Trends in induced abortion in England and Wales

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SUMMARY Analysis of routinely published abortion and fertility data for England and Wales between 1968 and 1980 shows that the age-specific abortion rates increased from 1968 until about 1973 when the rates peaked for all ages; rates then declined until 1977 but have subsequently returned to higher levels. Two factors are implicated: (1) the recent changes are related to parallel changes in the fertility rate; but (2) there is also a tendency for recent cohorts of women to resort to abortion more readily. These relationships are derived from analyses of fertility rates and abortion ratios, the proportion of conceptions that result in abortions. The results are discussed in terms of attitudes and practices related to birth control.

Before the 1967 Abortion Act the total number of induced abortions carried out in England and Wales was not known. It was considered that large numbers of operations were being carried out illegally and estimates were as high as 100 000 to 200 000 a year.[1] A national opinion poll in the United Kingdom in 1966 found that 4% of women in a sample of 3500 admitted to having had induced abortion and 11% to having attempted to induce abortion[2]; these are likely to have been considerable underestimates.

These operations were accompanied by a high mortality and morbidity. Between 1964 and 1966 there were 98 known deaths from illegal abortions and 10 known deaths from legal abortions; the mortality rates from all induced abortions have declined dramatically since the 1967 Abortion Act brought safer operations within reach of most women.[3]

One of the requirements of the Abortion Act is the statutory notification of all abortions to the Chief Medical Officer, DHSS, and reliable annual counts are therefore now available.

The object of this paper is to review trends in induced abortion since the coming into force of the 1967 Abortion Act in 1968 and to relate them to fertility trends.

Methods

DATA

Each year the Office of Population Censuses and

Surveys publishes the number of legal abortions performed in England and Wales by the age of the woman[4 5]; about 1% of the women have no age recorded. Corresponding data for live births and stillbirths and for the population of women to whom these conceptions relate are routinely available.[6–10]

The number of legal abortions performed on resident women in England and Wales under the provisions of the 1967 Abortion Act increased from 22 300 during the latter eight months of 1968 to 110 568 in 1973, thereafter falling to 101 912 in 1976 and subsequently increasing to 128 927 in 1980 (table 1).

These numbers may in themselves be misleading, and unless the ages of the women and the fertility patterns are taken into account an increase or decrease in the total number of abortions may be erroneously interpreted as implying a parallel change in rates.

To investigate trends in abortion, therefore, we considered age specific rates and the age specific ratios of induced abortions to total births.

RATES AND RATIOS

We defined the age and period specific abortion rate as:

$$r_{ij} = 1000 \ (a_{ij}/n_{ij}) \qquad (1)$$

where a_{ij} is the number of abortions to women normally resident in England and Wales who were aged i in the year j,

Table 1 *Legal abortions for residents of England and Wales. Rate per 1000 women by age and year of abortion and total number a year**

Year	11–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	No of legal abortions (1000s)
1968†	0·14	2·17	3·32	2·69	2·48	1·99	0·86	0·09	22
1969	0·25	5·39	6·91	5·98	5·63	4·50	1·94	0·16	50
1970	0·37	9·05	10·52	8·93	8·36	6·58	2·78	0·24	76
1971	0·44	12·09	13·20	10·80	10·07	8·00	3·33	0·29	95
1972	0·48	14·37	15·28	11·98	11·39	8·90	3·87	0·31	109
1973	0·56	15·43	15·65	11·86	11·07	8·77	3·82	0·35	111
1974	0·56	15·70	15·75	11·52	10·48	8·31	3·68	0·34	110
1975	0·57	15·39	15·12	11·07	9·96	7·77	3·57	0·32	106
1976	0·56	14·81	14·28	10·49	9·29	7·32	3·33	0·34	102
1977	0·58	15·21	14·43	10·45	8·90	7·28	2·56	0·37	103
1978	0·53	15·37	15·78	11·65	9·76	7·85	3·74	0·34	112
1979	0·54	16·59	17·22	12·35	10·22	8·22	3·58	0·38	121
1980	0·61	17·61	18·72	13·38	10·65	8·49	3·80	0·39	129

*Excludes spontaneous abortions, abortions to non-residents, and abortions not notified.
†Relates to the period from 27 April 1968.

and n_{ij} is the mid-year estimate of resident women aged i in year j;

We defined the age and specific fertility rate as:

$$f_{ij} = 1000 \, (a_{ij} + b_{ij})/n_{ij} \qquad (2)$$

where b_{ij} is the mean number of live and stillbirths at age i for the years j and j+1. We took this adjustment to match abortions that occur on average six months earlier than births. The fertility rate should ideally be based on the total number of conceptions, but spontaneous abortions are not quantifiable and multiple births are neglected.

We defined the abortion ratio as:

$$R_{ij} = 1000 \, a_{ij}/(a_{ij} + b_{ij}) = 1000 \, r_{ij}/f_{ij} \qquad (3)$$

STATISTICAL MODELLING

Tables of age and period specific rates may be used to obtain cohort specific rates. These describe the experience of women born in the same year or group of years and follow them through their reproductive history. For example, in table 1, which gives the abortion rates by age of woman and year of event, the women who were aged 15–19 in 1969 were 20–24 in 1974 and 25–29 in 1979. Clearly there is only one rate for the youngest and the oldest cohorts.

Osmond and Gardner[11] have recently described a technique that separates the contributions of factors associated with age, period, and cohort; they published examples based on cancer mortality.[12]

Their method is an extension of earlier work by Kermack et al[13] and Barrett.[14] It is based on a log linear model with three sets of parameters for age, period, and cohort; these are then estimated from the data to give parameter estimates with the following four properties.

(a) The age values are of the same magnitude as typical age specific rates.

(b) The cohort values have a mean of unity.

(c) The period values have a mean of unity.

(d) The product of the three values for a given cell is the estimated value of the rate for that cell.

Thus if one period value is twice that of another the inference is that all age specific rates in that period were double.

A problem arises, however, that knowledge of any two of age, period, or cohort necessarily provides knowledge of the third; thus the variables are confounded. Osmond and Gardner[11] describe a treatment of this difficulty. Their method incorporates solutions from the submodels that include only two of the variables. They then show how these may be used to provide one unique set of parameter values from among the range that fit the data equally well.

The material may be presented graphically as we have done (figs 1–3). We applied this modelling method to obtain age, period, and cohort values for the abortion rate, the fertility rate, and the abortion ratio.

Results

ABORTION RATES

The abortion rates for the years 1968–80, although available in single year age groups, are shown in table 1 in five year age intervals for women aged 15 and over with one interval of four years of age from 11 to 14. Subsequent analyses are based on single year age groups. The rates for 1968 are calculated as if the Act was in force for the full year and so underestimate the true annual rates.

The highest abortion rates are in the age groups 15–24 with progressively lower rates with increasing age and low rates under age 15. For all ages the rates increased from 1968 until around 1972–4. In 1975

and 1976 the rates fell for all except the youngest and oldest age groups, but since 1977 rates have again increased in all age groups.

The older women reached the first peal in abortion rates earlier; for women aged 25–44 this peak occurred in 1972 while for those aged 15–24 it occurred in 1974.

ABORTION RATIOS

In contrast to abortion rates the highest abortion ratios occurred in women over 40 and under 15 (table 2) and the lowest ratios occurred in women between 20 and 34; women aged 15–19 and 35–39 had intermediate ratios. There is a suggestion that abortion ratios have peaked, although there is considerable year to year variation in the older women and some indication of an increasing trend in the younger.

COHORT MODEL—ABORTION RATES

The values derived from the log linear cohort model applied to the abortion rates for 1968-80 are shown in fig 1. The youngest age group included in this analysis were 13 year olds. The age values increase to a maximum of 15·9 per thousand at age 19 and decline smoothly thereafter. The period parameters show a rapid rise until 1972, peak at 1973, decline to a minimum in 1977, and subsequently rise reaching a value of 1·16 in 1980 that is actually higher than that of 1·15 in 1973. The early rapid rise in period values corresponds to the take-up effect as legal abortion services began to be used. Cohort values have a minimum for the cohort born in 1947. Values decrease to this and rise afterwards. There is less stability at the extreme points as these are based on fewer observations. Recent cohorts of women (born since 1950) have shown disproportionate increases in abortion rates over and above those implied by recent period based average increases.

The strong take-up effect so clearly seen in the period values could have produced misleading results in this analysis. We therefore recalculated the values for the period 1972–80. The age values have a similar shape, although the maximum now occurs at age 18 (18·5 per thousand). The period values have the same relative positions, with the largest value in 1980 being further emphasised. The cohort values again form a similar shape, although the early points change position because they are based on fewer observed abortion rates.

ABORTION RATIOS

The abortions ratios for 1972–80 have been analysed in the same way as the abortion rate, and the results are shown in fig 2. Age values are largest at 14 (390·9 per 1000) and 45 (632·6 per 1000). Intervening values decrease and have a minimum at 26 (89·2 per 1000). Period values have been quite stable. The value furthest from unity occurred in 1972. Its low value could correspond to the final effects of uptake of services. The cohort values have a "W" shape with minima at 1928 and 1947 and an intervening maximum at 1941.

FERTILITY

The model based on fertility rates shows age values that rise until age 25 and then decline smoothly (fig 3). The fertility rate shows period values that drop sharply from 1971 to 1976 but then recover again. Additional decreases in fertility have occurred for more recent cohorts.

Discussion

There are two important reasons for having a clear picture of abortion trends within England and Wales. Firstly, in the political debate concerning abortion objective data are the prerequisite of an informed discussion and, secondly, health authorities responsible for providing abortions under the terms

Table 2 *Abortion ratio per 1000 "conceptions" by woman's age and year of operation (England and Wales)**

| Year	Age							
	11–14	*15–19*	*20–24*	*25–29*	*30–34*	*35–39*	*40–44*	*45–49*
1968	172	34	20	17	29	52	91	149
1969	278	79	41	38	68	119	200	267
1970	356	125	62	56	101	174	282	366
1971	398	165	79	70	127	218	334	432
1972	411	203	97	82	156	263	401	479
1973	460	227	105	85	163	290	437	526
1974	477	248	112	86	162	303	456	541
1975	507	263	113	85	158	305	474	515
1976	500	274	112	84	149	305	477	546
1977	530	282	113	81	138	302	495	577
1978	512	284	119	85	138	301	512	547
1979	526	296	125	86	136	296	495	528

*Excludes spontaneous abortions
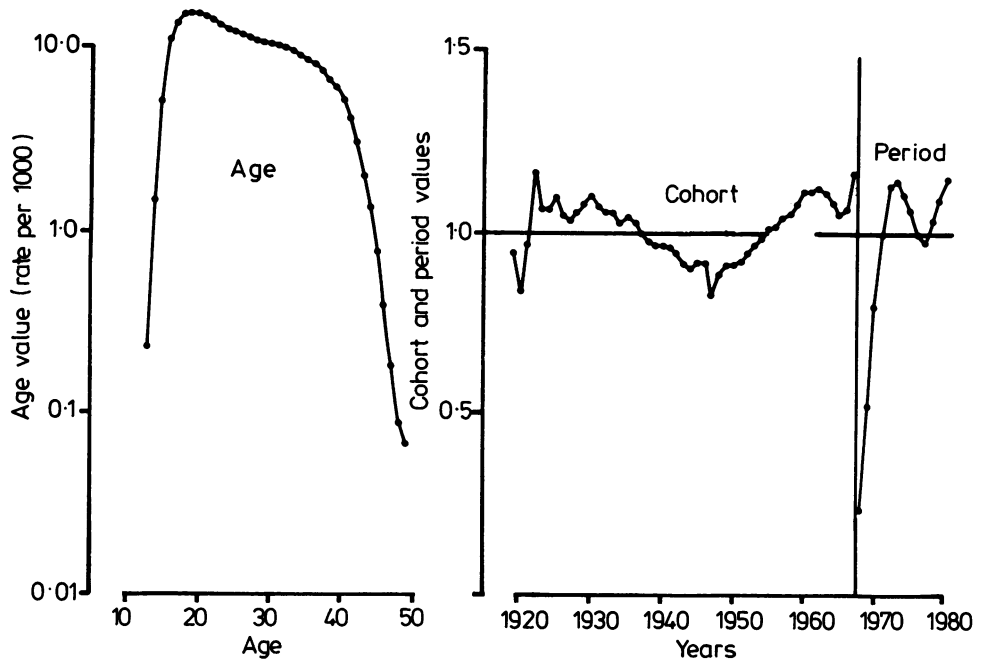
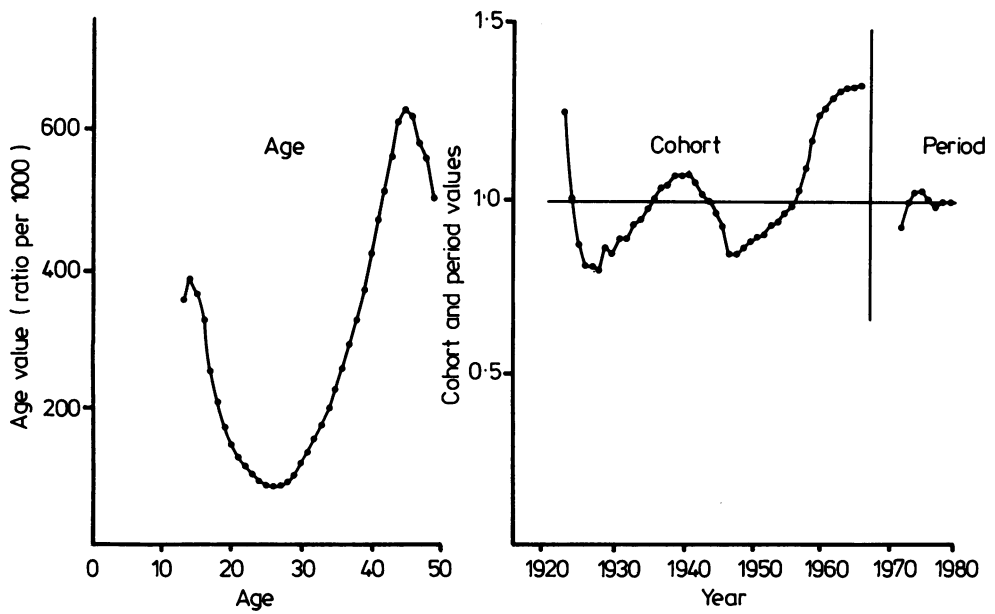Fig 1   *Abortion rate: age, period, and cohort model.*

Fig 2   *Abortion ratio: age, period, and cohort model excluding 1968–71.*

of the 1967 Abortion Act need to have reliable information for planning purposes.

The rates and ratios are strongly influenced by age of women, year of event, and cohort year of women. The changes with age are clearest. Fertility rates are greatest in the ages 20–29 (fig 3) when pregnancies least often result in induced abortion, as may be seen from the inversely shaped age curve for the abortion ratio (fig 2). The combination of these two curves produces a maximum age specific abortion rate at age 18. Below this age conceptions are rarer, and above it the abortion ratio is smaller.

There are three clear period effects in the rates. After the 1967 Abortion Act there was a period of several years of increasing use of the new availability of legal induced abortion. This is most clearly seen in fig 1 in which the rates are seen to rise to a maximum in 1973. The second period effect concerns fertility rates that fell for all age groups from 1970 to 1976 (fig 3). This coincided with a period during which family planning services became increasingly responsive to the requests of women as contraceptive advice became freely available from the community health and general practitioner services.[15] Little change has been seen in the overall abortion ratio period trend (fig 3) so that the decrease in the abortion rate between 1973 and 1977 (table 1) appears to be related to and is probably caused by the decrease in fertility rates at that time. The third clear period effect is the increase in the fertility rate from 1976 to 1979, the end of the study period (fig 3).[15] It seems that the increase in the abortion rates from 1977 onwards are related to, and probably caused by, these increases in the fertility rate from 1976 onwards.

The cohort effects are more subtle and would not be immediately apparent from graphical analyses. The first six cohort values for fertility (fig 3) come from the experience of the oldest women in the period of take-up of abortion services. Many conceptions at this age result in abortions so that these points are unreliably low and are best ignored. The remaining values decreased progressively with the exception of minor increases for women born between 1941 and 1948. These cohorts may have shown increased fertility because of the trend towards deferred family formation[16 17] and the increasing phenomenon of births within a second marriage to older women. The overall decrease of about one third implies that the youngest cohorts have been experiencing fewer conceptions than their predecessors, allowing for the recent period value rise. The cohort value pattern for the abortion ratio is most striking (fig 2). The first two points are high but not very reliable being based on little data. Thereafter the cohort values rise to 1941, decline to 1947, and then rise again. The generations of women showing the intermediate decline are the same ones that had a fertility rate increase. The implication is once more that these were planned, deferred pregnancies. Subsequently the increasing trend points to changing attitudes and practices among women towards conception and abortion and merits more detailed examination.[18] If this trend continues it will have implications for health
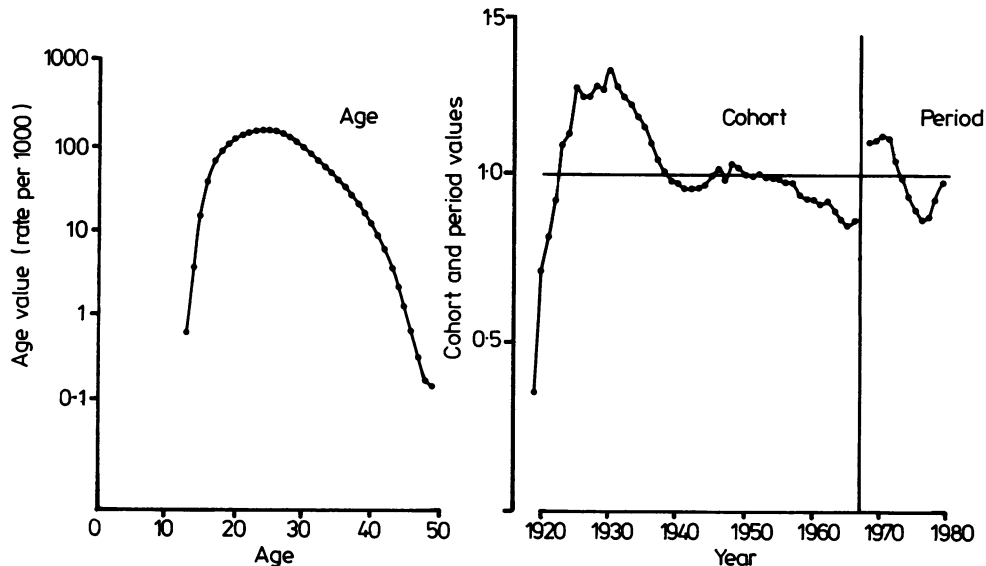

Fig 3 *Fertility rate: age, period, and cohort model.*

education, contraception, and abortion services. The cohort value pattern for abortion rates may be deduced from the two sets of cohort points already discussed. Indeed, each abortion rate cohort value is well approximated by the product of the other two corresponding cohort values. Thus the high fertility rate for the earliest cohorts studied produces relatively higher cohort values for the abortion rate. These were women who became sexually active at a time when the only contraceptives available to them were the barrier methods and withdrawal. Probably, they continued to use these methods after the introduction of oral contraceptives and the intrauterine device. The abortion rates decreased for cohorts along with the fertility rate until the recent rise in abortion ratios took effect. These cohorts have had progressively greater access to both reliable contraception and safe abortion. Although they have experienced declining fertility, the progressively increasing abortion ratio has caused their abortion rate cohort values to increase.

It is worth bearing in mind that four additional factors could continue to cause increases in the abortion ratios and rates. These are the disenchantment with "safe" methods of contraception, in particular oral contraception and the intrauterine device, after the publication of research findings about their possible side effects[19]; the pressure on health authorities to reduce regional variations in the availability of abortion services; the reluctance of people to cope with an unplanned child because of the economic recession and the impact of a child on their disposable income; and the reduction in family planning clinics as a result of financial constraints in the health service.

The statistical modelling has allowed the simultaneous assessment of age, period, and cohort effects in providing a readily interpretable summary of the data. Additionally, this method allows estimates of future abortions by extending period and cohort values linearly, and recombining with age values. This is currently under investigation.

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