Adolescent fertility and risky environments: a population-level perspective across the lifespan

Caitlyn D. Placek* and Robert J. Quinlan

Department of Anthropology, Washington State University, PO Box 644910, Pullman, WA 99163, USA

Timing of first reproduction is a key life-history variable with important implications for global economic development and health. Life-history theory predicts that human reproductive strategies are shaped by mortality regimes. This study provides the first test of the relationship between population-level adolescent fertility (AF) and extrinsic risk at two time points. Data are from United Nations database and were analysed using mediation and moderation techniques. The goals were to determine whether (i) early risk has a stronger impact on fertility than current risk; (ii) current risk mediates the relationship between early risk and fertility outcomes; and (iii) different levels of early risk influence the relationship between current risk and fertility. Results indicated that current risk partially mediated the relationship between early risk and fertility, with early risk having the strongest impact on reproduction. Measures for early and current mortality did not show significant interaction effects. However, a series of separate regression analyses using a quantile split of early risk indicated that high levels of early risk strengthened the relationship between current risk and AF. Overall, these findings demonstrate that reproductive strategies are significantly influenced by fluctuations of early mortality as well as current environmental cues of harshness.

Keywords: life-history theory; reproductive effort; environmental risk

1. INTRODUCTION

Timing of first reproduction is a key life-history variable with important implications for global economic development and health. Life-history theory predicts that human reproductive strategies are shaped by mortality regimes. Extrinsic mortality is the local risk of death that is not conditional on an organism’s reproductive behaviour [1]. Statistically, extrinsic mortality can be defined as variance in the probability of death that is not accounted for by mating effort or parenting effort (or by extension trade-offs between reproductive and somatic effort). In other words, an organism cannot escape extrinsic mortality by changing its behaviour: it is the age-specific risk of death that is equally shared by all members of a population. Recent empirical advances have demonstrated that extrinsic mortality has profound influences on adaptive behaviour, such as reproductive effort [2–5]. Here, we examine cross-national effects of mortality on timing of reproductive onset indicated by adolescent fertility rates (AFRs). We examine the interaction of population mortality levels around birth and in early life and compare those effects with mortality levels at age of maturity to identify canalization effects from those of facultative reproductive adjustments later in life.

Extrinsic mortality plays a key role in the evolution of life histories and reproductive strategies [1,6–10]. When extrinsic mortality is high, then organisms should reproduce relatively early in life to reduce mortality exposure over time and extend the length of the reproductive span, which should maximize fertility to ‘beat the odds’ that some offspring will die. Conversely, when extrinsic mortality is low, then differential reproductive success is contingent on resources invested in growth, development and parental effort rather than luck. Hence, in low extrinsic risk environments individuals may enhance fitness by delaying reproduction to accrue additional resources (including knowledge and skills), and by reducing fertility and increasing investment per offspring. These predicted relationships hold among mammals: juvenile mortality is negatively correlated with age at maturity, age at weaning, maternal investment and positively correlated with litter size, and pace of reproduction [9].

Empirical evidence suggests that the relationship between mortality and life-history strategies is complex. Environmental effects often show nonlinear relations with parental investment and reproductive effort [3,4,5,11]. Data from a rural Dominican village, for example, demonstrated that moderate levels of extrinsic mortality at birth predicted higher rates of fertility, but low environmental risk and very high environmental risk both resulted in phenotypically similar alterations in reproductive effort [5]. It appears likely that females shut down reproductive development in order to preserve somatic resources either for self-preservation or to accrue resources in highly stressful environments [11,12].

There is long-standing debate regarding the role of development in shaping human reproductive strategies, and questions remain concerning sensitive periods for development. Early childhood, from 1 to about 7 years, has been suggested as a sensitive period that has the strongest effects on adult outcomes [5,8,13–17]. Recent adoption studies show that conditions in the first 42 months are important in shaping development, with a