a medical practitioner. Six patients had severe diarrhoea and vomiting and a further five patients had severe vomiting. The diagnosis made instead of an ectopic pregnancy included acute appendicitis, pyelitis, cholecystitis, perforated ulcer, pulmonary embolism (twice) and cardiac failure.

In six patients the duration of the pregnancy was not known. Seven patients had no amenorrhoea. The pregnancy was of twelve weeks duration or less in twenty cases. Two patients had progressed to the twentieth week of pregnancy, one to the twenty-sixth week and in one instance an intraligamentary pregnancy reached the thirty-sixth week of gestation. The patient was a primigravida aged 33. An X-ray examination of the abdomen was performed before laparotomy at which a live child of 7 lb. (3·17 Kg.) was delivered. It was considered that a tight binder might have caused trauma sufficient to start bleeding.

Avoidable Factors

In seven instances an avoidable factor was present. In one case this was attributable to a patient who refused a blood transfusion because of religious beliefs. A general practitioner was dilatory in admitting a patient to hospital on one occasion. In the remaining four cases the surgeon attempted to resuscitate the patient before laparotomy and in one instance the anaesthetist was similarly at fault in not appreciating that *resuscitation should not precede but should be co-incidental with operation* and that transfusion may be dangerous in that it may restart bleeding that has been temporarily arrested. This occurred in the instance of a woman admitted to a large hospital and treated for an ectopic pregnancy by a general surgeon. A total of five pints of blood and two and a half pints of other fluid were transfused before laparotomy. On opening the abdomen a "vast quantity of blood ran out all over the floor"; aortic compression was made and a further seven and a half pints of fluid were transfused. Only after death in the operating theatre was the diagnosis of an ectopic pregnancy made.

Summary and Conclusions

1. The total of forty-two maternal deaths caused by ectopic pregnancy does not show a significant variation from the numbers recorded in previous reports from 1952.

2. Thirty per cent of the women who died from ectopic pregnancy were known to be "coloured".
3. The diagnosis is often difficult and may be easily missed.
4. Where there is an avoidable factor this is usually due to failure to operate immediately.

12. PUERPERAL SEPSIS

There were twenty-eight deaths from puerperal sepsis which are shown in Appendix I, Table 1 under the International Classification of Diseases as sepsis of childbirth or the puerperium (I.C.D. 681). In addition there were twenty-nine deaths due to sepsis following surgical treatment (subsidiary coding I.C.D. E950), and sixty-six deaths due to abortion with sepsis (I.C.D. 651).

Altogether 123 maternal deaths were due to sepsis.

Previous triennial reports have not included a chapter on maternal deaths from sepsis, but the following table compares the frequency of these deaths with previous three-year periods.

Maternal deaths from sepsis

	1952–54	1955–57	1958–60	1961–63	1964–66
Abortion with sepsis ...	91	82	77	74	66
Puerperal sepsis	42	46	24	18	28
Sepsis after surgical treatment	26	30	23	19	29
Total ...	159	158	124	111	123

In the Enquiry series deaths following abortion have always been shown as one of the four major causes of maternal deaths, even though these patients die from sepsis, haemorrhage, air embolism or pulmonary embolism. If deaths from abortion were not so categorized, sepsis would appear as the second commonest cause of maternal deaths, a fact which is not easy to accept.

It is often said that deaths from puerperal sepsis are now extremely rare, and of course they are rare in comparison with the years before antibiotics were introduced. Considerable thought must now be given to ways in which these deaths can be reduced in number. It would be helpful if detailed information could in future be given in the confidential reports on the bacteriological findings and sensitivities to antibiotics in all deaths from sepsis.

In addition to these deaths from puerperal, post-operative or post-abortal sepsis, there were ten deaths from infection not originating in the genital tract. These include deaths from mastitis (2), appendicitis (2), cholecystitis (2), dental abscess (1), meningitis (2) and one case of septicaemia of unknown cause in a twelve weeks pregnant woman. These deaths are not included in this discussion.

Puerperal sepsis

Of the twenty-eight deaths due to puerperal sepsis, the majority followed spontaneous delivery, manual removal of the placenta being performed in only one patient. One patient developed peritonitis after sterilization during the puerperium.

Avoidable factors were considered to be present in twelve of these twenty-eight deaths. These included wrong booking for confinement at home or in a general practitioner maternity home, or delay in sending for consultant help in

four cases; inadequate ante-natal care in two cases, in one of which the patient had concealed her pregnancy throughout; unwise early discharge from hospital and failure to re-admit in spite of pyrexia in two cases.

In one case artificial rupture of the membranes was performed by a general practitioner in the patient's home, and in another case a "membrane sweep" was carried out by a general practitioner in an ante-natal clinic. In another case septicaemia was apparently the result of an intravenous transfusion of fluid contaminated with aeromonas bacilli.

It must be said that the clinical diagnosis of sepsis was frequently not made before death, and in many cases the bacterial cause was only looked for and determined at post-mortem.

Post-mortem examinations were made on all but one of these women and a causative organism was identified before or after death in twenty of the twenty-eight cases, as follows: *Staph. aureus* (4), *Esch. coli* (4), *Cl. welchii* (3), Haemolytic Streptococcus (2), other streptococci (5), *Pneumococcus* (1), *Aeromonas* bacillus (1).

Sepsis following surgical treatment

There were twenty-nine deaths following surgical treatment, of which twenty-five followed Caesarean section and four followed rupture of the uterus. (One followed hysterotomy but this is included under "abortion with sepsis"). These deaths are more fully discussed in the appropriate chapters, but it may be noted that only five of the Caesarean sections were elective, and the majority of the remaining twenty sections were for prolonged labour, with membranes ruptured for some considerable time. In four of these cases peritonitis resulted from perforation of the bowel in patients with paralytic ileus.

The risk of performing Caesarean section late in labour, when the membranes have been ruptured for many hours must be well known, and vaginal swabs should be taken for bacteriology in such cases. Perforation of the bowel in patients with paralytic ileus should be preventable by gastric or intestinal suction.

In sixteen cases no bacteriological findings were reported. In the remaining thirteen cases bacteriological examination before or after death showed the following organisms:

Esch. coli (5), *Staph. aureus* (3), *B. proteus* (2), Haemolytic streptococcus (1), other streptococci (1), *Cl. welchii* (1).

Abortion with sepsis

Deaths from sepsis occurred in sixty-six patients after abortion, and these have been more fully discussed in a separate chapter. These included three therapeutic abortions, one by hysterotomy and two following the injection of paste into the uterus. One death followed the spontaneous evacuation of a hydatidiform mole. The remaining sixty-two deaths were probably the result of induced abortion, either by the patient herself or by some other person, but evidence of criminal abortion is always difficult to obtain.

In fourteen patients the bacteriology was either not done or not stated. There were thirty-four proved cases of *Cl. welchii* infection and one of tetanus. There were seven cases of streptococcal infection, including two due to haemolytic streptococcus group A. and there were two cases of *Staph. aureus* infection. Six

cases were due to *Esch. coli* alone, but this organism was also found in association with other organisms, in two cases with *B. proteus*.

In at least twelve patients there was acute renal failure.

Avoidable factors, other than the action of the unfortunate patient in seeking abortion, are difficult to determine. From the information provided and in retrospect it is probable that it would have been better to have taken active surgical measures to deal with septic abortions, particularly when anaerobic organisms were present. Antibiotic cover should certainly be given, but there should not be undue delay in evacuating retained products of conception; if there is any question of peritonitis, laparotomy may be wise, and hysterectomy may sometimes be necessary if gas gangrene of the uterus is present.

The management of these patients is often difficult, requiring special medical and nursing skills. Early consultation and use of special units with facilities for haemo-dialysis should help to reduce the number of these deaths.

Summary and Conclusions

1. Twenty-eight deaths occurred from puerperal sepsis, and in addition there were 29 deaths following surgical treatment including 25 Caesarean sections, and 66 deaths due to abortion with sepsis. Altogether 123 deaths were due to sepsis, and considerable thought must be given to ways in which these deaths can be reduced in number.
2. In many cases the clinical diagnosis was not made before death, and more detailed information on the bacteriological findings would be helpful in future reports on confidential enquiries into maternal deaths.
3. The risk of infection after Caesarean section in cases of prolonged labour with ruptured membranes is emphasized, and perforation of the bowel in patients with paralytic ileus should be avoidable.
4. Undue delay in evacuating the uterus in patients with septic abortion and delay in performing laparotomy when peritonitis is suspected are possible avoidable factors.
5. The risk of death from sepsis after vaginal or operative deliveries has not disappeared. Attention must be paid to aseptic techniques if such deaths are to be prevented.

13. MISCELLANEOUS

Although the main value of these reports has been the discussion of the major causes of maternal deaths, it is felt that something might be gained by discussing certain groups of cases and some miscellaneous causes of death.

Anaemia

Anaemia may be a factor in deaths from haemorrhage, sepsis or other causes of maternal death, but fifteen deaths are described here in which anaemia played an important role, and avoidable factors were present in nine.

Iron deficiency anaemia was present in four women who died.

1. A patient was unwisely discharged from hospital with a haemoglobin or only 65 per cent (9·62 gm. per 100 ml.).* Apparently she was not given iron or visited by her general practitioner until she became dangerously ill on the eleventh day of the puerperium when she was sent into hospital with a breast infection, and she died from septicaemia.
2. A patient with undiagnosed mitral stenosis developed pre-eclamptic toxaemia, but was not admitted to hospital in spite of dyspnoea on exertion, although seen by a consultant. When she was admitted two weeks later, her haemoglobin was 52 per cent and she died the same day from heart failure.
3. A patient with arterial disease was given intramuscular iron injections at thirty weeks when her haemoglobin was 64 per cent. Albuminuria was apparently ignored by her general practitioner and hospital clinic, but she was admitted to hospital when it was found that her haemoglobin had fallen to 53 per cent. During a blood transfusion she developed dyspnoea, cough and sweating. She was delivered two days later, but died soon afterwards, presumbaly from heart failure.
4. A patient, who had no ante-natal care in her sixth pregnancy, was admitted to hospital in labour, and was found to have severe toxaemia. She delivered spontaneously, and three days later her haemoglobin was 53 per cent. A blood transfusion was started, but she developed heart failure and died with acute pulmonary oedema.

Megaloblastic anaemia was present in five women who died.

1. A patient with a twin pregnancy, being treated for iron deficiency anaemia, was admitted to hospital with malaena and died before she could be given blood. Although she had been given folic acid by mouth, her anaemia did not respond probably because of damage to the intestinal tract causing failure of absorption.
2. A patient was treated by iron injections during pregnancy but not given folic acid in spite of a rapidly falling haemoglobin. She was delivered at home, but admitted to hospital four days later with acute dyspnoea and a haemoglobin of 17 per cent. She died as a transfusion was being started.
3. A patient who had practically no ante-natal care, was delivered at home, and was then treated for anaemia with iron injections. On the sixth day of the puerperium she was admitted to hospital because of heart failure due to mitral stenosis, and was then found to have megaloblastic anaema with a haemoglobin

* 100 per cent haemoglobin is equal to 14·8 g per 100 ml.

of 42 per cent. She was transfused, but developed acute pulmonary oedema and died.

4. A patient with signs of severe toxaemia and a haemoglobin of 61 per cent. diagnosed as due to megaloblastic anaemia, was not admitted to hospital until she had a massive concealed haemorrhage; she was moribund on admission.

5. After spontaneous delivery, a patient developed acute renal failure and was found to have megaloblastic anaemia with a haemoglobin of 22 per cent.

Sickle-cell anaemia was present in four women who died. Only two of these deaths were considered to have avoidable factors. Although known to have sickle cell anaemia, one patient was not admitted to hospital for investigation and treatment. She collapsed in the street at thirty-two weeks and on arrival at hospital her haemoglobin was 13 per cent. She was in heart failure, and a transfusion of packed red cells was started, but she died soon after.

Another patient had inadequate ante-natal care in that no tests for sickling were done, and glycosuria was ignored until she was admitted in hyperglycaemic coma.

Purpura haemorrhagica. A young patient, treated for severe anaemia during pregnancy, also developed severe anaemia in the puerperium, and was treated by blood transfusion. It was not realized that she was suffering from thrombocytopenic purpura until she was re-admitted, soon after she had returned home, with haematuria and severe anaemia. She died from cerebral haemorrhage.

Two conclusions can be drawn from these deaths.

1. Failure to respond satisfactorily to treatment necessitates admission to hospital for investigation and treatment.

2. Treatment of severe anaemia by blood transfusion is potentially dangerous when there is evidence of heart failure. The use of packed red cells and the simultaneous withdrawal of venous blood might be one method of helping to prevent such women dying from heart failure.

Acute Renal Failure

There were forty-two deaths from acute renal failure and nine from hepato-renal failure.

Septic abortion was followed by death from acute renal failure in eleven cases, and dialysis was carried out in eight of these. One of the patients who was not dialysed had abortion induced with paste and developed severe jaundice; another, also severely jaundiced was transferred to hospital too late for dialysis.

Haemorrhage was followed by death from acute renal failure in twelve cases, eight followed concealed haemorrhage with blood coagulation failure and two followed post-partum haemorrhage associated with coagulation disorder. One followed haemorrhage during Caesarean section and another followed haemorrhage and sepsis after Caesarean section. Four of these twelve patients did not have dialysis.

Renal disease accounted for seven deaths from acute renal failure. Three were patients with chronic pyelonephritis; two were patients with malignant hypertension, one of whom had suffered from hypertension through eleven previous

pregnancies; one patient had chronic nephritis, and another apparently had an acute nephritis.

Hyperemesis gravidarum was associated with two deaths from acute renal failure. Both of these patients should have been admitted to hospital earlier, and neither were dialysed.

Pre-eclamptic and eclamptic toxaemia of pregnancy was followed by death from acute renal failure in eight women, one of whom may possibly have been a chronic nephritic. None had dialysis.

Megaloblastic anaemia. One patient suffering from megaloblastic anaemia died from acute renal failure.

Influenzal pneumonia. One patient suffering from acute influenzal pneumonia died from acute renal failure.

Hepato-renal failure accounted for nine deaths and the cause of the hepato-renal failure was obscure, although one woman had pyelonephritis and another hyperemesis gravidarum. Two patients were dialysed, and another who was transferred too late for dialysis, was found to have acute necrosis of the liver.

Hepatic Failure

In addition to the nine deaths from hepato-renal failure already mentioned, there were eleven other deaths from liver failure. Two of these patients were diagnosed as hepato-renal failure in which the renal lesions were minimal. Three deaths were attributed to infective hepatitis, three were apparently due to cirrhosis of the liver, and the remainder complicated pre-eclamptic and eclamptic toxaemia of pregnancy.

Two deaths were considered to have avoidable factors, both due to toxaemia and in both ante-natal care was deficient.

Diabetes

Eight maternal deaths occurred in patients with diabetes.

A multipara had a premature labour at home with a stillborn child. A week later she collapsed and was transferred to hospital in coma. It was reported that her blood sugar was 1760 mgm per cent and her urine loaded with sugar and acetone. She died four hours later and her death might have been avoided if either the midwife or general practitioner had tested her urine for sugar.

An elderly multipara had had toxaemia and a 13 lb. (5·9 Kg.) stillbirth in her previous pregnancy. She was very obese, over 280 lb. (127 Kg.) and had a family history of diabetes. At thirty-four weeks she had hypertension and albuminuria, as well as glycosuria, and her fasting blood sugar was 155 mgm per cent. She was treated by diet restriction, but was not admitted to hospital until two days after the expected date of delivery. The membranes ruptured spontaneously but uterine contractions were erratic for three days, after which a syntocinon drip was commenced. The cervix became fully dilated next day, but the head remained high, and a lower segment Caesarean section was performed because of maternal distress. The foetus was macerated and weighed over 13 lb. (5·9 Kg.). The patient became shocked during the operation, and she was transfused, but her condition remained poor and she died two days later, probably from infection.

In addition to these two cases, there were six other deaths associated with diabetes. One death was thought to be due to Mendleson's syndrome following an elective Caesarean section, two were due to pulmonary embolism following Caesarean section, two followed acute infections, and the sixth was associated with sickle cell anaemia and it was uncertain whether the diabetes was coincidental or caused by thrombosis of the pancreatic vessels.

Suicide

During the three years 1964–66 there were nine deaths from suicide, of which seven were post-partum and presumably due to puerperal insanity. One of these was also found to have a cerebellar tumour. Only two deaths from suicide occurred during pregnancy, one, at about twenty weeks, was a married woman with six children, and the other at eight months, was attending a psychiatric clinic, having attempted suicide in early pregnancy.

Between 1956 and the present enquiry series confidential reports were received on fourteen deaths from suicide, of which eight were post-partum and six occurred during pregnancy.

It should perhaps be made clear that deaths from suicide in the early months of pregnancy are unlikely to be included in the Enquiry series, because the fact of pregnancy may not be mentioned on the death certificate. The number of such cases is unknown. Thanks to the co-operation of Coroners and the Home Office, confidential copies of post-mortem reports of suicides associated with pregnancy or the puerperium are now being sent to the Chief Medical Officer of the Ministry of Health, and in future more information should be available for the confidential enquiry.

Miscellaneous Cases

1. *Inversion of Uterus.* A primigravida, delivered in a consultant unit, gradually become shocked three to four hours after a spontaneous delivery, and she died without the diagnosis being made. There was delay in calling in medical aid, and failure to make a vaginal examination.

2. *Intraperitoneal haemorrhage* from rupture of a uterine vessel caused the death of a young primigravida. She was admitted to hospital with air hunger and abdominal pain, which was thought to be due to concealed accidental haemorrhage. Artificial rupture of the membranes caused some improvement in her condition, but then she collapsed and died. This death was considered to be unavoidable because of the rarity of this condition and the difficulty of diagnosis.

3. *Carcinoma of the Breast.* A patient, who had had a radical mastectomy and deep X-ray therapy five years previously, was allowed to continue with her pregnancy after consultation with her general surgeon. She developed gland metastases in the last two months of her pregnancy and died a month after delivery. This death was assessed as unavoidable.

14. THE BOOKING ARRANGEMENTS FOR ALL PATIENTS IN THE ENQUIRY SERIES

An analysis has been made of the deaths of all patients in the 1964–66 enquiry series according to the original booking arrangements for the place of confinement. There were 755 deaths, 349 occurred in women originally booked for delivery in a consultant obstetric unit, 8 for delivery in private nursing homes, 76 for delivery in a general practitioner maternity home, and 125 were booked for a domiciliary confinement. In seven instances no information was given on the enquiry form. The remaining 190 women who died had no arrangements made for their confinements.

Patients for whom no booking arrangements had been made

There were 190 in this group and 147 of them received no ante-natal care. In all except seventeen, the maternal death occurred before the foetus became viable. One hundred and twenty-one died from abortion and thirty-four from ruptured ectopic pregnancy.

Forty-three deaths occurred amongst women who were receiving ante-natal care but for whom arrangements had not been made for the place of delivery. Twenty-four of these deaths followed abortions and five died from ruptured ectopic pregnancy. Eleven other women died before the foetus was viable, seven of them in the first trimester, three because of pulmonary embolism and the others from associated disease. Three women died at term. One attended both her family doctor and the hospital ante-natal clinic early in pregnancy but was not seen again until eclampsia occurred. Because the woman failed to keep her clinic appointment no arrangement was made for the confinement and there was no record that any attempt had been made to discover why she defaulted and to ensure that she received ante-natal care. Another woman who had a history of five normal pregnancies and deliveries requested ante-natal care from her family doctor; he referred her for a hospital booking because of her multiparity but she did not keep her appointment; she had no ante-natal care until admitted to hospital with severe toxaemia superimposed on long standing arteriosclerotic heart disease. The third woman had had severe toxaemia in her four previous pregnancies but did not seek ante-natal care until the last month of her pregnancy and she died at home from severe pre-eclamptic toxaemia.

Patients booked for a domiciliary confinement

There were 125 deaths amongst women originally booked for a domiciliary confinement. Twenty-seven died in their homes before the onset of labour, and forty-four during or after labour. Thirteen women had their booking arrangement changed to a consultant maternity unit during the ante-natal period, and four of them died in hospital before labour began. Forty-one were transferred as emergencies and were delivered in hospital, twenty-seven of these births resulting in live babies.

The duration of pregnancy of women who died who were booked for confinement at home was:

Duration of pregnancy in weeks	*Number of women*
Less than 14	2
14–28	7
29–32	7
33–36	14
37–40	48
Between 40 and 41	27
Between 41 and 42	11
More than 42	7
Not stated	2
	125

In the 125 women booked for a home confinement the causes of death were:

Toxaemia (including 10 deaths from eclampsia) ...	15
Accidental ante-partum haemorrhage	4
Placenta praevia	1
Ruptured uterus	6
Malpresentation, malposition, disproportion, etc. ...	6
Post-partum haemorrhage	7
Amniotic fluid embolism	7
Pulmonary embolism	23
(before delivery 4)	
(puerperal 19)	
Puerperal cerebral thrombosis	1
Puerperal sepsis	10
Other puerperal complications	3
Abortion and ectopic pregnancy	6
Cardiac disease	7
Diabetes	1
Liver failure	3
Other associated conditions	25
	125

The importance of death from pulmonary embolism is immediately apparent and of the twenty-three women who died, five were known to have phlebothrombosis in the legs.

The need for more careful ante-natal care and earlier referral for expert advice is clear when women who suffer from toxaemia and other obstetric complications such as disproportion and attend regularly for examination are allowed to die from these causes. Deaths from sepsis in domiciliary midwifery suggest inadequate aseptic precautions in the home.

TABLE XXXVIII

Deaths in women, by age, booked for delivery in their Own Home.

Age (years)	Maternities (deliveries which occurred at home)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
		Number	Proportion per thousand maternities	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent
Under 16	163	—	0·130	—	75	—	25
16 and 17	30,835	1		1		—	
18 and 19		3		2		1	
20–24	204,900	28	0·137	20	71	8	29
25–29	252,943	37	0·146	27	73	10	27
30–34	134,640	29	0·215	19	66	10	34
35–39	51,698	21	0·406	8	38	13	62
40–44	8,825	5	0·567	1	20	4	80
45 and over	397	1	2·519	1	100	—	
All	684,401	125	0·183	79	63	46	37

TABLE XXXIX

Deaths in women, by parity, booked for delivery in their Own Home.

Parity*	Maternities (deliveries which occurred at home)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
		Number	Proportion per thousand maternities	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent
1	91,667	16	0·175	13	81	3	19
2	276,896	35	0·126	25	71	10	29
3	178,066	36	0·202	21	58	15	42
4	83,339	13	0·156	10	77	3	23
5–9	54,433	24	0·459	10	42	14	58
10 or more		1		—	—	1	100
All	684,401	125	0·183	79	63	46	37

* For definition of parity see page 7.

The age and parity distribution of women booked for delivery in their own home is shown in Tables XXXVIII and XXXIX. The figures, as in previous reports, demonstrate the enhanced risk of pregnancy with advancing age and in the higher parities. These women might have died had they been booked for delivery in hospital but surely they should be booked for delivery in a place where facilities for blood transfusion and surgical intervention are readily available. It will be noted that not all the deaths assessed as having no avoidable factors were of women correctly booked for a home confinement; but however unsuitable the booking arrangement it was not counted as an avoidable factor unless there was evidence that it had some bearing on the subsequent death.

Despite general agreement that the criterion for a confinement to take place at home should be the anticipation that pregnancy, labour and the puerperium will be normal, at the time of booking there were fifty-four women who were not normal according to accepted criteria and who were unwisely booked for delivery at home. Twenty-seven were women over the age of 35 years and two older than 30 years who were pregnant for the first time. Twenty-five women were having their fifth or subsequent pregnancy. Nine were known to have impairment of their general health, one because of diabetes, five because of heart lesions, one had chronic renal disease, another hypertension and the other

was known to suffer from sickle cell anaemia. Six women had had obstetric complications in previous pregnancies but consultant help and advice was not sought in the fatal pregnancy and they were booked for a confinement at home. Three died at home from eclampsia, one from ruptured uterus, one from haemorrhage and one whose previous baby was stillborn died from puerperal pulmonary embolism.

In twenty-four of the fifty-four women unsuitable booking arrangements were considered an avoidable factor in the chain of events which ended in death. In two of the twenty-four the woman herself was solely responsibile for the unsuitable arrangements, in one a midwife, in six the patient and midwife shared the responsibility, and in fifteen the doctor acceded to the patient's wish to be confined at home and there was no record that any real attempt had been made to persuade the patient or her husband that it would be safer for the confinement to occur where the full resources of a consultant unit were immediately available. In one instance a consultant obstetrician failed to book for hospital confinement an elderly woman who was hypertensive. Four women in whom there were indications for hospital confinement at the time of booking might not have died had consultant help been obtained as soon as signs of toxaemia occurred. Three died from eclampsia and one from severe toxaemia. Three others whose deaths were due to diabetes, mitral stenosis and ruptured uterus might have survived had their ante-natal care been less cursory and consultant advice obtained before disasters occurred in labour.

Eight women in whom nothing was detected to necessitate a hospital booking at the beginning of pregnancy developed complications during the ante-natal period. Five might have survived had consultant advice been sought or the booking been changed when complications occurred. In two of these women ante-natal care was deficient and symptoms of toxaemia went unheeded, in one case by a midwife and in another by midwife and doctor.

Six women who died at home might have lived had the assistance of the flying squad been requested. One died from a ruptured uterus, three from post-partum haemorrhage, one from puerperal sepsis which occurred when she was severely anaemic following haemorrhage after delivery, and in another blood loss followed by puerperal anaemia in a woman already suffering from chronic rheumatic heart disease proved fatal. Not one of these women was referred for consultant advice or help.

Patients booked for delivery in general practitioner maternity homes

In the three years under review there were seventy-six deaths amongst women originally booked for delivery in a general practitioner maternity home. Three died in the early months of pregnancy, one from pulmonary embolism, one from abortion associated with toxaemia and the third from a carneous mole. Twelve others died undelivered. Thirty-two were confined in the maternity home for which they were booked for delivery but died during or after labour. Seven women had their booking arrangements changed to a consultant maternity unit during the ante-natal period and twenty-two were transferred as emergencies, five of them before labour commenced.

The duration of pregnancy of women who died who were booked for confinement in general practitioner maternity homes was:

Duration of pregnancy in weeks	*Number of women*
Less than 14	1
14–28	2
29–32	2
33–36	13
37–40	29
Between 40 and 41	17
Between 41 and 42	10
More than 42	1
Not stated	1
	—
	76
	—

TABLE XL

Deaths in women, by age, booked for Delivery in a General Practitioner Maternity Home.

Age (years)	Maternities (deliveries which occurred in N.H.S. and other hospitals)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
		Number	Proportion per thousand maternities	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent
Under 16		—		—		—	
16–17	209,182	2	0·043	2	100	—	
18–19		7		4	57	3	43
20–24	620,855	19	0·031	17	90	2	10
25–29	528,236	19	0·036	12	63	7	37
30–34	298,756	13	0·044	7	54	6	46
35–39	164,003	11	0·067	2	18	9	82
40–44	54,435	5	0·092	1	20	4	80
45 and over	3,728	—		—		—	
All	1,879,195	76	0·040	45	59	31	41

TABLE XLI

Deaths in women, by parity, booked for delivery in a General Practitioner Maternity Home.

Parity*	Maternities (deliveries which occurred in N.H.S. and other hospitals)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
		Number	Proportion per thousand maternities	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent
1	850,829	40	0·047	29	72	11	28
2	499,837	13	0·026	9	69	4	31
3	247,691	5	0·020	3	60	2	40
4	123,176	7	0·057	1	14	6	86
5–9	157,662	11	0·070	3	27	8	73
10 or more		—		—		—	
All	1,879,195	76	0·040	45	59	31	41

* For definition of parity see page 7.

The age and parity distribution of the seventy-six women who died who were booked for delivery in general practitioner maternity homes is shown in Tables XL and XLI. Over half the women were primigravidae but the number by age and parity distribution of women delivered in general practitioner maternity homes is unknown so it is impossible to compare these figures with the distribution of all women delivered in general practitioner maternity homes. Six deaths listed in the tables as having no avoidable factor were in women who were potentially at risk because of multiparity or on account of their age, but because the unwise booking arrangement was not a factor which adversely influenced the outcome, they were not included with the deaths in which avoidable factors were present.

For the purpose of this enquiry a general practitioner maternity home is defined as a place equipped for *normal* obstetrics where the patient remains under the care of a general practitioner and there is no resident doctor. Because the full resources of a consultant unit are not *immediately available* and a doctor may not be *immediately available* it is generally agreed that the women booked for delivery in these units should:

1. As far as can be ascertained have unimpaired physical health.
2. Be pregnant for the second, third or fourth time, the previous pregnancies, labour and puerperia having all been normal; and should be less than 35 years of age.
3. If a primigravida be less than 30 years of age.
4. Be known to have no Rhesus antibodies.*

Twenty-eight women died who were booked for delivery in general practitioner maternity homes who did not fulfil these criteria at the time the booking arrangement was made. Of these women, eleven were having their fifth or more child; three who were pregnant for the first time were over the age of 30 years, sixteen were aged more than 35 years, and twelve had adverse obstetric histories. Three were known to have heart lesions, two of whom were never referred to either a consultant obstetrician or physician, one was known to have suffered from several episodes of heart failure in a previous pregnancy, one was elderly and had not been pregnant for sixteen years. Five of the women who died from pre-eclamptic toxaemia or eclampsia gave a history of similar trouble in previous pregnancies. One woman whose first pregnancy was complicated by a long and inert labour was booked for her second confinement in a general practitioner maternity home where she had a similar type of labour and eventually died from puerperal sepsis. Another whose first baby was delivered by forceps and whose second pregnancy resulted in a late abortion complicated by sepsis and massive blood loss had her labour induced by intermittent intramuscular pitocin injections in a general practitioner maternity home where she died from a ruptured uterus.

* In the opinion of the Regional Assessors and Consultant Advisers Rh (D) negative primiparae and Rh (D) negative unsensitized multiparae who do not have a surviving child should not be booked for delivery at home or in general practitioner maternity homes, because, if the immunisation of these women who are not yet sensitized is to be prevented, they should be tested to discover whether their blood contains sufficient foetal cells to make sensitization likely, and if it does they should be given an intramuscular injection of immunoglobulin within thirty-six hours of delivery. If the baby is born late on a Saturday night or during a holiday weekend this procedure may be impossible unless the patient is confined in a place where pathology services are immediately available.

The causes of death in the seventy-six women originally booked for their confinement in general practitioner maternity homes were:

Toxaemia (including 4 deaths from eclampsia) ...	5
Accidental ante-partum haemorrhage	3
Placenta praevia	1
Ruptured uterus	4
Malpresentation, malposition, disproportion and prolonged labour (the actual cause of death was anaesthetic misadventure in 6 and sepsis in 4) ...	10
Post-partum haemorrhage	9
Amniotic fluid embolism	3
Pulmonary embolism ... ... (before delivery 4) (puerperal 6)	10
Puerperal sepsis and mastitis	9
Other puerperal complications	1
Abortion	2
Cardiac disease	4
Liver failure	2
Other associated conditions	13
	76

Ten deaths occurred because of pulmonary embolism but in only one instance was the woman known to suffer from phlebo-thrombosis and none were considered to have avoidable factors. One of the women who died from puerperal sepsis had a normal delivery and at her own request was discharged to her home forty-eight hours after delivery where she received regular visits from her domiciliary midwife and family doctor. At first all seemed well but symptoms of sepsis developed and for three days she was left at home with pyrexia and her condition steadily deteriorated. When unforeseen complications occur in the home in recently delivered mothers, lives might be saved by arranging either an obstetric domiciliary consultation or the admission of the mother to hospital before she becomes seriously ill.

Four of the ten women who died from obstetric complications such as disproportion and prolonged labour died from sepsis. All four had emergency Caesarean section operations, one in the maternity home and three after transfer in labour to a consultant obstetric unit. One of the women whose uterus ruptured was also transferred as an emergency and died from post-operative sepsis. Six other women who suffered from disproportion or prolonged labour died from anaesthesia administered in two cases in the general practitioner maternity home and in four after transfer to a consultant obstetric unit.

Five women who died from haemorrhage were healthy and obstetrically normal at the time of booking and throughout the ante-natal period. In two cases the flying squad was not summoned and in three help was requested far too late.

Three women died who had unforeseen complications. Responsibility was accepted by doctors whose status was such that they had inadequate knowledge and experience. In one case the woman's episiotomy wound became infected and broke down whilst in her general practitioner maternity home. After she had been discharged home she became severely ill with peritonitis and paralytic ileus. She was sent into hospital into a general surgical ward where it was reported she received no treatment and for forty-eight hours was not seen by any one more senior than a house surgeon. An obese woman who was discovered during labour to have a large baby presenting as a breech, was delivered by Caesarean section in the maternity home by an unsupervised general practitioner clinical assistant who performed abdominal operations no more than once or twice a year. The third woman had a prolonged labour in a general practitioner maternity home where she was supervised by her general practitioner and her progress assessed by repeated vaginal examinations. When tachycardia and ketonuria developed she was transferred to hospital where an inexperienced registrar applied forceps but failed to deliver the baby; he thereupon did a Caesarean section. Despite the presence of two consultant obstetritions in the hospital at the time, neither was informed of these events. In these three cases clinical management was defective and this was caused by the administrative failure to ensure that consultant obstetrician opinion be obtained at an early stage in all such cases.

Patients booked for a private nursing home

Eight women died who were originally booked for delivery in private nursing homes which did not have the facilities or equipment of a consultant obstetric unit and where there was no resident medical officer. Four women remained under the sole care of their family doctor, three were transferred to a consultant maternity unit when complications occurred, and one received care from a consultant obstetrician. Four of the women were more than 35 years of age, one of whom also had an adverse obstetric history and another was known to have diabetes when the booking arrangements were made. Avoidable factors were present in the events which resulted in six of the deaths. In one instance the unsuitable booking arrangement was considered an avoidable factor in a death from eclampsia, but death still might not have occurred had consultant advice been sought or the booking arrangements changed when symptoms of pre-eclamptic toxaemia developed. In two women obstetric complications during labour were allowed to continue far too long before consultant help was obtained; two women died as a result of anaesthesia, and facilities were not immediately available to deal with inhaled vomit.

Patients booked for delivery in consultant obstetric hospitals

There were 349 deaths amongst women originally booked for delivery in consultant obstetric hospitals; 101 died from causes associated with pregnancy or childbirth and 248 were true maternal deaths. The causes were:

	Total	*Number with avoidable factors*
Associated deaths:		
Cardiac disease	30	3
Liver failure	3	—
Chronic renal disease	5	—
Diabetes	3	1
Sickle cell anaemia	4	2
Other	56	2
	101	8
True maternal deaths:		
Abortion	11	7
Ectopic pregnancy	4	1
Ante-natal complications e.g. anaemia arising during pregnancy	6	3
Toxaemia (including 20 deaths from eclampsia)	38	15
Accidental ante-partum haemorrhage ...	17	3
Placenta praevia	13	4
Ruptured uterus	17	12
Malpresentation, malposition, disproportion and prolonged labour	37	20
(The actual causes of death were:		
Anaesthetic misadventure 22		
Haemorrhage during Caesarean section 3		
Post-operative sepsis 9		
Paralytic ileus 2		
Air embolism ... ... 1)		
Other complications of pregnancy and delivery such as foetal distress, prolonged pregnancy and inversion of the uterus. The actual causes of death were post-operative sepsis in 4, anaesthetic misadventure in 3 and shock in one.	8	1
Postpartum haemorrhage	9	1
Amniotic fluid embolism	18	—
Pulmonary embolism	48	2
(before delivery 10)		
(puerperal 38)		
Puerperal cerebral thrombosis	1	—
Puerperal sepsis	10	2
Other puerperal complications	11	—
	248	71

The duration of pregnancy of women who died and were originally booked for delivery in hospital was:

Duration of pregnancy in weeks	*Associated deaths*	*True maternal deaths*
Less than 14	—	2
14–28	14	19
29–32	13	7
33–36	25	39
37–40	38	101
Between 40 and 41	8	41
Between 41 and 42	3	21
More than 42	—	15
Not stated	—	3
	101	248

In many cases, the ante-natal care of the women who died and were booked for their confinement in hospital was shared between the hospital and domiciliary services; in this enquiry series in no case is it suggested that the patient suffered because the various doctors and midwives were unaware of each others' findings. The increased use of record-co-operation cards in obstetric departments may have helped to minimize this hazard. Ante-natal care for women who died who were booked for hospital was as follows:

	Associated deaths	*True maternal deaths*
Consultant hospital obstetric team ...	47	116
Hospital care shared with general practitioner	48	120
Hospital care shared with local health authority medical officer	—	11
General practitioner	5	—
General practitioner shared with local health authority medical officer ...	1	—
Local health authority medical officer ...	—	1
	101	248

The age and parity distribution and the deaths in which there were avoidable factors are shown in Tables XLII and XLIII.

TABLE XLII

Deaths in women, by age, booked for delivery in Hospital.

Age (years)	Maternities (deliveries which occurred in N.H.S. and other hospitals)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
		Number	Proportion per thousand maternities	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent
Under 16	209,182	—	0·100	—	—	—	—
16–17		4		4	100	—	—
18–19		17		15	88	2	12
20–24	620,855	54	0·087	36	67	18	33
25–29	528,236	82	0·155	65	79	17	21
30–34	298,756	82	0·274	62	76	20	24
35–39	164,003	66	0·402	53	80	13	20
40–44	54,435	39	0·716	31	79	8	21
45 and over	3,728	5	1·341	4	80	1	20
All	1,879,195	349	0·183	270	77	79	23

TABLE XLIII

Deaths in women by parity, booked for delivery in Hospital.

Parity*	Maternities (deliveries which occurred in N.H.S. and other hospitals)	All deaths		Deaths with no avoidable factor present		Deaths with avoidable factor present	
		Number	Proportion per thousand maternities	Number	Proportion of all deaths per cent	Number	Proportion of all deaths per cent
1	850,829	128	0·150	98	77	30	23
2	499,837	69	0·138	58	84	11	16
3	247,691	49	0·198	39	80	10	20
4	123,176	33	0·268	29	88	4	12
5–9	157,662	62	0·444	41	66	21	34
10 or more		7		5	71	2	29
Not stated	—	1		—		1	100
All	1,879,195	349	0·186	270	77	79	23

* For definition of parity see page 7.

It will be noted that even when booked for hospital where the full resources of equipment and expertise are immediately available, and in those cases where no avoidable factors were discovered, the older women and the women in the higher parities are at greater risk than younger women with smaller families.

The commonest avoidable factor which adversely affected the outcome for the women booked for delivery in hospital was inadequate ante-natal care. In thirteen instances this was because the patient failed to keep her clinic appointment or follow the advice given her, but in three cases no attempt was made to follow up the defaulting patient. One patient who attended an ante-natal clinic regularly never saw a doctor more senior than a house officer and never had her haemoglobin estimated. The consultant obstetrician was considered responsible for the administrative arrangements which permitted this to occur. An anaemic patient who did not respond to routine iron and folic acid medication was not investigated despite the severity and chronicity of the condition and she eventually died from haemorrhage. In cases of pre-eclamptic toxaemia there were fifteen instances where women with mild signs were given long intervals between

clinic appointments or women with more severe signs allowed home and not seen until the next clinic appointment a week later. The consultant was directly responsible in seven cases, a registrar in one, and a general practitioner in seven.

During labour the chief avoidable factor was assumption by junior hospital staff of too much responsibility and their failing to inform and seek the help and advice of their seniors. This factor was present in nine deaths from ruptured uterus, in one from disproportion when the patient died from haemorrhage during Caesarean section, in one from placenta praevia when operative intervention should have occurred much earlier, and in another from inversion of the uterus together with delay in seeking consultant help when the patient failed to respond to treatment for shock. Four patients died from haemorrhage whose lives might have been saved had there not been failure or delay in commencing blood transfusion.

Two patients died in whom unsuitable early discharge was considered an avoidable factor. One was complaining of pain in the chest whilst in hospital and she died at home from pulmonary embolism. Another, who had an episiotomy wound which was infected and breaking down when she left hospital, died from septicaemia. Organised schemes for discharge of suitable patients within a few days of delivery have become established as a normal pattern in maternity care and are accepted by most obstetricians and midwives and have proved popular with patients, so the advice given in the memorandum issued by the Standing Maternity and Midwifery Advisory Committee in April 1965 is relevant:–

"(*a*) The mothers for early discharge should be selected by the consultant obstetrician as early as possible in pregnancy, the implications of early discharge fully explained to them and their agreement obtained.

(*b*) The local health authority should be asked to assess whether the patient's home circumstances are suitable.

(*c*) The general practitioner should be asked if he will accept medical responsibility for the mother and baby on their discharge.

(*d*) During pregnancy the plan should be kept under review and modified, if necessary, in the light of individual circumstances.

(*e*) The responsibility for early discharge after confinement rests with the consultant obstetrician and paediatrician. The mother and baby should be examined before discharge to ensure that they are not discharged until both have been examined and found to be fit. If the examination is undertaken by junior medical staff, especially where discharge takes place very shortly after confinement, the medical considerations should have been fully explained to them. The local health authority and the general practitioner should be informed of the decision. Immediate re-admission should be accepted without question if requested."

15. FACTORS INFLUENCING MATERNAL MORTALITY IN THE WHOLE SERIES

The confidential enquiries into maternal mortality began in 1952 and the first report was concerned with the years 1952–54 since which time "true" and "associated" maternal deaths in the enquiry series have almost halved and the rate per 100,000 births has more than halved.

TABLE XLIV

All deaths in the enquiry series compared with total maternities.

	Total maternities	Deaths directly due to pregnancy and childbirth		Deaths associated with pregnancy and childbirth	
		Number	Rate per 100,000 maternities	Number	Rate per 100,000 maternities
1952–54	2,052,953	1,094	53·3	316	15·4
1955–57	2,113,471	861	40·7	339	16·0
1958–60	2,294,414	742	32·3	254	11·1
1961–63	2,520,420	692	27·5	244	9·7
1964–66	2,600,367	579	22·3	176	6·8

There has been a significant reduction of deaths in the present series compared with 1961–63 mainly because of fewer deaths from toxaemia (91 to 63), post-partum haemorrhage (34 to 14), pulmonary embolism (129 to 91) and cardiac disease (81 to 50).

The number of deaths in which avoidable factors were considered to be present is shown for each cause of death and in the whole series in Tables 1 and 2 in Appendix I and they have been discussed in relation to the principal causes of death in the preceding chapters. Reports of 579 deaths directly due to pregnancy and childbirth were received for this enquiry for the years 1964–66. Of the 579 reported deaths 263 or 45 per cent had avoidable factors. Reports were also received for 176 deaths associated with, although not directly due to, pregnancy and childbirth, of which 23 or 13 per cent had avoidable factors. The presence of an avoidable factor or factors does not mean that death could have been averted, or that a factor identified as avoidable was the cause of the mother's death. It does mean that there is reason to believe that if the avoidable factor or factors had been recognized or anticipated or handled differently a fatal issue might have been avoided.

The number of deaths with avoidable factors is shown in Table XLV.

TABLE XLV

Number of deaths with avoidable factors in the enquiry series.

	Deaths directly due to pregnancy or childbirth	Deaths associated with pregnancy and childbirth
1952–54	472	53
1955–57	353	57
1958–60	315	45
1961–63	262	34
1964–66	263	23

The proportion of deaths with avoidable factors among all deaths in each enquiry series is shown in Table XLVI.

TABLE XLVI

Deaths with avoidable factors as a percentage of deaths in the enquiry series.

	1952–54	1955–57	1958–60	1961–63	1964–66
Deaths directly due to pregnancy and childbirth	43·1	41·0	42·5	37·9	44·6
Deaths directly due to pregnancy and childbirth excluding abortion and ectopic pregnancy ...	40·0	37·3	38·9	34·4	34·9
Deaths associated with pregnancy and childbirth ...	16·8	16·8	17·7	13·9	13·1

Assignment for responsibility for avoidable factors is tabulated in Table XLVII. In one column are listed deaths with avoidable factors in which it was considered that one person was wholly responsible for the avoidable factor(s). The other column indicates those in which responsibility was shared, or there was more than one avoidable factor with differing responsibility.

TABLE XLVII

The apportionment of responsibility for avoidable factors in the 281 deaths with avoidable factors.

	Entirely responsible		Partially responsible	
	1961–63	1964–66	1961–63	1964–66
Hospital:				
Consultant obstetrician ...	25	33	20	29
Obstetric registrar or houseman	13	5	18	14
Hospital midwife	1	—	1	1
Anaesthetist	6	14	2	10
Consultants in other specialities	2	2	1	3
General practitioner maternity home:				
Consultant obstetrician ...	2	—	2	5
General practitioner	21	7	5	5
Midwife	—	—	2	2
Domiciliary service:				
Consultant obstetrician ...	1	7	1	1
General practitioner	32	17	55	37
Local Health Authority Medical Officer	—	—	5	—
Domiciliary midwife	—	1	21	10
Patient	121	128	33	21

It will be seen that the majority of avoidable factors were the responsibility of the patient herself and in ninety-eight cases this was by seeking illegal termination of the pregnancy.

Although deaths from haemorrhage have been more than halved since the commencement of the enquiry series, if haemorrhage from abortion, during Caesarean section or because of ruptured ectopic pregnancy and rupture of the uterus are added to those coded to placenta praevia, accidental haemorrhage and post-partum haemorrhage, then haemorrhage is the most important cause of death and accounts for more than one-quarter of true maternal deaths. It would seem that within the boundaries of present medical knowledge and by better and earlier use of existing facilities many of these deaths could be prevented.

In this enquiry series attention is drawn to the fact that the second most common cause of maternal death is sepsis if septic abortions are included, a fact that is concealed by tables compiled from the international classification of diseases where deaths are attributed to the underlying disease or abnormality and not to the final cause of death. Sepsis acquired in the patient's home, in general practitioner maternity units and in hospital suggest inadequate standards of asepsis, and in many instances no attempt was made to detect the infecting organism and determine effective treatment until after the patient's death. The 123 women who died from sepsis are a salutary reminder that despite modern drugs post-abortal and puerperal sepsis are still killing diseases.

During the years 1964–66 there was a disquieting rise in deaths associated with anaesthesia, a rise proportionally greater than the increase in number of

births during the same period. This may reflect a greater use of anaesthesia during pregnancy and childbirth and figures are not available to discover if this is the sole cause. Whatever the reason the findings of this enquiry suggest that a skilled anaesthetist must be immediately available whenever and wherever abnormal obstetric work is undertaken.

Figure 4 in chapter 1 of this report illustrates the increasing proportion of births occurring in hospital, and it may be that this steady increase is one of several factors which have tended to reduce the number of deaths due to or associated with pregnancy and childbirth. The figures in Tables XXXVIII and XXXIX show a rate of 0·183 deaths amongst women booked for home confinement per 1,000 births at home where only normal confinements are or should be undertaken. Tables XLII and XLIII give deaths among women booked for delivery in hospital where the chance of complication ending in death is considerably weighted by the deliberate selection of medically and obstetrically abnormal women and those living in adverse social circumstances.

An age-parity analysis was made of all women who died whose age and parity was reported in the 1964–66 series and is shown in Table 8 of Appendix I. It will be seen that death increased with age independent of parity and the safest age for the mother having a first baby was between 20 and 25 years whereas the primigravida of 40 years or more was at greatest danger. At any age the maternal death rate was considerably increased amongst women who were having their fifth or more child, and this was also true of women over the age of 40 years regardless of parity. The reduction in maternal mortality since the previous three-year period is therefore partially due to the fact that during the years 1964–66 fewer babies were born to women over the age of 29 (see Appendix I, Table 4) and fewer women had five or more children (see Appendix I, Table 6).

APPENDIX I—TABLE 1

Deaths due to Pregnancy and Childbirth, 1964–66.

International List No.	Cause of Death	1964			1965			1966			1964–66			
		R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		
			Total	Avoidable		Total	Avoidable		Total	Avoidable		Total	Avoidable Number	Avoidable Percentage
640	Pyelitis and pyelonephritis of pregnancy	—	1	—	1	—	—	2	—	—	3	1	—	—
641	Other infections of genito-urinary tract during pregnancy	—	1	1	—	—	—	—	—	—	—	1	1	100
642	Toxaemias of pregnancy	30	14	8	38	28	17	35	23	12	103	65	37	57
643	Placenta praevia	—	2	2	—	1	1	1	1	1	1	4	4	100
644	Other haemorrhage of pregnancy	—	6	2	1	7	2	—	1	1	1	14	5	36
645	Ectopic pregnancy	21	21	3	11	8	1	17	13	3	49	42	7	17
646	Anaemia of pregnancy	—	2	2	3	1	—	—	—	—	3	3	2	67
648	Other complications arising from pregnancy	20	14	1	12	5	2	15	9	—	47	29	3	10
649	Pregnancy associated with other conditions	—	—	—	—	1	—	—	—	—	—	1	—	0
650	Abortion without mention of sepsis or toxaemia	16	18	16	21	24	21	19	17	15	56	59	52	88
651	Abortion with sepsis	29	29	24	29	22	19	29	18	12	87	69	55	80
652	Abortion with toxaemia without mention of sepsis	5	3	1	2	1	1	5	1	1	12	5	3	60
660	Delivery without mention of complication	5	—	—	9	—	—	9	1	—	23	1	—	—
670	Delivery complicated by placenta praevia or ante-partum haemorrhage	7	5	—	12	8	3	12	12	2	31	25	5	20
671	Delivery complicated by retained placenta	5	3	2	5	5	1	4	3	1	14	11	4	36
672	Delivery complicated by other post-partum haemorrhage	7	5	3	6	3	2	10	6	4	23	14	9	64
673	Delivery complicated by abnormality of bony pelvis	—	—	—	—	—	—	1	—	—	1	—	—	—
674	Delivery complicated by disproportion or malposition of foetus	7	8	5	3	12	8	9	14	5	19	34	18	53
675	Delivery complicated by prolonged labour of other origin	6	8	5	9	5	3	6	2	1	21	15	9	60
676	Delivery with laceration of perineum without mention of other laceration	—	1	—	—	—	—	—	—	—	—	1	—	—
677	Delivery with other trauma	11	14	11	1	4	1	5	10	8	17	28	20	71
678	Delivery with other complication of childbirth	15	9	2	22	17	2	18	16	1	55	42	5	12
680	Puerperal urinary infection without other sepsis	1	—	—	1	—	—	—	—	—	2	—	—	—
681	Sepsis of childbirth and the puerperium	10	9	6	4	6	1	7	13	5	21	28	12	43
682	Puerperal phlebitis and thrombosis	16	—	—	14	—	—	9	—	—	39	—	—	—
683	Pyrexia of unknown origin during the puerperium	—	—	—	—	—	—	—	—	—	—	—	—	—
684	Puerperal pulmonary embolism	6	24	5	3	21	2	2	23	2	11	67	9	13
685	Puerperal eclampsia	4	1	—	7	1	—	2	—	—	13	2	—	—
686	Other forms of puerperal toxaemia	—	—	—	3	—	—	1	—	—	4	—	—	—
687	Cerebral haemorrhage of the puerperium	1	2	—	3	1	—	2	—	—	6	3	—	—
688	Other and unspecified complications of the puerperium	4	5	2	1	3	—	3	5	—	8	13	2	15
689	Mastitis and other disorders of lactation	1	2	1	—	—	—	—	—	—	1	2	1	50
	Maternal deaths omitting those due to ectopic pregnancy and abortion	156	136	58	158	129	45	153	139	43	467	404	141	35
	Maternal deaths due to ectopic pregnancy and abortion	71	71	44	63	55	42	70	49	31	204	175	117	67
	Total Maternal Deaths	227	207	102	221	184	87	223	188	74	671	579	263	45

APPENDIX I—TABLE 2

Deaths not classed to pregnancy or childbirth but associated therewith, 1964–1966.

Cause of Death and I.C.D. No.	1964			1965			1966			1964–66			
	R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		
		Total	Avoidable		Total	Avoidable		Total	Avoidable		Total	Avoidable Number	Avoidable Percentage
I. Infective and parasitic diseases	2	2	—	2	5	—	2	3	—	6	10	—	0
002 Pulmonary tuberculosis	1	—	—	1	1	—	2	—	—	4	1	—	0
022 Aneurysm of aorta	—	1	—	—	—	—	—	—	—	—	1	—	0
023 Other cardiovascular syphilis	1	1	—	—	—	—	—	—	—	1	1	—	0
046 Amoebiasis	—	—	—	—	1	—	—	—	—	—	1	—	0
053 Septicaemia and pyaemia	—	—	—	—	1	—	—	—	—	—	1	—	0
082 Acute infectious encephalitis	—	—	—	1	1	—	—	—	—	1	1	—	0
092 Infectious hepatitis	—	—	—	—	1	—	—	3	—	—	4	—	0
II. Neoplasms	9	9	—	11	9	—	12	9	—	32	27	—	0
140–199 Malignant neoplasms	3	—	—	5	—	—	8	—	—	16	—	—	0
151 Malignant neoplasm of stomach	—	—	—	—	1	—	—	—	—	—	1	—	0
153 Malignant neoplasm of large intestine, except rectum	—	—	—	—	—	—	—	1	—	—	1	—	0
156 Malignant neoplasm of liver (secondary and unspecified)	—	—	—	—	—	—	—	1	—	—	1	—	0
157 Malignant neoplasm of pancreas	—	1	—	—	—	—	—	—	—	—	1	—	0
163 Malignant neoplasm of lung	—	—	—	—	—	—	—	1	—	—	1	—	0
170 Malignant neoplasm of breast	—	1	—	—	2	—	—	3	—	—	6	—	0
171 Malignant neoplasm of cervix uteri	—	—	—	—	1	—	—	—	—	—	1	—	0
173 Chorion epithelioma	—	—	—	—	—	—	—	1	—	—	1	—	0
175 Malignant neoplasm of ovary	—	—	—	—	1	—	—	—	—	—	1	—	0
193 Malignant neoplasm of brain	—	—	—	—	1	—	—	1	—	—	2	—	0
201 Hodgkin's disease	—	—	—	1	—	—	—	—	—	1	—	—	0
203 Multiple myeloma	—	—	—	1	1	—	—	—	—	1	1	—	0
204 Leukaemia and aleukaemia	1	1	—	2	2	—	—	—	—	3	3	—	0
214 Uterine fibromyoma	1	1	—	2	—	—	2	—	—	5	1	—	0
216 Benign neoplasm of ovary	—	1	—	—	—	—	—	—	—	—	1	—	0
224 Benign neoplasm of endocrine glands	4	4	—	—	—	—	1	1	—	5	5	—	0
239 Neoplasm of unspecified nature of other and unspecified organs	—	—	—	—	—	—	1	—	—	1	—	—	—
III. Allergic, endocrine system, metabolic and nutritional diseases	3	4	2	3	2	—	5	4	1	11	10	3	30
241 Asthma	1	—	—	2	1	—	2	2	—	5	3	—	0
250 Simple goitre	1	—	—	—	—	—	—	—	—	1	—	—	0
260 Diabetes mellitus	—	2	2	1	1	—	2	2	1	3	5	3	60
285 Osteomalacia	1	1	—	—	—	—	—	—	—	1	1	—	0
287 Obesity, not specified as of endocrine origin	—	—	—	—	—	—	1	—	—	1	—	—	0
289 Other metabolic diseases	—	1	—	—	—	—	—	—	—	—	1	—	0
IV. Diseases of blood and blood-forming organs	1	—	—	1	2	1	5	4	1	7	6	2	33
292.6 Sickle cell anaemia	—	—	—	1	2	1	—	2	1	1	4	2	50
296 Purpura and other haemorrhage conditions	1	—	—	—	—	—	3	1	—	4	1	—	0
299 Other diseases of blood and blood forming organs	—	—	—	—	—	—	2	1	—	2	1	—	0

APPENDIX I—TABLE 2—*continued*

Cause of Death and I.C.D. No.	1964			1965			1966			1964–66			
	R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		
		Total	Avoidable		Total	Avoidable		Total	Avoidable		Total	Avoidable Number	Avoidable Percentage
V. **Mental, psychoneurotic and personality disorders**	—	—	—	—	—	—	—	—	—	—	—	—	0
VI. **Diseases of the nervous and sense organs**	4	7	—	2	8	—	3	14	2	9	29	2	6
330 Subarachnoid haemorrhage	2	4	—	1	5	—	1	8	1	4	17	1	59
331 Cerebral haemorrhage	—	1	—	—	2	—	2	5	1	2	8	1	13
340 Pneumococcal meningitis	1	1	—	1	1	—	—	—	—	2	2	—	0
342 Intracranial abscess	—	—	—	—	—	—	—	1	—	—	1	—	0
343 Encephalitis	—	1	—	—	—	—	—	—	—	—	1	—	0
353 Epilepsy	1	—	—	—	—	—	—	—	—	1	—	—	0
VII. **Diseases of the circulatory system**	14	13	3	9	14	1	18	20	8	41	47	12	26
410 Chronic rheumatic diseases of the mitral valve	5	7	2	3	5	—	5	7	4	13	19	6	31
411 Diseases of aortic valve specified as rheumatic	—	—	—	—	—	—	—	1	1	—	1	1	100
415 Rheumatic myocarditis	—	—	—	1	1	—	—	—	—	1	1	—	0
416 Bacterial endocarditis	—	1	1	—	—	—	1	1	1	1	2	2	100
420 Arteriosclerotic heart disease including coronary disease	4	2	—	2	4	1	3	—	—	9	6	1	17
421 Chronic endocarditis not specified as rheumatic	—	2	—	—	—	—	2	5	2	2	7	2	29
422 Other myocardial degeneration	—	1	—	2	1	—	—	—	—	2	2	—	0
430 Acute and subacute bacterial endocarditis	—	—	—	—	1	—	1	1	—	1	2	—	0
431 Acute myocarditis not specified as rheumatic	2	—	—	1	—	—	1	—	—	4	—	—	0
434 Other and unspecified diseases of heart	—	—	—	—	1	—	—	—	—	—	1	—	0
443 Unspecified hypertensive heart disease	—	—	—	—	—	—	1	—	—	1	—	—	0
444 Essential benign hypertension	1	—	—	—	—	—	1	1	—	2	1	—	0
445 Essential malignant hypertension	—	—	—	—	—	—	—	1	—	—	1	—	0
450 General arteriosclerosis	1	—	—	—	—	—	—	—	—	1	—	—	0
451 Dissecting aneurysm of aorta	1	—	—	—	—	—	1	2	—	2	2	—	0
452 Ruptured splenic aneurysm	—	—	—	—	1	—	—	—	—	—	1	—	0
456 Other diseases of arteries	—	—	—	—	—	—	2	1	—	2	1	—	0
VIII. **Diseases of the respiratory system**	8	3	—	5	2	—	3	3	1	16	8	1	12
475 Upper respiratory infection of multiple or unspecified sites	—	—	—	1	—	—	—	—	—	1	—	—	0
480 Influenza with pneumonia	—	—	—	—	—	—	—	2	—	—	2	—	0
481 Influenza	—	—	—	—	—	—	1	—	—	1	—	—	0
490–493 Pneumonia	5	—	—	1+	—	—	1+	—	—	7	—	—	0
491 Bronchopneumonia	—	2	—	1	—	—	—	—	—	1	2	—	0
492 Primary atypical pneumonia	—	1	—	1	—	—	—	—	—	—	1	—	0
500 Acute bronchitis	—	—	—	1	—	—	—	—	—	1	—	—	0
502 Chronic bronchitis	—	—	—	1	1	—	—	—	—	1	1	—	0

APPENDIX I—TABLE 2—*continued*

Cause of Death and I.C.D. No.		1964			1965			1966			1964–66			
		R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		R.G.	Enquiry Series		
			Total	Avoidable		Total	Avoidable		Total	Avoidable		Total	Avoidable Number	Avoidable Percentage
VIII.	**Diseases of the respiratory system (*continued*)**													
518	Empyema	1	—	—	—	—	—	—	—	—	1	—	—	0
520	Spontaneous pneumothorax	—	—	—	—	—	—	—	1	1	—	1	1	100
526	Bronchiectasis	—	—	—	—	—	—	1	—	—	1	—	—	0
527	Other diseases of lung and pleural cavity	2	—	—	—	1	—	—	—	—	2	1	—	0
IX.	**Diseases of the digestive system**	5	5	—	5	5	1	1	6	—	11	16	1	6
531	Dental caries	—	1	—	—	—	—	—	—	—	—	1	—	0
540	Ulcer of stomach	—	1	—	—	—	—	—	—	—	—	1	—	0
541	Ulcer of duodenum	—	—	—	1	—	—	—	—	—	1	—	—	0
550	Acute appendicitis	—	—	—	—	—	—	—	2	—	—	2	—	0
551	Appendicitis (unqualified)	1	1	—	1	—	—	—	—	—	2	1	—	0
570	Intestinal obstruction without mention of hernia	3	1	—	1	3	1	—	—	—	4	4	1	25
581	Cirrhosis of liver	1	1	—	2	1	—	—	—	—	3	2	—	0
583	Other diseases of liver—Chiarri	—	—	—	—	1	—	—	1	—	—	2	—	0
584	Cholelithiasis	—	—	—	—	—	—	1	—	—	1	—	—	0
585	Cholecystitis without mention of calculi	—	—	—	—	—	—	—	2	—	—	2	—	0
587·0	Acute pancreatitis	—	—	—	—	—	—	—	1	—	—	1	—	0
X.	**Diseases of the genito urinary system**	1	2	—	1	4	1	—	2	—	2	8	1	12
592	Chronic nephritis	—	1	—	—	2	1	—	2	—	—	5	1	20
593	Nephritis not specified as acute or chronic	—	—	—	—	1	—	—	—	—	—	1	—	0
600	Infections of kidney	—	—	—	—	1	—	—	—	—	—	1	—	0
601	Hydronephrosis	—	1	—	—	—	—	—	—	—	—	1	—	0
603	Other diseases of kidney and ureter	1	—	—	1	—	—	—	—	—	2	—	—	0
XI. XII.	**Diseases of the skin and cellular tissue**	—	—	—	1	—	—	—	—	—	1	—	—	0
XIII.	**Diseases of the bones and organs of movement**	—	1	—	—	—	—	—	—	—	—	1	—	0
XIV.	**Congenital malformations**	2	2	1	2	3	—	2	2	1	6	7	2	29
754	Fallet's tetralogy	—	—	—	1	1	—	—	—	—	1	1	—	0
754	Patent ductus arteriosus	—	—	—	—	1	—	1	1	1	1	2	1	50
754	Eisenmengers complex	—	1	—	—	—	—	—	—	—	—	1	—	0
754	Interauricular septal defect	—	—	—	—	—	—	1	—	—	1	—	—	0
754	Congenital malformation of heart	2	1	1	—	1	—	—	1	—	2	3	1	33
759	Adrenal hypoplasia	—	—	—	1	—	—	—	—	—	1	—	—	0
XV.	**Certain diseases of early infancy**	—	—	—	—	—	—	—	—	—	—	—	—	0
XVI.	**Symptoms, senility and ill-defined conditions**	—	—	—	—	—	—	—	—	—	—	—	—	0
XVII.	**Accidents, poisonings, and violence**	6	3	—	6	3	—	5	1	—	17	7	—	0
	Accident	—	—	—	—	2	—	—	—	—	—	2	—	0
	Suicide	—	3	—	—	1	—	—	1	—	—	5	—	0
	Total	55	51	6	48	57	4	56	68	14	159	176	24	13

APPENDIX I, TABLE 3

Age of Mother

Number of deaths in the enquiry 1964–66 compared with those included in 1961–63.

Age (years)	Numbers of deaths				Rate per million maternities			
	1961–1963		1964–1966		1961–1963		1964–1966	
	"True" maternal	Associated	"True" maternal	Associated	"True" maternal	Associated	"True" maternal	Associated
Under 16	3	1	1	—	1356·9	452·3	281·5	—
16–17	27	10	4	3	136·0	50·4	139·6	45·2
18–19			30	8				
20–24	134	49	112	30	171·1	62·6	132·7	35·5
25–29	137	65	141	44	177·6	84·2	178·5	55·7
30–34	161	48	136	41	348·2	103·8	312·1	94·1
35–39	141	45	103	29	611·6	195·2	476·1	134·1
40–44	83	24	48	16	1210·5	350·0	757·4	252·5
45+	6	2	4	5	1462·0	487·3	967·1	1208·9
All	692	244	579	176	274·6	96·8	222·7	67·7

APPENDIX I, TABLE 4

Number of maternities by age of mother at time of birth.

Age of mother at time of birth (years)	Number of maternities	
	1961–1963	1964–1966
Under 16	2,211	3,553
16–19	198,490	243,565
20–24	782,941	843,910
25–29	771,218	789,747
30–34	462,338	435,756
35–39	230,549	216,327
40–44	68,569	63,373
45 and over ...	4,104	4,136
Total ...	2,520,420	2,600,367

APPENDIX I, TABLE 5

Number of deaths in the enquiry 1964–66 compared with those included in 1961–63.

Parity of Mother

Parity*	Numbers of deaths				Rate per million maternities			
	1961–1963		1964–1966		1961–1963		1964–1966	
	"True" maternal	Associated	"True" maternal	Associated	"True" maternal	Associated	"True" maternal	Associated
1	206	94	172	61	222·1	101·4	175·8	62·4
2	116	35	111	43	149·3	45·1	137·6	53·3
3	104	48	83	35	246·8	113·9	192·4	81·1
4	73	23	63	15	355·6	112·0	305·6	72·8
5–9	148	37	117	21	675·0	168·7	611·0	105·8
10 or more			10	1				
Not stated	45	7	23	—	—	—	—	—
All	692	244	579	176	271·3	95·7	247·2	75·1

* For definition of parity see page 7.

APPENDIX I, TABLE 6

Number of maternities by parity of the mother.

*Parity of mother	Number of maternities	
	1961–1963	1964–1966
1	910,572	957,232
2	757,218	792,544
3	424,447	430,048
4	203,241	207,740
5 or more ...	224,942	212,803
Total ...	2,520,420	2,600,367

* For definition of parity, see page 7.

APPENDIX I, TABLE 7

Number of "True" Maternal Deaths included in the enquiry, 1964–66, by age and parity.

Age (years)	Parity*							
	1	2	3	4	5–9	10+	Not stated	All
Under 16 ...	1	—	—	—	—	—	—	1
16–17 ...	4	—	—	—	—	—	—	4
18–19 ...	26	3	—	—	—	—	1	30
20–24 ...	54	31	12	3	4	—	8	112
25–29 ...	42	38	17	21	15	1	7	141
30–34 ...	23	24	29	16	40	1	3	136
35–39 ...	13	11	18	14	40	3	4	103
40–44 ...	8	4	5	9	18	4	—	48
45 and over	1	—	2	—	—	1	—	4
Not stated	—	—	—	—	—	—	—	—
All ...	172	111	83	63	117	10	23	579

APPENDIX I, TABLE 8

Death rates per million maternities by age and parity.

Age	Parity*				
	1	2	3	4	5+
Under 20 ...	157	68	—	—	—
20– ...	123	111	131	119	536
25– ...	190	130	106	305	343
30– ...	335	193	263	252	596
35– ...	543	259	358	369	697
40 and over	1,660	442	547	748	816

* For definition of parity, see page 7.

APPENDIX I, TABLE 9

Death rates of women from maternal causes per 100,000 live- and still-births by hospital regions in England and Wales.

	Years				
	1955–57	1958–60	1961–63	1964–66	
				Rate	Number
Newcastle	62·7	40·8	28·3	19·0	32
Leeds	53·2	43·8	30·8	26·6	46
Sheffield	51·9	39·3	30·7	24·8	63
East Anglian	49·8	29·4	36·2	24·7	21
North West Metropolitan ...	49·3	38·5	36·1	27·4	66
North East Metropolitan ...	51·1	38·4	42·3	23·8	43
South East Metropolitan ...	42·0	39·2	30·9	33·2	60
South West Metropolitan ...					
(*a*) South West Metropolitan	55·6*	43·8*	38·9†	28·5	27·5	47
(*b*) Wessex			52·0‡	23·3	15·9	16
Oxford	35·9	21·2	21·3	24·2	26
South Western	50·8	43·1	22·4	24·3	38
Birmingham	58·5	36·0	35·9	25·9	75
Manchester	62·8	44·4	34·6	28·6	71
Liverpool	62·4	37·2	30·1	22·7	30
Wales (including Monmouthshire)...	79·3	51·4	36·3	26·2	37
England and Wales	55·5	40·4	32·0	25·5	671

* South West Metropolitan Region as constituted prior to 1959.
† South West Metropolitan Region as constituted since 1959.
‡ Wessex Region as constituted since 1959.

APPENDIX II
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