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Legally Induced Abortion: The Demographic Profile and Hazards to the Health of Women

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ABSTRACT To review the impact on the health of women of legally induced abortion, this paper draws on the published abortion statistics of Great Britain and the Scandinavian countries to examine the consistency of the demographic pattern of legally induced abortion with the known epidemiology of medical conditions that are abortion related. The age distribution of women having abortions is modelled. The social gradient of abortion is considered. Trends in Parous and Nulliparous abortions are reviewed. Health issues among women post abortion such as mental health and especially depressive illnesses, premature and low-weight births, and breast cancer are discussed so as to identify how the incidence of these conditions might be affected by abortion and indicate the prospects and priorities for future research.

LEGALLY INDUCED ABORTION: A FACTOR AND A CHALLENGE IN SOCIAL EPIDEMIOLOGY

Abortion Records and Data

In most countries of the world abortions are not fully reported so that officially published abortion statistics are deficient. But it is believed that few induced abortions are unreported in Great Britain and in Scandinavian countries.

While in England and Wales and Scotland, these (Abortion Statistics) are comprehensive, the social implications of legally induced abortions and their effect on the health of women are little researched. Considerations of privacy and confidentiality weigh against research on abortion sequelae. The British NHS (National Health Service) number links patient records for other NHS operations. But for abortions this is not recorded. By using names and dates of birth to link women's abortion records, some research on health sequelae is possible in Scotland (Brewster et al. 2005). But, in England, neither name nor NHS number is entered on computer records of abortions. The Department of Health "for patient confidentiality" (Ellis K, personal communication,12 December 2008) encourage the use of hospital reference over name or NHS number and there are "no plans to change our current system for the foreseeable future" Hospital reference numbers are used only internally within hospitals. Most English abortions take place in private clinics, 62% in 2008, when NHS funded abortions numbered 103,905 together with 16,958 privately funded took place there, compared to 74,433 in NHS hospitals. Consequently, English research requiring record linkage of abortions to other hospital episodes is impractical and Scottish research misses the abortions carried out in England (Brewster 2005) on Scottish resident women that have been around 2% or 3% of all Scottish abortions with a higher proportion of late abortions (Abortion Statistics) (Carroll 2007a, 2009).

When abortion is relevant, sample studies often fail to cover it. Private clinics guarantee confidentiality. British longitudinal studies do not link abortion. Researchers, who attempt to investigate abortion, find that women prefer not to discuss abortion in a research context. Researchers may exclude questions on abortion from a questionnaire to avoid jeopardising the response. And where abortion is investigated using questionnaires or by reference to historic records as in case control studies, underreporting of abortions may engender bias.

However, after 40 years of Legally Induced Abortions in Great Britain under the 1967 Act, national data has accumulated. With ecological studies and correlation analysis we can identify subjects of concern and report on the impact here, albeit with limited inference as to causality (Car-

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roll 2007a,2009) and make international comparisons.

THE DEMOGRAPHIC PATTERN OF ABORTION IN CIDENCE

Decline in the Birth Rate

All abortions avert a live birth and lower the birth rate. In the modern era, Abortion allied with Contraception, can largely account for the decline in British fertility to below replacement level (Carroll 2007a, 2009) (Population Projections). Throughout Europe, modern access to abortion has been a major factor in the decline of the birth rate.

Impact on Replacement Level of Sex-selective Abortions in Asian Countries

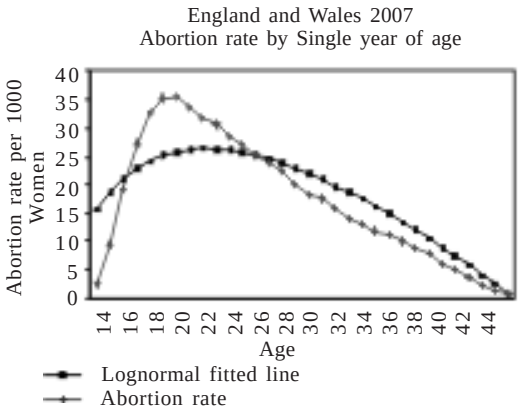
Sex-selective abortions have additional demographic impact. They raise the replacement level by increasing the ratio of male to female live births. The replacement level is a function of the gender ratio at birth and female mortality between birth and childbearing. Asian countries are particularly affected by sex-selective abortions. South Korea has some concern at sex selective abortions. The Korean replacement level is 2.09 and the low birth rate TFR 1.29 is only 54% of this. Larger Asian countries such as India are more severely affected by sex selective abortions and this has a corresponding impact on their demographic prospects.

Implications for Pension Provision and Health Care for the Elderly in a Modern Economy

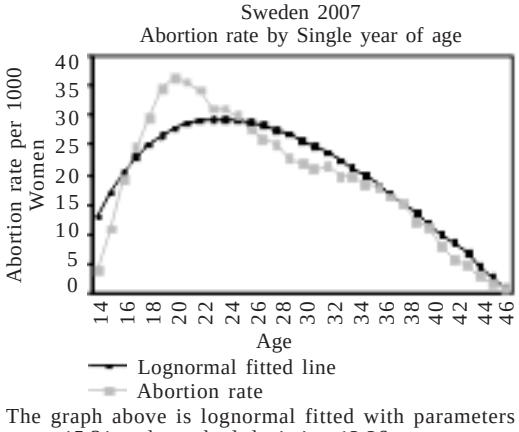
The changes in a country's demographic profile resulting from such a decline in the birth rate have adverse economic and financial implications. The burden of old-age pension provision falls on a smaller working population (Carroll 1998, 2007a, 2008, 2009). And, so does the burden of healthcare. At the same time a lack of dynamism on the economy follows from a fall in the numbers of young consumers so that recovery from recession becomes more difficult in countries with an older age profile (Carroll 2008).

The Age Distribution of Women Having Abortions: Lognormal Distribution

The age distribution of women having abortions is distinctive. The peak or modal age for abortion is between 19 and 20 in the UK, much less than 30 for live births. The abortion curve has more tail weight at both ends. Teenage pregnancies are more often aborted and so are pregnancies over age 35. Parametric distributions (e.g. Hadwiger) used to fit birth rates do not fit abortion rates. Of the well known two parameter distributions, the lognormal, used to fit losses in fire insurance, fits comparatively well as in Figure 1 for England and Wales and Figure 2 for Sweden. Both graphs serve to highlight the peak around ages 19 and 20.



The graph above is lognormal fitted with parameters mean 32 and standard deviation 10.82436.
Fig. 1.



The graph above is lognormal fitted with parameters mean 15.31 and standard deviation 12.26.
Fig. 2.

Fig. 1 and 2. Fit the lognormal to abortion rates for England & Wales and Sweden

The Swedish model, characterised by sex education and state funded reproductive health services, has been influential. Figures 3 and 4 shows the lower teenage abortion rate in Sweden

is accompanied by higher rates in the mid-30s age range and a higher overall Total Abortion Rate.

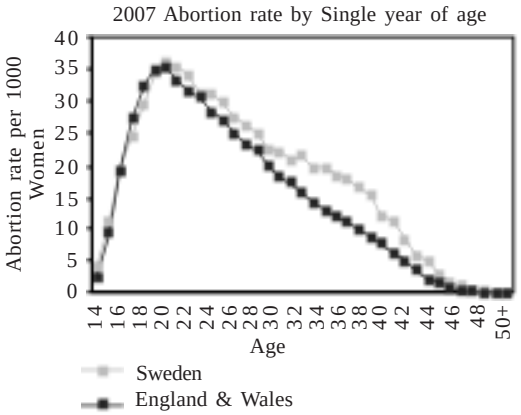


Fig. 3. Abortion rate by age of women Sweden and England & Wales

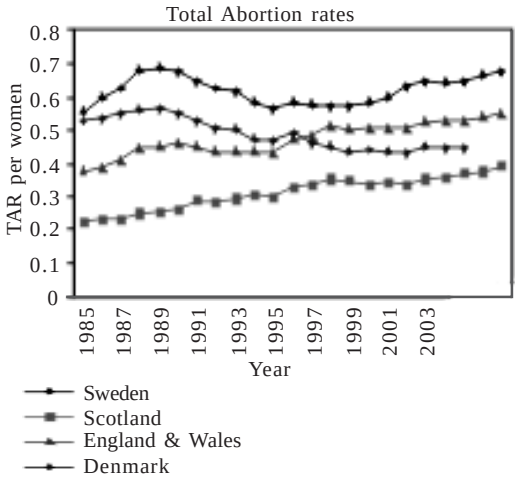


Fig. 4. Total abortion rate trends 1985-England & Wales, Scotland, Sweden and Denmark

Possibly, the higher abortion rate for Sweden at the mid-30s reflects more social instability among the couples in Sweden at these ages.

In Figure 4 the higher rates in Sweden and England and Wales suggest that smaller countries are more socially conservative and averse to abortions.

Parous and Nulliparous Abortions: Implications for Health

Abortions rates are higher among unmarried women, whose parity progression is less. Figure 5 shows English Abortion numbers according to Parity. Most English abortions continue to be nulliparous. But the more recent increase is in parous abortions, reflecting the increase in single parenting. With the decline of marriage, there are more extra marital first births. Single parents tend to abort further pregnancies driving higher abortion rates in England and Sweden.

Nulliparous abortions, where there has not been a previous full term pregnancy, are more damaging to health. Post-abortion women suffer from: depressive illnesses, impaired fertility, infertility, premature births, infant morbidity and increased breast cancer risks. All these health problems are more consequential when a woman aborts her first pregnancy at a young age.

The Social Gradient of Abortion: UK and Finland

Better educated women in the higher socio-economic groups are more informed about contraception and are more motivated to avoid early pregnancies. Table 1 for Scotland shows a steep social gradient with the higher rates for the more deprived.

Table 1: Abortion and deprivation in Scotland 2006

Deprivation (SIMD) quintile	*Rate per 1,000 women age 15-44*
1 - Most affluent	8.8
2	9.8
3	11.3
4	13.7
5 - Most Deprived	16.6

Source: Abortion Statistics Scotland
Note: SIMD is Social Indicator of Multiple Deprivation.

But more first pregnancies among the less deprived women are aborted and more abortions among upper class women are nulliparous. In Finland between 1996 and 2006, 16% of all pregnancies were terminated (c.f. 22% in England and Wales in 2006). Young women in Finland aged less than 20 years (59%) and older women aged 40 years or more (25%) terminated their pregnancies most often. Single women (52%) terminated their pregnancies more often than married (6%) or cohabiting (10%) women. As to occupation, students terminated their pregnancies more often (34%) than manual workers (14%), less skilled non-manual workers (9%) and more skilled non-manual workers (6%). The high proportion of pregnancies aborted among students has

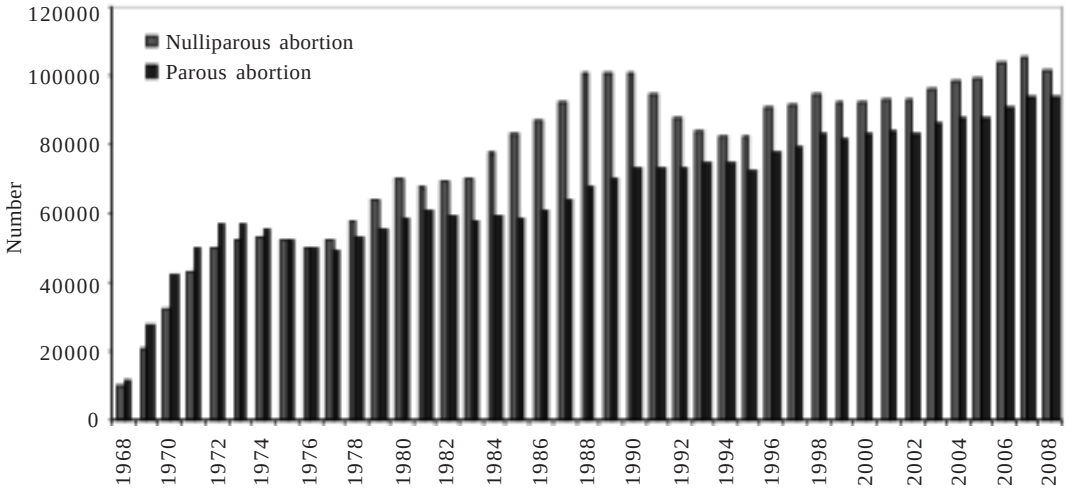


Fig. 5. Numbers of Parous and Nulliparous abortins of women in England and Wales 1968-2008
Source: Abortion Statistics

particular implications for understanding the social gradient of some health conditions such as breast cancer.

Ethnicity and Abortion

Figure 6 shows that in England and Wales, abortion rates are markedly higher among the black population than among other ethnic groups. This runs parallel to higher rates of birth outside wedlock.

Marital Status and Abortion

Single women have a much higher abortion rate, about three times as high as married women as shown in table 2.

Table 2: Abortion rates per thousand women aged 15-44 in England & Wales 2006

Marital Status	*2006*
Single	24.7
Married	8.1
Widowed	0.0
Divorced	5.0
All	17.4

Source: rates derived from abortion numbers and ethic percentages as reported in Abortion Statistics and from female population estimates for ethic groups on ONS web site.

Mental Health and Abortion

The memory of the abortion remains short and long term. Depressive illnesses are common among women post-abortion but the link between depressive illness and abortion is little studied.

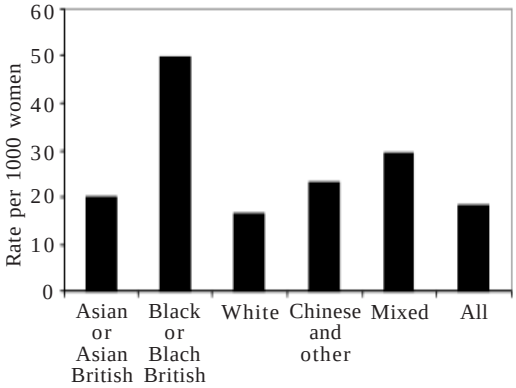


Fig. 6. Abortion rates by ethnicity in England & Wales.
Source: Abortion Statistics England & Wales.

In England, women's mental health has deteriorated: "The proportion of women (aged 16 to 64) suffering a common mental disorder (CMG) – typically depression or anxiety – increased from 19.1 per cent in 1993 to 21.5 per cent in 2007….The largest increase in rate of CMD was in women aged 45-64 among whom the rate rose by a fifth" (Adult Psychiatric Morbidity Survey 2007). In this last age group, women now have experienced more legally induced abortions than previous cohorts. British prescription statistics indicate more than a billion anti-depressant pills are prescribed each year, with few details of users.

Figure 7 shows that Common Mental Disorders are common among black women whose abortion rate has also been noted as high.

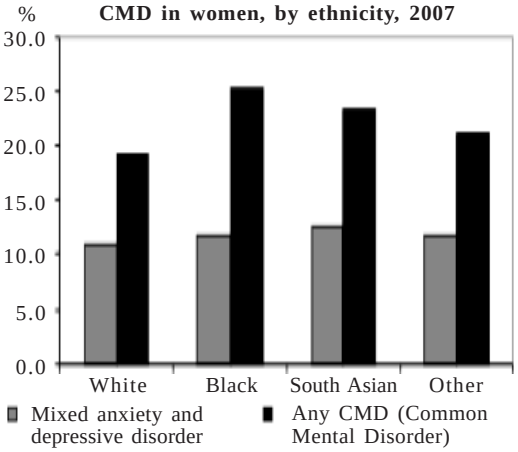


Fig. 7. Common mental disorders among British women.
Source: NHS Adult psychiatric morbidity in England, 2007, Claire Deverill and Michael King

Married women have better mental health than other women as shown in Figure 8.

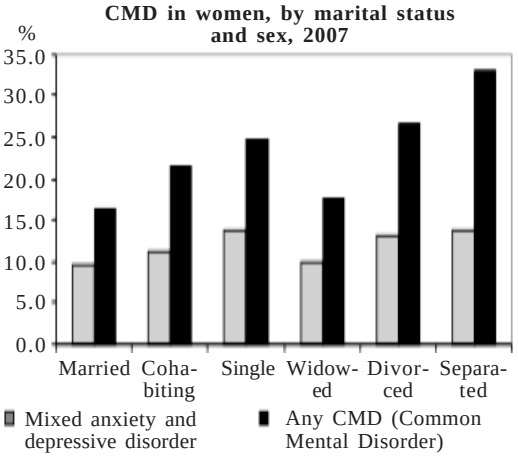


Fig. 8. Common Mental Disorders in Women by Marital Status.
Source: NHS Adult psychiatric morbidity in England, 2007, Claire Deverill and Michael King

Their lower abortion rate noted above may be understood as contributing to this.

The Finnish health-care registers provide more information, with high quality data little affected by non-response as reporting is obligatory (Gissler and Haukka 2004). The completeness and validity has been shown to be good (Gissler et al. 1995, 1996a) and the current data protection legislation allows their use in scientific research (Verschuuren et al. 2008).

Psychotropic Medicine and Pregnancy Termination

A preliminary analysis of Finnish data from 1996-2001 showed that women who had used psychotropic drugs before pregnancy terminated their pregnancies (25-34% by type of drug) more often than women in general (16%). Adjustment for background characteristics did not explain this elevated risk. A similar risk was found for first pregnancies (23-34% vs. 19%). The risk of terminating the pregnancy was the highest for women using antipsychotics (33% of all pregnancies and 31% of first pregnancies) and antidepressants (34% of all and first pregnancies) (Gissler et al. 2010).

The previous mental health of women having abortions differs from women giving birth and is relevant to investigation of mental health post-abortion. If the usage of antidepressants prior to abortion is known, it is a concomitant variable which can be used in analysis so that more precise estimates of the effect of abortion on the mental health of women can be made.

Post- abortion women have a higher usage of psychotropic drugs than women who have full term pregnancies. Doctors may be reluctant to prescribe them before and after the pregnancy of mothers in view of possible side-effects such as risks to the infant on delivery or in breast feeding after birth. Side-effects on withdrawal also lead to more extended use of anti-depressants which impacts women who have abortions.

Mortality

The Register on Induced Abortions, and Hospital Discharge Register were used to identify a recent pregnancy within one year prior to the death (Gissler et al. 2005). Mortality was higher in Finland after a spontaneous abortion or ectopic pregnancy (35 per 100 000 pregnancies) - especially among women under 25 - and higher still after an induced abortion (60/100 000 pregnancies) when compared to women who are not pregnant whose mortality from external

causes by way of injuries and accidents is 24 per 100 000 women. But it was lower for all pregnant women (19/100 000 pregnancies) and women after giving birth (10/100 000 pregnancies).

The risk of pregnancy-associated death from external causes differed according to the cause of death, age, and the outcome of pregnancy. The highest rates were observed for women having an induced abortion and it is likely that induced abortions and injury deaths share common risk factors (Gissler 1996b, 1999).

The pregnancy-associated mortality rate from external causes decreased between the late 1980s and the late 1990s in Finland. Reduced abortion rates, changes in the background characteristics of women with recent pregnancies, and improved health care services may explain this positive trend.

Premature and Low Weight Births Post- abortion

Low weight and premature births continue to be a concern to health policy makers "a rising proportion of number of babies born in the UK are being born prematurely and at a low birth weight. Over the last twenty years, the proportion of low birth weight babies has risen from 6.7 per cent of births in 1989 to 7.6 per cent in 1999 to 7.8 per cent in 2006" (Bamfield 2007).

There is scientific evidence of a causal association between induced abortion and subsequent preterm labour and delivery of a premature baby. A recently published meta-analysis of 37 studies (Shah and Zao 2009) reported that the risk of a low weight birth increased post- abortion induced in the first or second trimester by 35%. Thorp and colleagues (Thorp et al. 2003) undertook a detailed review of 24 published studies of the effect of induced abortion on the risk of preterm birth in subsequent pregnancies. The authors reported that half (12) of the studies found a positive association with increased risk ratios which were consistently between 1.3 and 2.0. Seven published studies found a dose-response effect, in that the risk estimate increased with increasing numbers of induced abortions. Each of three large cohort studies performed in the 1990s showed an increased risk of preterm delivery and a dose response effect. These studies had attempted to avoid recall bias by obtaining data on induced abortions from prospectively obtained records rather than self-reporting. The recent French EPIPAGE study (Moreau et al. 2005) and the international EUROPOP study (Ancel et al. 2004) have also confirmed a positive association. In the EPIPAGE study, the adjusted odds ratio for very preterm birth was 1.6, with 95% confidence interval (1.2, 2.1). Where there was a history of more than 1 previous induced abortion, the adjusted odds ratio was 2.9 with 95% confidence intervals (1.3, 6.5) Controlling for maternal characteristics such as age, education and history of smoking, had very little effect on the magnitude of the increased risk. The authors also confirmed their prior hypothesis that induced abortion would increase the risk of subsequent very preterm birth due to infectious or mechanical processes, but not the risk of very preterm delivery due to vascular causes, especially hypertension. The risk of preterm delivery associated with induced abortions tended to be higher for extremely preterm deliveries between 22 and 27 weeks of gestation (OR 1.7) compared with delivery at 28 - 34 weeks of gestation (OR 1.4). In the EUROPOP study, data were obtained from 10 European countries with widely varying rates of induced abortion. The adjusted odds ratios for preterm birth following induced abortion varied between 1.2 and 1.8.

It is noted that there is a consistent relationship between abortion and preterm delivery related to infectious and mechanical factors but no relationship with delivery due to maternal hypertension or vascular abnormalities. But induced abortion increases the risk of infectious complications in a later pregnancy (Muhlemann et al. 1996). Cervical instrumentation has also been suggested to increase the risk of endometrial damage, thus impairing trophoblastic invasion and migration. This would increase the risk of placenta praevia which is a major cause of antepartum haemorrhage, leading to preterm delivery.

Extremely preterm delivery is associated with a high risk of death in the neonatal period and with a greatly increased risk of brain damage. It is unfortunate that preterm delivery precipitated by infection or antepartum haemorrhage is particularly associated with brain injury, leading to a substantially increased risk of permanent disability including cerebral palsy, severe learning difficulties and sensory impairment (Murphy et al. 1995).

In addition to major neurological impair-

ments, long term outcome studies of ex-preterm infants have indicated that up to 50% of survivors have educational or behavioural difficulties at school-age (Wolke et al. 2008).

"Being born at low weight casts a long shadow over children's prospects of flourishing for the rest of their lives" (Bamfield 2007). "Low birth-weight is associated with poor outcomes in child health and poor cognitive skills and, in particular, the development of cognitive skills. It is also related to illness in adult life, such as diabetes, stroke and lung disease" (Birth Statistics 2005).

Most epidemiological and policy oriented analyses published here on low birth weight and premature births have focussed on social and economic deprivation and unhealthy habits such as smoking in pregnancy (Bakeo and Clarke 2006). The country is now more prosperous and less deprived. Public health initiatives and health education as to smoking cessation have reduced smoking among pregnant women. Still the rate of prematurity rises.

Marital status is a risk factor. "In the 1990s the factor most strongly associated with low birthweight was being born outside marriage, where the birth was registered by the mother alone. This was the case even after taking account of the mother's economic status" (Bakeo and Clarke 2006). Within marriage, low weight births were 5.2% and outside marriage 7.9% in the 1980s. In the 1990s, only 5% of births within marriage were low weight and 7.4% outside marriage (9.4% for sole registrations). Lone mothers are also more exposed to abortion "80% of abortions in 2006 were carried out for single women, 16% for married and 4% for separated and divorced women" (Maternity Statistics 2006).

The comparison between Sweden's lower rate (5%) of premature births with Great Britain's higher rate (7.7%) becomes more explicable, notwithstanding Sweden's higher abortion rate, when it is noted that most of the British abortions are nulliparous but most Swedish women having abortions are already mothers and many have no further full term pregnancies post abortion.

When information systems are set up to make research possible we can expect useful findings within a few years. Three years after an abortion, women are said to be at most risk of having a premature birth with the health of the baby impaired.

Breast Cancer

Recent papers such as a Turkish study (Ozmen et al. 2009) which found "age and induced abortion were found to be significantly associated with breast cancer risk" and a Sri Lankan study (De Silva et al. 2010) which found 'Abortion triples breast cancer risk' have added to the evidence linking breast cancer and abortion.

The modern epidemic of breast cancer was unanticipated and remains unexplained. The reported increase in incidence in the UK in the early 1990s was misinterpreted as attributable merely to the introduction of the new screening programme around 1989. Leading British epidemiologists in 2001 described the scale of the increase in incidence as "small in percentage terms" (Schwerdlow et al.2001) in an analysis of British breast cancer trends, when they noted for England and Wales the number of "over 25,000" new malignant cases annually. But now over 40,000 new malignant cases are reported for 2006 (Cancer Statistics) for the two countries.

At the same time, when abortion was treated as an explanatory variable, it seemed to be the best predictor of the incidence trend. Modelling of breast cancer incidence, using cumulated cohort birth rates and abortion rates as explanatory variables, produced useful forecasts in 2001(Carroll 2001,2002, 2007).

The social gradient of breast cancer is unlike that of other cancers: upper class women have the higher incidence of breast cancer. This becomes more explicable, notwithstanding the higher rate of abortion among lower class women, when abortion is seen as a path to upward mobility.

Lower class women, who are single parents choosing abortions, increase their breast cancer risks less than higher class students who abort their first pregnancies, as parous abortions are less conducive to breast cancer. Access to educational and career opportunities is facilitated by women who choose abortion when pregnant at a young age, while the more deprived young women who opt for parenthood at a young age, often as single mothers, face impaired career prospects but they gain some protection against breast cancer from the full term pregnancy (and more protection from any associated breast feeding). Forecasts of the social gradient can also be made when abortion is used as an explanatory variable in the model (Carroll 2007).

Reports of positive associations between induced abortion and breast cancer incidence began appearing in the medical literature over half a century ago (Segi et al.1957). A comprehensive review and meta-analysis of the abortion-breast cancer (ABC) literature in 1996 (Brind et al. 1996) reported a statistically significant overall odds ratio of 1:3.

Researchers have yet to resolve the long term nature of the risk. Young women aborting their first pregnancies increase their risk of breast cancer after age 50. At young ages a higher proportion of breast cancers are attributable to genetic factors. Left censoring misses events before the period of observation such as the often nulliparous abortions at young ages of women, that are more hormonally crucial to breast cell development. Right censoring misses events after the period of observation such as post menopausal cancers where the modern epidemic is most apparent. A more appropriate analysis of such data would have considered successive cohorts of women.

Another issue is the analysis of carcinomas in situ that recent papers treat as non cancers.

Besides flaws in the Harvard Nurses Study II (Michels et al. 2007) that have already been discussed (Brind 2005), two other recent reports illustrate these problems: the EPIC (European Prospective Investigation into Cancer) study in Europe (Reeves et al. 2006), and the California Teachers Study (Henderson et al. 2008) in the USA. All these studies are skewed towards younger women and suffer from right censoring, whereby abortions are counted and the corresponding breast cancers are missed.

The 2006 EPIC study (Reeves et al. 2006) covered a cohort of European (including UK) women included women between the ages of 35 and 70 years, recruited between 1992 and 2000. Left censoring before age 35 misses the early abortions. No increase in risk for an induced abortion was found.

Abortions up to the year 2000 were counted for women over age 35. Right censoring, whereby breast cancers following these abortions near the end of the observation period are lost to the study, leads to underestimation of risks.

The authors included only malignant cases and excluded cases of breast carcinoma *in situ*. Carcinoma *in situ* (ICD-10 D05) is a form of cancer listed in British Cancer Statistics. In situ cancers are often indeed treated medically in the same way as malignant cancers (ICD-10 C50). Data on both the malignant and in situ cancers is statistically useful. In age groups subject to screening in the UK, Carcinomas in Situ tend to be around 9 % of cancers reported so the omission is not trivial.

It is also noteworthy that in this study the average age of diagnosis of cancer is 58, which is significantly less than the average age at diagnosis in Germany and the UK, which is 63 so the study misses the full extent of the modern epidemic apparent at ages 50+.

The California Teachers Study (Henderson et al. 2008) found "Breast cancer risk was not associated with the outcome of first pregnancy…" This seems incredible. It is well established that an early full term pregnancy, i.e. a low age at first birth, gives a woman more protection against breast cancer later. Apparently this result followed from an inappropriate comparison between women whose first pregnancy ended in abortion and those who were never pregnant, rather than to those who gave birth.

The questionnaire was long and intrusive. As the authors note in the discussion "Some women in our cohort may have underreported induced abortion…"

Again *in situ* cancers were not appropriately analysed. They numbered 708 cases compared to 3,325 cases of invasive cancer. But the *in situ* cases were treated as disease free women who moved out of California. This misclassification lowers the calculated HR for induced abortion in this population (Relative hazard reported as 0.95; 95% CI 0.76-1.18).

Cancer epidemiologists who take pride in the discovery that a full term pregnancy at an early age is more protective are strangely reluctant to acknowledge that abortions at these young ages may be more conducive to cancer.

The modern epidemic of female breast cancer has been manifested in much higher increases in incidence rates over age 50 than at younger ages. Whereas biologists and medical oncologists do not distinguish between pre and post menopausal cancers, epidemiologists do. Whereas there is recognition by the leading epidemiologists of a different aetiology for pre and post menopausal female breast cancers in their literature (Schwerdlow et al.2001) , there is no explicit acknowledgement of this in the published papers that discuss breast cancer risks post abortion. Most papers concentrate on

women below age 50 whose abortion history is known. For older women included in such studies, the abortion history is often unknown. Meta analysis of such papers tends to compound this problem of skewness in the data. The breast cancer authorities (The Royal College of Obstetricians and Gynaecologists in the UK, The American Cancer Institute et al.) that have concluded there is no significant risk to women of cancer post abortion, may not be aware how much of the evidence submitted to them is based on studies of younger women, where the findings are not exactly relevant to older women.

Registration of legally induced abortions in Europe started only in the 1970s (Great Britain in 1968 was first) when the laws were liberalised. In Finland, data is available from 1970 and cohorts of women born after 1955 can be followed with full information compiled on their pregnancy histories. Yet even now this cohort is still too young to draw final conclusions on the impact of various reproductive risk factors that affect breast cancer.

An early study (Howe 1989), that reported a higher risk for women after abortions, called for an extension of the study to cover cancers found over age 40. It is to be regretted this has yet to be accomplished. Many women are affected by abortion and by breast cancer. A better analysis of the link between breast cancer and abortion is long awaited.

ACKNOWLEDGEMENTS

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