

Do Grandmothers Promote Inclusive Fitness?: Evidence from the Utah Population Database

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All organisms are expected to exhibit behavioral choices that will tend to increase their inclusive fitness, generally measurable by the number of offspring surviving to reproductive maturity and their descendants. But the early reproductive senescence of the human female (menopause) seems inconsistent with this hypothesis. Numerous researchers have attempted to provide an evolutionary explanation for this apparently anomalous life history factor of humans. The most likely explanations to date are based on the proposition that early menopause stops a mother from investing in offspring that are less likely to survive to reproductive maturity (perhaps also reducing the mother's longevity by death in childbirth) and allows that investment to be applied to her earlier offspring and their progeny, potentially reducing her daughters' interbirth intervals with a net result being an increase in her own inclusive fitness over what she could have realized by having more offspring of her own (i.e., the Grandmother Hypothesis). There have been few tests of these hypotheses and no completely satisfactory ones, though some tests, while not supporting the hypothesis, could not reject it.

We test key aspects of the hypothesis by using the Utah Population Data Base (UPDB) based on data from over 40,000 mothers, their mothers (and fathers), and 185,000 of their offspring, all drawn

from a period of time reflecting natural fertility conditions in the Western frontier (mid to late 1800s). We first compared the fertility of two groups, egos consisting of women who produced offspring while egos own mothers were living and in close proximity (living within the same county) and the other consisting of egos who produced their offspring in the absence of their own mothers, either because of their mother's death or because she lived remotely. Cox proportional hazard models are estimated to assess the association between the presence or absence of a living, geographically proximate grandmother and the fertility hazard rate. We find evidence indicating that grandmothers are associated with shorter birth intervals. This results is consistent with Grandmother Hypothesis. We also find evidence that finds similar albeit weaker fertility effects among grandfathers.

We next extended the analysis to compare egos whose own mothers were living and in close proximity with egos whose own mothers were not living or not in close proximity in terms of the survival of Egos own children to age 18. In other words, we consider whether grandmothers promote the survival of their grandchildren to sexual maturity (e.g., age 18). We again find support for this association: grandchildren whose grandmothers are alive and present have lower childhood mortality rates than grandchildren who do not.