Abortion rates reflect the optimization of parental investment strategies

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Parental investment decisions in human beings, including infanticide, have usually been considered in relation to the postnatal survival probabilities of their children. A number of factors which influence parental ability and willingness to invest in offspring have been identified from these studies. Here we argue that at least some of the same factors which influence investment decisions postpartum also affect the decision to terminate a current pregnancy through voluntary abortion. We show that both female age and marital status influence the probability of abortion, with the key variable being the likelihood of future marriage. Thus, abortion procedures extend a woman's ability to manage her reproduction into the prenatal period.

Keywords: human beings; marriage probability; reproductive decisions; parental investment; infanticide; abortion

1. INTRODUCTION

Parental investment decisions reflect parents' willingness and ability to invest in particular offspring. Evolutionary principles suggest that these decisions are likely to be determined by a number of 'maternal' factors which are likely to include the length of interbirth intervals (Blurton Jones 1986, 1987; Daly & Wilson 1988), current family size (Voland & Dunbar 1995) and resource availability (Daly & Wilson 1988). Other 'extrinsic' factors also influence parental investment decisions and these include the certainty of paternity, offspring quality and levels of assured paternal support (Essock-Vitale & McGuire 1985; Daly & Wilson 1988).

Most studies of human parental investment decisions have focused on the postnatal survival probabilities of children (Blurton Jones 1987; Voland et al 1991; Klindworth & Voland 1995; Bereczkei & Dunbar 1997) or, in their most extreme form, on cross-cultural analyses of infanticide data (Daly & Wilson 1988). Children who are considered unlikely to survive and reproduce and, thus, who are unlikely to be contributors to their parents' fitness are killed at birth in many societies (Daly & Wilson 1983) and, where they are not killed, they experience elevated risks of physical abuse and/or destructive neglect (Daly & Wilson 1983). Here we argue that the same decision factors that influence discriminative care postpartum can be expected to operate in utero. There is a compelling reason why this might be expected to be the case: in species such as humans with greatly extended periods of postnatal development, every child reared represents a significant fraction of the mother's life span and labour. As such, it would be in the mother's best interests to assess current circumstances and to then decide whether these are favourable such that a current pregnancy should be carried to term. In other words, abortion procedures thus extend a woman's ability to manage her reproduction into the prenatal period.

Abortion procedures are readily available in most industrialized societies and deliberate attempts to induce abortion through the ingestion of toxic plant material have been recorded for a range of subsistence societies (Devereux 1976; Shostak 1981).

Well-established evolutionary principles make two specific predictions.

(i) Prediction 1. Single women will be more likely to abort a pregnancy than will married women. This prediction follows from the cross-cultural finding that a lack of paternal support (or, more generally, inadequate resources) is a common ground for infanticide because single women usually have less social and material support for child rearing (Daly & Wilson 1988).

(ii) Prediction 2. Since a female's residual reproductive value declines with age, single females should place increasing value on current reproduction at the expense of future reproduction as they age. In other words, as the chances of finding a suitable partner diminish, they should prefer to opt for single parenthood rather than wait any longer. This should yield a negative relationship between age and willingness to abort a pregnancy. In contrast, married women should show the opposite relationship. Since their socioeconomic conditions for reproduction are as optimal as they are ever likely to be, their willingness to see a conception through to term should reflect only the potential risks and costs of reproduction; given that these increase in

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Table 1. Total number of voluntary abortions and pregnancies by female marital status and age group for women in England and Wales during 1991

(National census data for women by marital status and age group as well as the calculated percentages of pregnancies that were terminated through voluntary abortion are also presented. Pregnancies are calculated from data providing the total number of abortions and live and still births. Source: Office for National Statistics (1991a–d).)

<table>
<thead>
<tr>
<th>female age (years)</th>
<th>abortions</th>
<th>pregnancies</th>
<th>female population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>single</td>
<td>married</td>
<td>single</td>
</tr>
<tr>
<td>16–19</td>
<td>30,115</td>
<td>564</td>
<td>72,116</td>
</tr>
<tr>
<td>20–24</td>
<td>44,277</td>
<td>7,367</td>
<td>121,742</td>
</tr>
<tr>
<td>25–29</td>
<td>22,470</td>
<td>15,203</td>
<td>74,535</td>
</tr>
<tr>
<td>30–34</td>
<td>7,841</td>
<td>15,019</td>
<td>33,290</td>
</tr>
<tr>
<td>35–39</td>
<td>24,16</td>
<td>10,308</td>
<td>12,150</td>
</tr>
<tr>
<td>40–45</td>
<td>574</td>
<td>4214</td>
<td>2585</td>
</tr>
<tr>
<td>45–49</td>
<td>25</td>
<td>376</td>
<td>97</td>
</tr>
</tbody>
</table>

older age classes and older women are more likely to have achieved their preferred family size, we may expect an increase in the frequency of abortions with age in this category of women.

We test these predictions and show that, at the least, these two factors (the mother’s age and her marital status), which are known to affect postnatal investment decisions, also affect the probability that a current pregnancy will be terminated through voluntary abortion.

2. METHODS

Data on abortions, pregnancies, marriage rates and the 1991 population census for England and Wales were obtained from Office for National Statistics’ (1991a–d) publications. From these publications we extracted data which related to abortion seekers’ age, marital status and previous number of children. We confined our analysis to 1991 only in order to match the abortion statistics with accurate demographic census data and birth data for the same year.

We excluded cases in all analyses where any of the maternal variables were unknown or uncertain; we also excluded data for females aged 15 years or less since females below 16 years of age cannot be legally married in England and Wales. Marital status was defined as single or married in all analyses; the latter category incorporates previously married women (divorced or widowed) who were identified in abortion and census statistics publications. We did this in order to make use of birth statistics which provide data for single and married women only. The data on age-specific marriage rates for single women were used to calculate an age-specific survivorship curve for remaining single between the ages of 16 and 40 years and this was then used to calculate the probability that a single woman would ever marry between her current age and age 40 years (taken as the maximum cut-off to allow time for reproduction after marriage).

3. RESULTS

The relevant data detailing the number of abortions and pregnancies and the female population size in England and Wales during 1991 by marital status and age are presented in table 1. The percentages of pregnancies by marital status and age that were terminated through voluntary abortion are included.

To test the first prediction, we compared the observed number of abortions within marital categories. Out of the 160769 legal abortions that were performed during 1991, 67% of abortion seekers were single and 33% were married or previously married. Correcting for the number of pregnancies by age group and marital status, single women had significantly more abortions than expected ($\chi^2 = 29,030.7$, d.f. = 6 and $p < 0.001$). Partitioning this difference, single women in the age range 16–34 years had more abortions than expected while women aged 40–49 years had fewer abortions than expected. The converse pattern is apparent for married women: when correcting for the number of pregnancies by age group, married women had significantly fewer abortions than expected ($\chi^2 = 20,116$, d.f. = 6 and $p < 0.001$) with women aged 16–34 years aborting pregnancies less often than expected, while women aged 35–49 years aborted pregnancies at the expected levels.

Overall, pregnant single women were more likely to abort a pregnancy than were pregnant ever-married women (34 and 9.7%, respectively; Mann–Whitney test across age classes, $z = -2.236$ and $p = 0.025$).

The second prediction provides a more stringent test since it predicts different patterns in the incidence of abortion across age classes in the two marital categories. Figure 1 shows that this is indeed so: for single women there is a decline through to age 35–39 years, after which the proportion of pregnancies aborted stabilizes, whereas for married women the proportion of aborted pregnancies remains relatively constant through ages 16–34 years and then increases steeply. The best-fit regression equations for the two marital categories are
\[
\ln(\text{abort}_{\text{single}}) = 5.57 - 0.66\ln(\text{age}) (r^2 = 0.75, t_5 = -3.89 \\
\quad \text{and } p = 0.012 \tag{1}
\]

and

\[
\ln(\text{abort}_{\text{married}}) = -4.09 + 1.95\ln(\text{age}) (r^2 = 0.82, t_5 = 4.72 \\
\quad \text{and } p = 0.005. \tag{2}
\]

The slope coefficients for the two equations differ significantly \((t_5 = 9.85\) and \(p \ll 0.001\), as do the intercepts \((t_5 = 11.14\) and \(p \ll 0.001\)). As predicted, the abortion rate declines with age for single women and increases with age for married women.

One likely explanation for these patterns is that younger single women are more likely to abort a pregnancy in the expectation that future opportunities for child rearing might be more favourable, whereas older single women might do as well to carry current reproduction to term rather than rely on a rapidly reducing likelihood that their circumstances will improve. If this is so, then the age-specific frequency of abortions should correlate directly with the age-specific probability of future marriage for single women. With the latter determined from the national marriage statistics for single women in 1991 (Office for National Statistics 1991a–d), figure 2 plots the age-specific probability of a pregnancy being aborted against the age-specific probability of future marriage for those age classes that lie within the reproductive period (ages 16–40 years inclusive). As predicted, there is a very tight, positive, linear relationship (Pearson \(r = 0.979\) and \(p = 0.004\), suggesting that the likelihood of future marriage is the key variable which drives the decision to opt for an abortion. The alternative possibility, that abortion rates are higher among single women because they have higher pregnancy rates, can be discounted because, between the ages of 16 and 34 years, single women are significantly less likely to be pregnant than married women (Mann–Whitney \(U = -2.31\) and \(p = 0.021\)).

**Figure 1.** Percentage of pregnancies aborted as a function of age (in five-year cohorts) for married and single women for all women who were pregnant in England and Wales in 1991. Source: Office for National Statistics (1991a–d).

**Figure 2.** Age-specific probability of abortions plotted against the probability of future marriage during the reproductive life span (ages 16–40 years) of single women. Source: Office for National Statistics (1991a–d).

### 4. Discussion

We have shown that the probability that a current pregnancy will be terminated through voluntary abortion is affected by both the mother’s age and her marital status. We suggest that, whereas younger single women might be more likely to abort a pregnancy in anticipation of more favourable opportunities for child rearing, the same does not hold for older single women. This point is made clear by the strong relationship between the age-specific probabilities of future marriage for single women and of abortion of a current pregnancy (figure 2). Younger single women, for whom the probability of future marriage is high relative to that of older single women, are more likely to terminate a current pregnancy than are their older counterparts. This is possibly related to the cross-cultural finding that the presence of a dependent offspring impacts negatively on an unmarried woman’s future prospects of marriage (Strakageiersbach & Voland 1990) and is in line with data which show that mothers with high reproductive values are significantly more likely to commit infanticide than are older mothers nearing the end of their reproductive careers (Bugos & McCarthy 1984; Daly & Wilson 1980). The same considerations are less likely to apply in the case of married women since the conditions for reproduction will tend to remain constant in their case. This is implied by the flatness of the abortion rate graph for married women less than 35 years of age (figure 1).

The steep increase in the frequency of abortions in the 45–49 year cohort might be explained either by the elevated risk of producing a child with developmental or congenital defects (Olsen et al. 1996; Forbes 1997) or by a reluctance to increase family size relatively late in a woman’s life or both. While the first explanation will probably influence the decision to abort at least to some extent, the available data appear to support the second explanation. It is clear from figure 1 that it is married women who are mainly responsible for the steep increase in abortions among older women. If the primary reason for this increase is related to a
heightened risk of birth defects, then we ought to see a similar increase for women of the same age who are not married. This is not the case. On the other hand, there is at least some evidence to support the second explanation: although the data do not allow for a full examination of the hypothesis, the available evidence does suggest that there is an increase in the number of married women seeking abortions who already have one or two children.

We have not examined here the direct influence of increasing social and economic status with age on the probability that single women will terminate a current pregnancy through voluntary abortion. However, it is quite possible that the pattern of pregnancy termination by single women at least partly reflects this: with increasing social and economic independence, single women might not view the presence of a husband as a necessary precondition for successful child rearing. The data required to examine this possibility fully are not available. At the same time, there is an important applied implication of the data that we have presented: it is certainly clear from Canadian data (Daly & Wilson 1998) that it is the children of younger single mothers who are at highest risk of neglect and abuse. In our analyses, it is mostly younger single mothers who terminate pregnancies and, thus, it is possible that pregnancies that have a relatively higher likelihood of resulting in child abuse are being terminated. Thus, the availability of voluntary abortion procedures and services has important implications for child protection policies.

Overall, these patterns of abortion are almost identical to the pattern found in Canadian infanticide data (Daly & Wilson 1988). In particular, the steep increase in the proportion of pregnancies aborted in the 45–49 years age group is similar to that observed for infanticides by women in the 35+ years group reported by Daly & Wilson (1988). They argued that killing offspring can be viewed as ‘the desperate decision of a rational strategist allocating scarce resources’; that, given the costs associated with rearing offspring with extended postnatal care requirements, had decisions are likely to be penalized particularly severely by natural selection. To this we might add that late decisions might also be severely punished and this will increase the selection pressure favouring prenatal termination of parental investment over postnatal investment.

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REFERENCES


