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Area-level mortality and morbidity predict 'abortion proportion' in England and Wales

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ABSTRACT

Life history theory predicts that where mortality/morbidity is high, earlier reproduction will be favoured. A key component of reproductive decision-making in high income contexts is induced abortion. Accordingly, relationships between mortality/morbidity and 'abortion proportion' (proportion of conceptions ending in abortion) are explored at small-area ('ward') level in England and Wales. It is predicted that where mortality/morbidity is high, there will be a lower 'abortion proportion' in younger women (<25 years), adjusting for education, unemployment, income, housing tenure and population density. Results show that this prediction is supported: wards with both shorter life expectancy and a higher proportion of people with a limiting long-standing illness have lower abortion proportions in under 25 s. In older age bands, in contrast, elevated mortality and morbidity are mostly associated with a higher 'abortion proportion'. Further, morbidity appears to have a larger effect than mortality on 'abortion proportion' in the under-25 age band, perhaps because a) morbidity is be more salient than mortality in high-income contexts, and/or b) young women are influenced by health of potential female alloparents when scheduling fertility.

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1. Introduction

1.1. Life history theory

Life history theory posits that over the life course organisms face tradeoffs in allocating energy between competing functions such as growing, learning, mating, reproducing and self-care (Roff, 1992; Stearns, 1992). The optimal balance of these trade-offs to maximise reproductive fitness will depend on the local ecology (Schaffer, 1983). One characteristic which varies between ecologies is extrinsic mortality (and morbidity) risk, defined as the risk of death that is not conditional on an organism's reproductive behaviour (Stearns, 1992, p. 182). An organism cannot escape extrinsic mortality by behaving differently, as it is the "age-specific risk of death that is equally shared by all members of a population" (Quinlan, 2010, p. 125). Such risks are therefore important in setting the time horizon of energetic allocation, which will change the costs and benefits of energetic allocation to each respective function and the prioritisation of each. Mortality and morbidity curtail ability to conceive, bear and care for offspring (Geronimus, Bound, & Waidmann, 1999).

Indicators of a high mortality environment may be associated with 'faster' life histories, typified by accelerated reproductive development and earlier age at first reproduction, so that reproduction is temporally prioritised over growth and learning, in order to ensure it takes place while still relatively young and healthy. 'Slower' life histories occur in low mortality/less risky environments (Charnov, 1991), where individuals can afford to substantially invest in their embodied capital before reproducing.

Life histories can diverge between species (Promislow & Harvey, 1990) and within species (Reznick, Bryga, & Endler, 1990); and are not necessarily governed by conscious decision-making (Engqvist & Sauer, 2002; Javois & Tammaru, 2004). Across 22 small-scale human societies, high mortality rates were associated with earlier age at menarche and earlier reproduction (Walker et al., 2006). Such adaptations can happen over evolutionary time (Migliano, Vinicius, & Lahr, 2007); or within a lifespan, environmental cues can influence an organism's phenotype via evolved adaptive mechanisms. Within human lifespans, such effects may occur via physiological and psychological mechanisms (Del Giudice & Belsky, 2011; Nettle, 2011). As long as individuals are receiving enough calories to be fertile, mortality is therefore expected to influence reproductive scheduling (Belsky, Schlomer, & Ellis, 2012).

1.2. Health inequalities

This theoretical framework has been used to help explain socioeconomic differences in reproductive behaviour in high income contexts in our own species (Nettle, 2010). Poorer people when compared to richer people are more exposed to extrinsic morbidity and mortality hazards such as accidental death, homicide, air pollution and heart

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disease in their localities, adjusting for individual-level factors (Bolte, Tamburlini, & Kohlhuber, 2010; Cubbin, LeClere, & Smith, 2000; Smith, Hart, Watt, Hole, & Hawthorne, 1998). Those in the most deprived neighbourhoods may face a 2.5-fold increase in mortality risk when compared to those from the least deprived areas (CSDH, 2008). Morbidity can have even sharper socioeconomic differentials (Bajekal, 2005). It has now been consistently shown that within developed societies poorer people have children earlier (Geronimus et al., 1999; Imamura et al., 2007; Joshi, Hawkes, & Ward, 2004; Nettle & Cockerill, 2010). This empirical finding stimulated the 'weathering hypothesis' (Burton, 1990; Geronimus, 1992, 1996a, 1996b), which suggests that those with higher mortality and morbidity risk may schedule fertility earlier to mitigate reproductive costs, which increase more rapidly with age in those who experience relatively high burdens of morbidity. Nettle and colleagues have developed an explicitly evolutionary version of this hypothesis, whereby such behaviour makes sense in terms of maximising fitness (Nettle, 2010, 2011; Nettle & Cockerill, 2010). Further increasing the incentives to earlier reproduction is the suggestion that there can be educational and career benefits to delaying childbearing, but those at greater risk of mortality/morbidity may be less able to make these investments, despite potential long-term benefits to children (Bulled & Sosis, 2010; Geronimus, 1996b; Kaplan, Hill, Lancaster, & Hurtado, 2000; Krupp, 2012; Low, Hazel, Parker, & Welch, 2008; Nettle, 2011; Nguyen et al., 2012). Poorer families appear to disperse less for economic opportunities (Murphy, 2008; Sear & Dickins, 2010), which means that childcare is more likely to be undertaken by family (Kramer & Lancaster, 2010), so that early reproduction is optimal before one's relatives (mother, for example) see early functional limitation and mortality (Bajekal, 2005; Geronimus et al., 1999).

1.3. Rationale for investigating abortion

Research so far on links between mortality risk or socioeconomic status and the timing of childbearing have focused largely on births or conceptions. Conceptions do not always lead to births, however. A key component of reproductive decision-making in high income contexts is induced abortion. In most such contexts, safe medical abortion is relatively easily accessible and widely used by women as a means of managing their reproductive lives. Its incidence in developed countries where it is legal ranged in 2008 from 30 per 1000 women aged 15–44 in Estonia to Switzerland (seven per 1000). In terms of the proportion of pregnancies that end in induced abortion, the lowest in 2008 was in Israel (10%) and the highest was again in Estonia (30%) (Sedgh, Singh, Henshaw, & Bankole, 2011). Indeed, in some countries there has long been a tendency to use abortion as a contraceptive (e.g. in the former Soviet states) (Agadjanian, 2002); while in others, even where abortion is illegal, unsafe informal procedures or alternatives like menstrual regulation or abortifacients are used (Sedgh et al., 2011; Vlassoff, Hossain, Maddow-Zimet, Singh, & Bhuiyan, 2012). Therefore it can be seen as an important means of managing reproduction.

Hrdy (1979) argues that termination of investment in an offspring (e.g. infanticide) is an adaptive reproductive strategy in animals including primates in circumstances where there can be increased maternal survival or reproductive success of either parent "by elimination of an ill-timed, handicapped or supernumerary infant"(p.13). She also points out that in comparison to other primates humans are unusual in that they quite frequently terminate investment in infants, something which she attributes to the high costs of raising human children (Hrdy, 2009). This means there may well be an associated evolved psychology which enables facultative variation in the decision as to whether to continue investment in an offspring. Ancestrally, induced abortion was riskier for the mother than now, and infanticide was safer. In developed societies the situation is reversed, especially if abortion takes place in the early stages of pregnancy. The gain for the parent can depend on their personal attributes e.g. age and likely opportunity cost of bearing and rearing offspring currently, which may in itself vary depending on local resources and risks.

1.4. Abortion across the reproductive lifespan

Theoretically speaking, we would expect abortion rates to vary with age. Abortion rates show a J-shaped curve with age, at least in high income contexts – younger women tend to be the most likely to abort, abortion rates are lowest among women in their thirties then start to increase towards the end of the reproductive period (Lycett & Dunbar, 1999). This likely reflects both the changing costs and benefits of abortion with age – younger women have more opportunity to conceive again – and also the different reasons for abortion – younger women may be using it to manage the timing of their reproduction (e.g. to allow time for education or career-building; finding a secure partnership) (Lee, Clements, Ingham, & Stone, 2004; Lycett & Dunbar, 1999) while older women may be using it to manage family size or to abort less viable foetuses (as the risks of chromosomal abnormalities increase with maternal age). We also expect the relationship between abortion and morbidity/mortality to vary by age. Environments with high mortality/morbidity may be ones where norms encouraging investment in higher education do not develop because the long-term benefits of education are less clear, as waiting to reproduce may be a risky strategy. If this is the case then there is less need for fertility postponement and therefore we would expect to see lower abortion levels in younger age groups in areas with higher morbidity/mortality. Indeed there is an inverse relationship between education and abortion among young women (Diamond, Clements, Stone, & Ingham, 1999; Lee et al., 2004; Lo, Kaul, Kaul, Cooling, & Calvert, 1994; Wood, 1996).

1.5. Deprivation and abortion

There has been some previous research on how deprivation influences abortion. In the UK, more deprived individuals and communities have both lower levels of abortion (controlling for conceptions), and show less acceptance of it (Lee et al., 2004). Research on links between abortion and deprivation mostly comes from policymakers' interest in teenage pregnancy. These studies tend to measure deprivation in different ways, owing to its multidimensional nature. Much of the research also uses area-level data, given the sensitive nature of abortion and concerns about the risk of revealing individual identities. Quantitative area-level research often uses 'abortion proportion' as its outcome variable, i.e. the proportion of conceptions ending in abortion. At area level it is often the case that deprived areas with a high teenage conception rate also have a low abortion proportion (Bradshaw, Finch, & Miles, 2005; Garlick, Ineichen, & Hudson, 1993). There are descriptive and correlational studies (Garlick et al., 1993; Griffiths & Kirby, 2000; Smith, 1993; Uren, Sheers, & Dattani, 2007; Wilkinson et al., 2006; Wilson, Brown, & Richards, 1992; Wood, 1996) and multivariate research (Bradshaw et al., 2005; Conrad, 2012; Diamond et al., 1999; Lee et al., 2004; McLeod, 2001) showing the inverse relationship between deprivation and abortion. There is also some questionnaire and survey research confirming the same pattern at individual level (Lo et al., 1994; Smith & Roberts, 2009; Wellings, Wadsworth, Johnson, Field, & Macdowell, 1999). The studies just cited also show that repeatedly, deprivation is a far stronger factor in abortion proportion than the proximity and availability of contraception and abortion services, or the balance of state versus private provision; although in phase two of one study both the percentage of female GPs in local authorities and an index of opening hours of family planning clinics were also significant in final models (Lee et al., 2004). Similar patterns may hold elsewhere: one study in Barcelona shows that although with unintended pregnancy, women of lower socioeconomic position are more likely to choose abortion, this is not the case when they are young (Font-Ribera, Perez, & Borrell, 2008). And in the US and Sweden, deprived teens are less likely to have abortions than richer ones (Harding, 2003; Olausson,

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