

Study: Men shed light on the mystery of human longevity

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It turns out that older men chasing younger women contributes to human longevity and the survival of the species, according to new findings by researchers at Stanford and the University of California-Santa Barbara.

Evolutionary theory says that individuals should die of old age when their reproductive lives are complete, generally by age 55 in humans, according to demographer Cedric Puleston, a doctoral candidate in biological sciences at Stanford. But the fatherhood of a small number of older men is enough to postpone the date with death because natural selection fights life-shortening mutations until the species is finished reproducing.

"Rod Stewart and David Letterman having babies in their 50s and 60s provide no benefit for their personal survival, but the pattern [of reproducing at a later age] has an effect on the population as a whole," Puleston said. "It's advantageous to the species if these people stick around. By increasing the survival of men you have a spillover effect on women because men pass their genes to children of both sexes."

"Why Men Matter: Mating Patterns Drive Evolution of Human Lifespan," was published Aug. 29 in the online journal *Public Library of Science ONE*. Shripad Tuljapurkar, the Morrison Professor of Population Studies at Stanford; Puleston; and Michael Gurven, an assistant professor of anthropology at UCSB, co-authored the study in an effort to understand why humans don't die when female reproduction ends.

Human ability to scale the so-called "wall of death"—surviving beyond the reproductive years—has been a center of scientific controversy for more than 50 years, Puleston said. "The central question is: Why should a species that stops reproducing by some age stick around afterward?" he said. "Evolutionary theory predicts that, over time, harmful mutations that decrease survival will arise in the population and will remain invisible to natural selection after reproduction ends." However, in hunter-gatherer societies, which likely represent early human demographic conditions and mating patterns, one-third of people live beyond 55 years, past the reproductive lifespan for women. Furthermore, life expectancy in today's industrialized countries is 75 to 85 years, with mortality increasing gradually, not abruptly, following female menopause.

Grandmother hypothesis

In 1966, William Hamilton, a British evolutionary biologist, worked out the mathematics describing the "wall of death." Since then, the most popular explanation for why humans don't die by age 55 has been termed the "grandmother hypothesis," which suggests that women enhance the survival of their children and grandchildren by living long enough to care for them and "increasing the success of their genes," Puleston said. However, Hamilton's work has been difficult to express as a mathematical and genetic argument explaining why people live into old age.

Unlike previous research on human reproduction, this study—for the first time—includes data on males, a tweak that allowed the researchers to begin answering the "wall of death" question by matching it to human mortality patterns. According to Puleston, earlier studies looked only at women, because scientists can reproduce good datasets for humans entirely based on information related to female fertility and survival rates.

"People don't like to do two-sex models because [it's difficult] to look at how [men and women] pair up," he said. "But men's fertility is contingent on women's fertility—you have to figure out how they match up. We care about reproduction because that is a currency by which force of selection is counted. If we have not accounted for the entire pattern of reproduction, we may be missing something that's important to evolution."

Men and longevity

In the paper, the researchers analyzed "a general two-sex model to show that selection favors survival for as long as men reproduce." The scientists presented a "range of data showing that males much older than 50 years have substantial realized fertility through matings with younger females, a pattern that was likely typical among early humans." As a result, Puleston said, older male fertility helps to select against damaging cell mutations in humans who have passed the age of female menopause, consequently eliminating the "wall of death."

"Our analysis shows that old-age male fertility allows evolution to breach Hamilton's wall of death and predicts a gradual rise in mortality after the age of female menopause without relying on 'grandmother' effects or economic optimality," the researchers say in the paper.

The scientists compiled longevity and fertility data from two hunter-gatherer groups, the Dobe !Kung of the Kalahari and the Ache of Paraguay, one of the most isolated populations in the world. They also looked at the forager-farmer Yanomamo of Brazil and Venezuela, and the Tsimane, an indigenous group in Bolivia. "They're living a lifestyle that our ancestors lived and their fertility patterns are probably most consistent with our ancestors," Puleston said about the four groups. The study also looked at several farming villages in Gambia and, for comparison, a group of modern Canadians.

In the less developed, traditional societies, males were as much as 5-to-15 years older than their female partners. In the United States and Europe, the age spread was about two years. "It's a universal pattern that in typical marriages men are older than women," Puleston said. "The age gaps vary by culture, but in every group we looked at men start [being sexually reproductive] later. At the end of reproduction, male fertility rates taper off gradually, as opposed to the fairly sharp decline in female fertility by menopause."

Despite small differences based on marriage traditions, all women and most men in the six groups stopped having children by their 50s, the researchers found. But some men, particularly high-status males, continued to reproduce into their 70s. The paper noted that the age gap is most pronounced in societies that favor polygyny, where a man takes several wives, and in gerontocracies, where older men monopolize access to reproductive women. The authors also cite genetic and anthropological evidence that early humans were probably polygynous as well.

Older male fertility also exists in societies supporting serial monogamy, because men are more likely to remarry than women. "For these reasons, we argue that realized male fertility was substantial at ages well past female menopause for much of human history and the result is reflected in the mortality patterns of modern populations," the authors say. "We conclude that deleterious mutations acting after the age of female menopause are selected against ... solely as a result of the matings between older males and younger females."

According to Puleston, the "grandmother hypothesis" may be true, but the real pattern of male fertility extends beyond this explanation. "The key question is: Does the population have a greater growth rate if men are reproducing at a later age? The answer is 'yes.' The age of last reproduction gets pushed into the 60s and 70s if you add men to the

analysis. Hamilton's approach was right, but in a species where males and females have different reproductive patterns, you need a two-sex model. You can't correctly estimate the force of selection if you leave men out of the picture. As a man myself, it's gratifying to know that men do matter."

Source: Stanford University

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