

CHAPTER 20

Mortality in pregnant and nonpregnant women in England and Wales 1997–2002: are pregnant women healthier?

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Introduction

Pregnancy and the postpartum are thought to be vulnerable periods in a woman's life either because pregnancy directly leads to increased morbidity and mortality (*Direct* obstetric causes) or because pregnancy aggravates underlying disease conditions (*Indirect* obstetric causes). It is generally accepted that the adverse effects associated with pregnancy extend up to 6 weeks postpartum, although longer-term effects have also been suggested. The Tenth International Classification of Diseases, Injuries and Causes of Death (ICD10) revision added the category of *Late* maternal deaths, implying that the risks associated with pregnancy may extend up to 1 year after the termination of pregnancy.¹ Few studies have compared mortality during pregnancy with mortality at other times, however, and little is known about the actual length of the postpartum period during which women experience pregnancy-associated mortality risks.

While there is no doubt that deaths from *Direct* obstetric causes are attributable to pregnancy, less certainty exists about the so-called *Indirect* obstetric causes. The very nature of diseases aggravated by the pregnancy remains uncertain, and the extent to which deaths coinciding with the pregnancy are in effect caused by it has not been clearly appreciated.² According to ICD10, any death that occurs during pregnancy or within 42 days, and even within 1 year, potentially qualifies as an *Indirect* cause, except for accidents. In practice, those responsible for classifying maternal deaths often decide on a case-by-case basis whether or not they categorise certain diseases as indirectly attributable to or incidental to the pregnancy. It is not surprising, therefore, that definitions vary.³

Although deaths from injuries are not generally considered maternal deaths, some studies suggest that intentional injuries, and possibly unintentional injuries, may be more common among women when they are pregnant than when they are not. In New York City, for example, the risk of homicide was found to be higher among pregnant black women than among the general population of black women.⁴ In the UK, suicide has been reported as a leading cause of maternal death,⁵ although suicide rates appear to be much lower during pregnancy and in the first year after childbirth than in women without a recent pregnancy.⁶ Some authors have even supported the idea that women may be more prone to accidents during their pregnancy.⁷

One way to gain a better understanding of the contribution of indirect and injury-related causes to pregnancy-related mortality is to compare death rates from these causes in

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pregnant and nonpregnant women. If certain causes are more common or more severe in pregnancy, then mortality from these causes should be higher among pregnant than nonpregnant women. The objective of this study is to compare all-cause and cause-specific death rates in women during pregnancy and up to 42 days postpartum with all-cause and cause-specific death rates between 43 days and 1 year postpartum and in women without a recent pregnancy.

Methods

We computed death rates in women aged between 15 years and 44 years in the years 1997–2002 in England and Wales (E&W) in three exposure periods: during pregnancy and within 42 days after the end of pregnancy; between 43 and 365 days after the end of pregnancy and outside these two periods.

Numerators

Numbers of deaths of women aged between 15 years and 44 years in England and Wales were obtained from the Office for National Statistics (ONS). Deaths during pregnancy and within 1 year after birth were available through the Confidential Enquiry into Maternal Deaths (CEMD) 1997–2002 and a maternal death linkage study between 1997 and 2002 conducted by the ONS. In each of the four countries of the United Kingdom, any death of a woman who is either pregnant or within 1 year following delivery, termination of pregnancy, ectopic pregnancy or miscarriage should be reported to the local director of public health and/or directly to the country's Confidential Enquiry. To update deaths that may not have been notified to the Enquiry, all death records of women of reproductive age who died between 1997 and 2002 in England and Wales were matched with birth registrations up to 1 year previously.

Since this linkage study was restricted to data from England and Wales, we used only deaths registered in England and Wales in this analysis. These could not be extracted directly from the Enquiry database, as information on the country in which the death occurred is removed from the database following the publication of each Enquiry report. The total number of deaths from 1997 to 2002 was therefore estimated by assuming that cause-specific death rates in England and Wales were the same as cause-specific death rates in the UK overall.

Deaths reported to the Enquiry are assigned an underlying cause of death by a team of central assessors who review each case. Their assessment may occasionally differ from the underlying cause of death as recorded on the death certificate. We used the Enquiry causes of death for deaths during pregnancy and within 42 days after birth and ONS causes for all other deaths. Deaths were classified using the ninth revision of the International Classification of Diseases, Injuries and Causes of Death (ICD9) for deaths in 1997 to 2000 and the tenth revision (ICD10) for deaths in 2001 and 2002.

Deaths were subdivided into *Direct* obstetric, accidents and violence, and other causes. Deaths from *Direct* obstetric causes were classified separately because they occur only as a direct consequence of pregnancy. We also separated deaths from accidents and violence and, within those, deaths attributed to suicide, to clarify the possible relationship between pregnancy and mortality from intentional or unintentional injuries. Deaths

attributed to accidents and violence were defined using ICD codes E800.0 to E999.9 in ICD9; and V01 to Y98 in ICD10. Deaths attributed to suicide were defined using ICD codes E950.0 to E959.9 in ICD9 and X60 to X84 in ICD10. All deaths for which it had not been possible to determine whether they had been accidental or purposefully inflicted were grouped with the suicides (codes E980.0 to E989.0 in ICD9 and Y10 to Y34 in ICD10). The same was done for the Confidential Enquiry deaths.

Denominators

The mid-year population estimates of women aged 15–44 years in England and Wales in each of the years 1997 to 2002 were obtained from the ONS. The total women-years spent during pregnancy or within 1 year of birth were derived from the number of pregnancies, assuming a fixed gestational age by pregnancy outcome. The ONS provided data on maternities (live and still births), induced abortions, spontaneous miscarriages and ectopic pregnancies. Gestational age for live births, stillbirths, miscarriages and abortions, and ectopic pregnancies was assumed to be 280, 196, 84, and 84 days, respectively. To estimate the person time exposed for the 'during pregnancy and within 42 days after birth' category, each pregnancy was assigned the above period of gestation plus a puerperal period of 42 days. For the 'between 43 and 365 days' category, deaths during pregnancy or within 42 days of birth were deducted from the total number of pregnancies, and each remaining pregnancy assigned 323 days.

Death rates were expressed as deaths per 100,000 years of exposure. Death rates were compared using exact confidence intervals for the rate ratio. The heterogeneity of rate ratios across age groups was assessed using the Mantel–Haenszel test.

Results

All-cause mortality in women aged 15–44 years was 58.4 deaths per 100,000 women per year, increasing from 25.2 per 100,000 in women aged 15–19 years to 123.8 per 100,000 in women aged 40–44 years. Deaths during pregnancy and within 1 year after birth represent a small proportion of all deaths in women of reproductive age (1.3% of all deaths in women aged 15–44 years occur during pregnancy and within 42 days after birth and 1.7% occur between 43 and 365 days after birth).

All-cause death rates in the three exposure periods are shown in Table 20.1 and Figure 20.1. Death rates during pregnancy and within 42 days after birth were remarkably similar to those between 43 and 365 days after birth. Surprisingly, however, mortality during pregnancy or within 1 year after birth was between four and five times lower than mortality in women without a recent pregnancy. The rate ratios comparing the pregnancy–42 day and the 43–365 postpartum periods with nonpregnant women were 0.21 and 0.22, respectively.

Death rates by cause are shown in Figure 20.1, with the corresponding rate ratios shown in Table 20.2. *Direct* obstetric mortality was substantially higher during pregnancy and within 42 days postpartum (37.6% of all deaths) than between 43 days and 1 year postpartum (4.2% of all deaths).

Deaths attributed to accidents or violence represented 11.8%, 26.6% and 20.1% of all deaths in the three exposure periods, respectively. Death rates from accidental or violent

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Table 20.1 All-cause death rates per 100,000 women-years, by age and exposure period; England and Wales 1997–2002

Age group (years) and exposure period	Death rates	Rate ratios (95% confidence interval)
15–19		
Pregnant and 42 days	10.56	0.40 (0.27, 0.56)
43 days to 1 year	8.37	0.31 (0.22, 0.43)
Not pregnant	26.66	1.00
20–24		
Pregnant and 42 days	9.85	0.29 (0.22, 0.37)
43 days to 1 year	11.69	0.34 (0.28, 0.42)
Not pregnant	34.15	1.00
25–29		
Pregnant and 42 days	12.08	0.29 (0.24, 0.35)
43 days to 1 year	11.55	0.28 (0.23, 0.33)
Not pregnant	41.27	1.00
30–34		
Pregnant and 42 days	14.41	0.25 (0.21, 0.29)
43 days to 1 year	15.17	0.26 (0.23, 0.31)
Not pregnant	57.74	1.00
35–39		
Pregnant and 42 days	19.96	0.24 (0.20, 0.30)
43 days to 1 year	23.06	0.28 (0.23, 0.33)
Not pregnant	82.39	1.00
40–44		
Pregnant and 42 days	26.21	0.21 (0.13, 0.31)
43 days to 1 year	29.60	0.24 (0.16, 0.33)
Not pregnant	125.73	1.00
All (15–44)		
Pregnant and 42 days	13.56	0.21 (0.19, 0.23)
43 days to 1 year	14.17	0.22 (0.20, 0.24)
Not pregnant	64.74	1.00

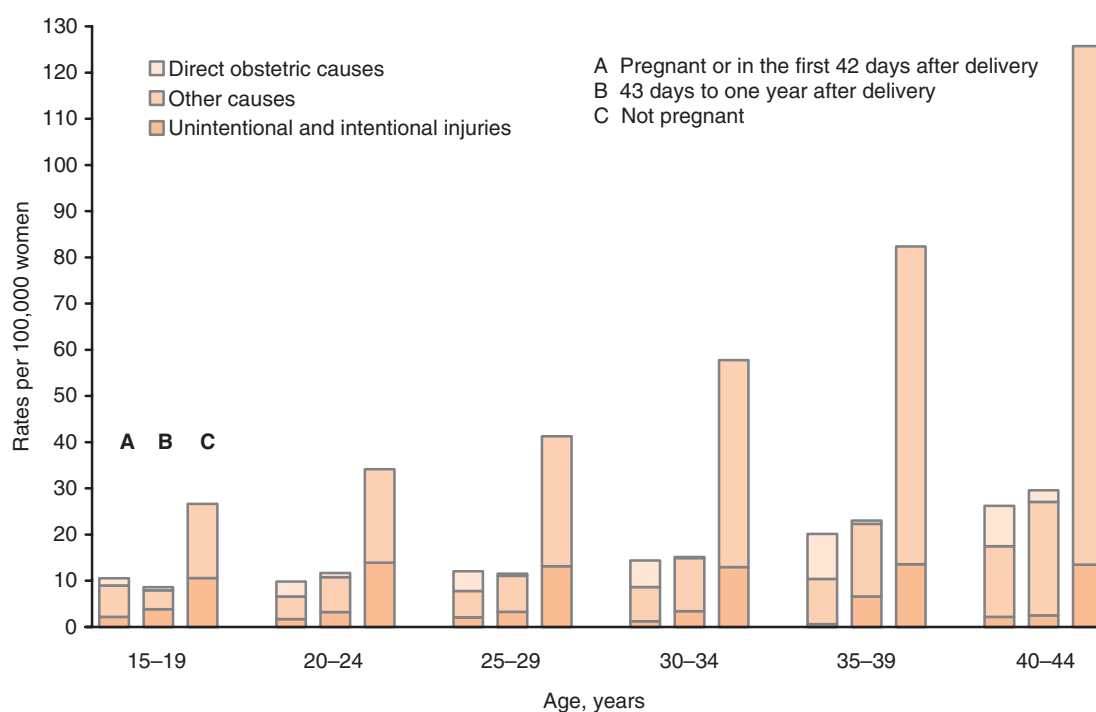


Figure 20.1

Table 20.2 Rate ratios (95% confidence intervals) comparing death rates during pregnancy and within 42 days and between 43 days and one year postpartum with those in nonpregnant women, by cause and age; England and Wales, 1997–2002

Age group (years) and exposure period	Direct obstetric causes	Accidents or violence*	Suicides	Other causes
15–19				
Pregnant and 42 days	3.43 (0.56–36.04)	0.20 (0.08–0.42)	No deaths	0.43 (0.27–0.65)
43 days to 1 year	1.00	0.36 (0.21–0.58)	0.21 (0.04–0.63)	0.25 (0.15–0.40)
Not pregnant	–	1.00	1.00	1.00
20–24				
Pregnant and 42 days	3.64 (1.57–9.40)	0.12 (0.06–0.21)	0.05 (0.01–0.17)	0.24 (0.17–0.34)
43 days to 1 year	1.00	0.23 (0.15–0.34)	0.16 (0.07–0.32)	0.37 (0.29–0.48)
Not pregnant	–	1.00	1.00	1.00
25–29				
Pregnant and 42 days	8.78 (3.74–25.20)	0.16 (0.10–0.24)	0.15 (0.08–0.27)	0.20 (0.15–0.26)
43 days to 1 year	1.00	0.25 (0.18–0.34)	0.30 (0.20–0.45)	0.28 (0.22–0.34)
Not pregnant	–	1.00	1.00	1.00
30–34				
Pregnant and 42 days	22.54 (7.35–112.36)	0.10 (0.05–0.17)	0.07 (0.02–0.17)	0.17 (0.13–0.21)
43 days to 1 year	1.00	0.26 (0.19–0.36)	0.32 (0.21–0.48)	0.26 (0.21–0.31)
Not pregnant	–	1.00	1.00	1.00
35–39				
Pregnant and 42 days	13.66 (5.00–52.22)	0.05 (0.01–0.13)	0.03 (0.00–0.16)	0.14 (0.10–0.19)
43 days to 1 year	1.00	0.49 (0.34–0.67)	0.51 (0.32–0.79)	0.23 (0.18–0.28)
Not pregnant	–	1.00	1.00	1.00
40–44				
Pregnant and 42 days	3.44 (0.83–20.15)	0.16 (0.02–0.58)	0.33 (0.04–1.20)	0.14 (0.07–0.23)
43 days to 1 year	1.00	0.19 (0.04–0.55)	0.13 (0.00–0.72)	0.22 (0.15–0.31)
Not pregnant	–	1.00	1.00	1.00
All (15–44)				
Pregnant and 42 days	8.65 (5.72–13.59)	0.12 (0.09–0.16)	0.09 (0.06–0.14)	0.13 (0.12–0.15)
43 days to 1 year	1.00	0.29 (0.25–0.34)	0.31 (0.25–0.38)	0.19 (0.17–0.21)
Not pregnant	–	1.00	1.00	1.00

* including suicide

causes were slightly higher between 43–365 days after birth than during pregnancy but were still substantially lower compared with women without a recent birth (rate ratios comparing the pregnancy–42 day postpartum and 43–365 day periods with nonpregnant women were 0.12 and 0.29, respectively).¹

Deaths attributed to suicide accounted for 4.3%, 13.6% and 9.6% of all deaths in the three exposure periods, respectively. Death rates from suicide were very low during pregnancy or within 42 days postpartum (Figure 20.1) but trebled after 6 weeks postpartum (compared with during pregnancy). However, death rates from suicide within a year after birth remained substantially lower than in the period beyond that (rate ratios comparing the pregnancy–42 day postpartum and 43–365 day periods with nonpregnant women were 0.09 and 0.31, respectively).¹

After excluding *Direct* obstetric and accidental or violent causes, death rates during pregnancy and 42 days postpartum and between 43 and 365 days postpartum were seven and five times lower than death rates beyond a year after birth (rate ratio 0.13 and 0.19, respectively). As expected, death rates from non-obstetric or non-injury-related causes increased with age, but the magnitude of the increase was much smaller among pregnant or recently delivered women than among women without a recent birth

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(Figure 20.1). Rate ratios differed significantly with age when comparing women during pregnancy and within a year after birth with nonpregnant women, with the magnitude of the protective effect increasing as the women's ages increased.

Discussion

As observed elsewhere in industrialised countries, we found a lower risk of death during pregnancy and within a year after its termination. The magnitude of the protective effect was greater than that reported in three other studies. In Canada, mortality rates during pregnancy or within 42 days of its termination and between 43 and 225 days postpartum were about half those of nonpregnant women.⁸ In Finland, the age-adjusted risk of a natural death within a year after birth or a miscarriage was half that of women without a pregnancy.⁹ In the USA, women who had delivered a live or stillborn infant in the previous year were half as likely to die as women who had not recently delivered.¹⁰

After excluding *Direct* obstetric and injury-related causes, the protective effect of pregnancy was even greater, particularly among older women. The rise in mortality with age was much more marked among women without a recent birth, widening the gap between the pregnant and the nonpregnant as age increases. This is strongly suggestive of a 'healthy pregnant woman effect', i.e. that women suffering ill health are less likely to become pregnant than their healthier peers, resulting in an over-representation of healthier women among those who are pregnant.^{2,11} Although better access to health care or enhanced preventive behaviour among pregnant women or those with a small child may have partly contributed to their lower mortality, this is unlikely to reduce mortality to the extent seen here. Similarly, there is as yet little evidence of a direct protective effect against certain diseases during pregnancy or immediately after birth and, if any, most of the evidence points to a harmful effect.

Data quality and, in particular, under-reporting of deaths, is a recurrent concern with maternal mortality data. However, record linkage of female deaths with registered births will have ensured that almost all deaths following childbirth were identified in this population. In addition, any death of a pregnant or recently pregnant woman is reported to the Enquiry in the UK, and the numbers of *Direct* and *Indirect* deaths identified by the Enquiry, always exceeds those identified from an examination of the causes of death on death certificates. Nevertheless, a small number of deaths may have been missed, although this is unlikely to explain the huge differential mortality between pregnant and nonpregnant women.

The lower risk of suicide during pregnancy or in the year after its termination confirms previous findings from the UK,⁶ Canada⁸ and New York City.^{4,12} Under-reporting of maternal suicides is unlikely to explain the findings, though it may affect their magnitude. The lower risks of suicide during pregnancy and in the year after birth remain largely unexplained.¹³ Although postpartum depression is common, it does not seem to result in an increased incidence of suicide compared with the general population.

Some authors have suggested a re-examination of the definition of maternal mortality, for example by categorising injury-related deaths as maternal⁴ or by considering diseases of the arteries, arterioles and capillaries in the category of *Direct* obstetric deaths.⁸ The interaction between pregnancy and disease or injury is complex however, and whether or not a cause is attributable to the pregnancy is likely to be influenced by the social,

epidemiological and healthcare context of the population under study. Whatever the statistical definition of maternal mortality, careful scrutiny of all deaths among pregnant and recently pregnant women, as currently carried out in the Enquiry, should continue. The design of appropriate public health interventions requires knowledge of the magnitude of all causes of death during and after pregnancy, whether or not these causes are thought to be attributable to or incidental to the pregnancy.

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