

Studies lend support to 'grandmother hypothesis,' but there are limits

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Humans are unusual in that women go through menopause and stop reproducing long before reaching the end of their life expectancy. One theory holds that this aspect of human life history may be explained by the evolutionary benefits associated with the role of grandmothers in helping their grandchildren. Now, two studies reported in *Current Biology* on February 7 add to evidence for this so-called "grandmother hypothesis." However, they also show that there are limits.

"Grandmother help is central to human families all around the world, but we find that the opportunity and ability to provide help to young grandchildren declines with grandmother age," says Virpi Lummaa of the University of Turku, Finland, corresponding author of one of the two studies.

"In our study, women whose mothers were alive had more children and more of those children lived to the age of 15," adds Patrick Bergeron of Bishop's University, Canada, a lead author on the other study. "Interestingly," he adds, "the grandmother effects decreased as the grandmother-daughter geographic distances

increased, suggesting that the potential for help may be related to [geographic proximity](#)."

While the influence of grandmothers has been well studied in some contexts, Lummaa's team saw a key question that hadn't been addressed: does the age of a grandmother affect the benefits her presence offers to her family? As the researchers explain, identifying situations when help does and does not occur could help us understand how post-[reproductive life](#) may have evolved and how grandmothers may have selected for its length.

The researchers relied on long-term life-history data from detailed pre-industrial Finnish church registers. The Finnish population in question experienced large fluctuations in rates of mortality and fertility. Its members were at risk due to a harsh climate, poor crop yields, and outbreaks of disease. About a third of the population died before the age of 5.

The data suggest that the opportunity and ability for grandmothers to help grandchildren declined with age. The presence of maternal grandmothers, aged 50 to 75, increased the survival of grandchildren, lending support to the idea that post-reproductive lifespan comes with a fitness advantage.

However, the researchers report, living with a paternal grandmother over the age of 75, who was presumably in poor health, was actually detrimental to grandchild survival. The findings suggest that the evolutionary benefits of grandmothers can select for a longer lifespan, but "only up to a certain point."

"Our work implies that, whilst post-reproductive lifespan could indeed have evolved at least partly due to beneficial grandmother effects, such benefits wane with age as the opportunities and ability to provide help decline, leading to limits to the evolution of even longer lifespan," first author Simon Chapman says. "As lifespan in modern industrialized nations is much longer than in the

past, it may be that medicine has allowed us to overcome the 'natural' limit on longevity."

To study the potential for grandmothers to help in their study, Bergeron's team, including first author Sacha Engelhardt, took advantage of exceptionally detailed data on the first French settlers to Quebec, Canada, during the 17th and 18th centuries. The data made it possible to explore the benefits of grandmothers on grandchild survival while accounting for geographic distances between grandmothers and their daughters.

"French settlers had large family size at the time, allowing us to control for potential shared familial genetic and environmental effects, by comparing the reproductive profile of sisters that lived with or without their mother," Bergeron says.

Living grandmothers allowed their daughters to increase the number of children they had by about 2 and the number surviving to the age of 15 by about 1 on average in comparison to families in which the maternal grandmother had passed away. As geographic distance increased, the researchers report, the number of children born and lifetime reproductive success decreased, while the age at first reproduction increased, despite the grandmothers' being alive. In other words, grandmothers weren't much help when they lived too far away.

"In investigating geographic distances, we have empirically shown another mediating factor of grandmother help, adding another piece to the complex puzzle of post-reproductive lifespan," Bergeron says.

The findings show that the influence of grandmothers can be context dependent, highlighting the importance of testing its importance in different populations, Bergeron notes. Chapman says they plan to continue exploring different contexts where grandmother effects have been particularly important, to build a clearer picture of the role of [grandmother](#) help in the evolution of post-reproductive life.

More information: *Current Biology*, Engelhardt et al.: "Using geographic distance as a potential proxy

for help in the assessment of the grandmother hypothesis" [www.cell.com/current-biology/fulltext/S0960-9822\(19\)30029-6](http://www.cell.com/current-biology/fulltext/S0960-9822(19)30029-6) DOI: [10.1016/j.cub.2019.01.027](https://doi.org/10.1016/j.cub.2019.01.027)

Current Biology, Chapman et al.: "Limits to fitness benefits of prolonged post-reproductive lifespan in women" [www.cell.com/current-biology/fulltext/S0960-9822\(19\)30008-9](http://www.cell.com/current-biology/fulltext/S0960-9822(19)30008-9) DOI: [10.1016/j.cub.2018.12.052](https://doi.org/10.1016/j.cub.2018.12.052)

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