

When Does Human Longevity Start?: Demarcation of the Boundaries for Human Longevity

NATALIA S. GAVRILOVA and LEONID A. GAVRILOV

ABSTRACT

The scientific debates on the future of human life span and its possible biological limits revealed a great need for direct identification of longevity boundaries, if they really exist. The key question posed in this study is as follows: how can we possibly determine the age when human longevity starts? To address this problem, we studied the familial transmission of human life span from parents to daughters, since daughters did not have a high incidence of violent causes of death due to military service and are particularly responsive to parental life span. We found that the familial transmission of human life span from mother to daughter is essentially nonlinear with virtually no daughter-mother life span resemblance for shorter-lived mothers (died before age 85) and very high familial resemblance (additive heritability) for longer-lived mothers. This indicates that maternal age of 85 years could be considered as a demarcation point (lower boundary) for female longevity. Women who live above this age are fundamentally (presumably genetically) different from other women in the sense that their daughters live significantly longer. Thus, the age of 85 years could be considered as a threshold age when women mortality becomes much more selective. A similar study of familial transmission of human life span from father to daughter revealed a demarcation point at 75 years, suggesting that this age might represent a lower boundary for male longevity. These results are also consistent with predictions of the evolutionary theory of aging and mutation accumulation theory in particular, namely that the additive genetic variance for human life span should increase with parental longevity. In other words, human mortality should become more selective at advanced ages, and this prediction is confirmed in the present study.

INTRODUCTION

THE SCIENTIFIC DEBATES on the future of human life span and its possible biological limits^{1, 2} revealed a great need for direct identification of longevity boundaries, if they really exist.^{3, 4} The key question posed in this study is as follows: how can we possibly determine the age when human longevity starts? To address this problem, we studied the familial transmission of human life span from parents to

daughters, since daughters did not have a high incidence of violent causes of death due to military service and are known to be particularly responsive to parental life span.⁵ If human life span is inherited just as any other polygenic quantitative trait, then the monotonic linear dependence between offspring life span and parental life span is expected.^{6, 7} In this case, no evidence for any boundaries of human longevity could be detected. On the other hand, if a special age corresponding to longevity