Astonishing conformity: Gompertz law predicts mortality in type 2 diabetes

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Researchers from the German Diabetes Center (DDZ) and the Robert Koch Institute have discovered a law for the relationship between mortality and age in people with diabetes: According to this law,

mortality in people with diabetes in Germany constantly rises by 8.3% in males and 10.2% in females each year from the age of 30.

The Gompertz law is based on the observation that biological processes in the body change with aging, resulting in a higher risk for illnesses and ultimately death. The mortality rate does not grow linearly, but exponentially, meaning that it continues to accelerate with age. This exponential change is observed virtually universally, both across regions and time.

Surprisingly accurate

The research group led by the DDZ recently used the Gompertz model to more precisely investigate mortality in association with type 2 diabetes.

"It is particularly remarkable how well the Gompertz law is able to predict mortality in people with diabetes. On a scale from 0% to 100%, values of over 97% were achieved—such good predictions are found extremely rarely in empirical research," says lead author Prof. Oliver Kuss, Director of the Institute for Biometrics and Epidemiology at the DDZ.

The researchers analyzed the data of all statutory health-insured persons (more than 47 million observations, of which over 6 million have diabetes) in 2013. They were followed up for one year and more than 760,000 deaths were recorded in this period, among them 288,000 people with diabetes.

Results

The study shows that mortality in people with diabetes in Germany

constantly rises by 8.3% for males and 10.2% for females each year from the age of 30.

"However, the greater increase in mortality for females is explainable: Females generally have a longer life expectancy than males because they start from a lower base level of mortality. At advanced ages, there is a convergence of mortality rates, meaning that the difference between the sexes becomes increasingly small," Kuss says, explaining the results.

Interestingly, the validity of the Gompertz law could also be demonstrated in the group of people without diabetes: The mortality of females with diabetes was nearly identical to that of males without diabetes. "The general advantage that females have in terms of life expectancy is lost if they develop diabetes," concludes the expert.

Furthermore, it was determined that the probability that a person with diabetes dies before a person without diabetes is 61.9% for females and 63.3% for males. "This study underlines the necessity for the early prevention, detection, and treatment of type 2 diabetes," claims Prof. Michael Roden, Director of the Department of Endocrinology and Diabetology at the University Hospital of Düsseldorf and Director of the DDZ.

The study is published in the journal *Acta Diabetologica*.

More information: Oliver Kuss et al, Mortality of type 2 diabetes in Germany: additional insights from Gompertz models, *Acta Diabetologica* (2024). DOI: 10.1007/s00592-024-02237-w