

Living long or healthy?

A current piece of research examines afresh the question of choosing a short and healthy life over a longer one with health issues



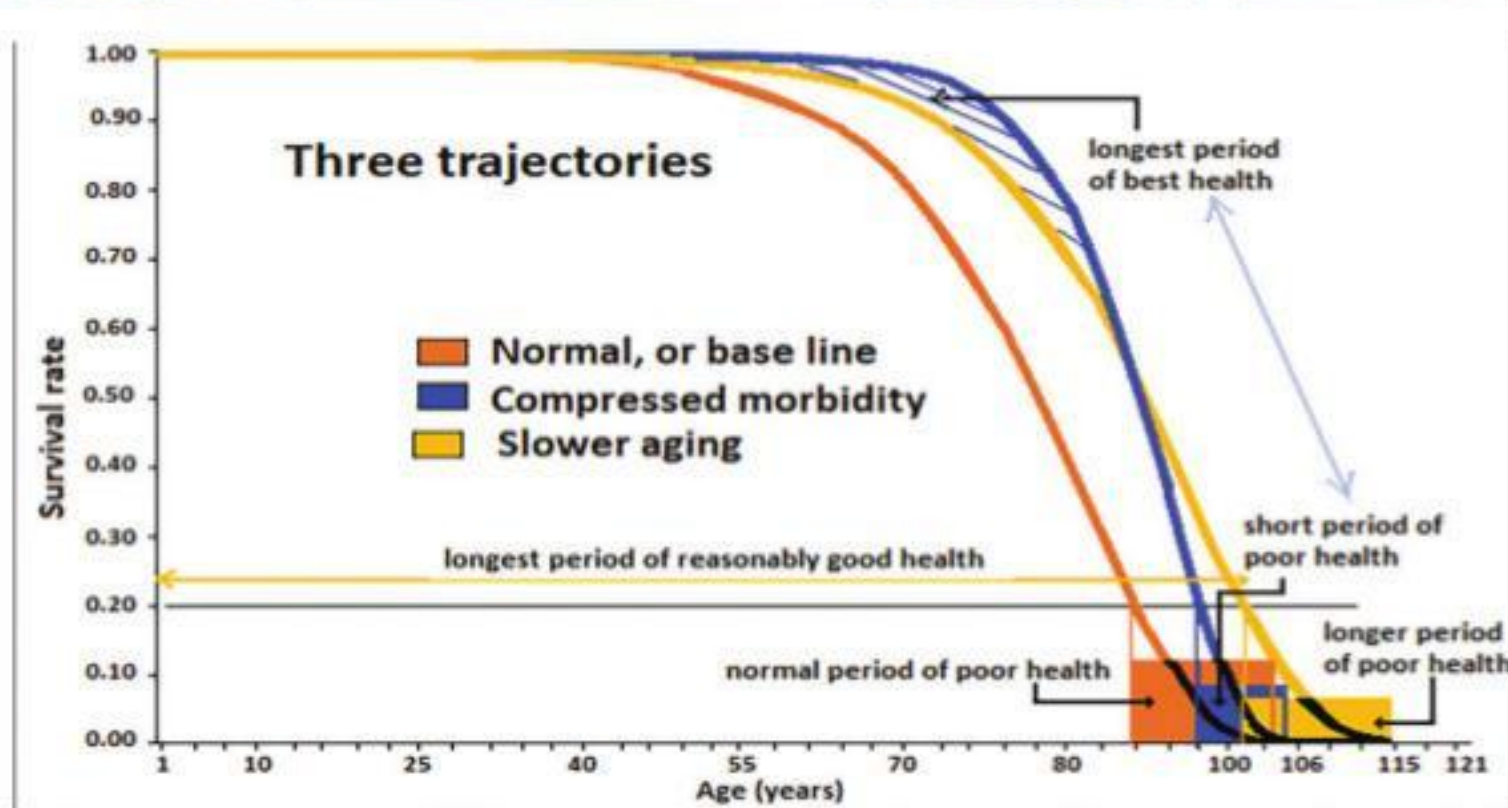
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The question of whether life has become more onerous in modern times is often raised. Has our capacity to perform declined since the time of our grandparents? What has been the price of the general increase of life expectancy that we have now?

Andrew J Scott, Martin Ellison and David A Sinclair, from the departments of economics at London Business School and the University of Oxford, and the Harvard Medical School, in a paper in the journal, *Nature Aging*, step away from subjective assessments to answer the question. Instead, they develop measures of the economic value of being alive and examine which public health strategy may be the best investment for society to make. The approach cuts through impressions of current crises, environment, personal stress, and simply estimates the total of the value that every individual places on life itself.

The question, in fact, of choosing a short and healthy life, over a longer one with health issues, has been examined many times in the past. The paper, in the course of presenting its results, draws on paradigms in literature and cinema, and uses them to represent alternative approaches to aging and mortality.

The first of these were the people of Luggnagg, called the Struldbrugg, in Jonathan Swift's satire *Gulliver's Travels*. The Struldbrugg grew old like the rest of us, but they could never die. As they would grow frailer with time, they were treated as legally dead when they were 80 years old and were not allowed to own property or participate in civic life. The second is Oscar Wilde's character, Dorian Gray, who was mortal, but did not age. In the novel, Dorian Gray had a portrait painted of himself as a young man, and it was the portrait that would age, and die, while the subject of the painting stayed young, till he died. The third case is Peter Pan, in J M Barrie's story of a boy who never grew old, and lived in Neverland, where time did not pass. And the fourth case is of Wolverine, the Marvel Comics superhero, who could regain youth by regenerating his



organs.

The context is the dramatic increase in life expectancy (LE), thanks to better nutrition and medical services, over the last 150 years. The paper, however, cites *The Global Burden of Diseases, Injuries, and Risk Factors Study*, 2019, which covered 204 countries, and finds that despite the increase in LE, the proportion of the lifetime spent in good health has not increased. While the years of poor health have increased, the paper notes, they were affected by chronic non-communicable diseases, which were the cause of 73.2 per cent of the deaths in the United States in 2016. Hence the emerging body of research that emphasises the idea of "healthy aging", the paper says.

What should be the way forward? Should the time of illness be compressed towards the end of life? How would it help to target aging itself, which could make life both healthier and longer? Or should the emphasis be on treating specific diseases? To find answers, the paper uses a technique, "the value of statistical life" methodology, which puts monetary value to the gains from longer life, better health and changes in the rate at which we age.

Long life or a healthy one?

"During the 20th century, life expectancy at birth for a representative American increased by roughly 30 years. In 1900, nearly 18 per cent of males born in the U S died before their first birthday; today, cumulative mortality does not reach 18 per cent until age 62" – Kevin Murphy and Robert Topel

The change since 1900 may be similar in most countries. But raising life expectancy alone may not be the best way to promote well-being. Are the additional years spent in good health?

The methodology consists of estimating what a person may be "willing to pay (WTP)" for a year's increase in LE, at any stage of life. The WTP is related to the individuals' lifetime expected utility. Increase of the lifetime implies

more time to enjoy goods, or the levels of consumption, and leisure that are available. And improvement in the quality of life would increase the utility of given amounts of goods and leisure.

The computations used are of the American population and levels of consumption and manner of living, which would certainly not hold for other parts of the world. The paper itself states that even for the American case, the assumptions of values could be questioned and modified. The objective, however, is not monetary evaluation, but a comparison of the value of different forms of health service interventions. In respect of the relative costs and benefits of alternatives, the differences in the values of inputs considered would affect each choice in the same way. The conclusions would hence continue to be valid.

The first case considered is of just extending life while health keeps failing as before. It is like the Struldbruggs, where the ratio of the "healthy LE" to the LE rapidly falls, a case of increasing population of the very old, all on life support. The next case is where morbidity, or serious illness is compressed to the last years, with LE unchanged. Here, the ratio of "healthy LE" to LE increases, and it would correspond to Dorian Gray. In the graph shown, this case is the blue line.

The next case is where aging itself is slowed down, with improvement in health as well as mortality. As aging can be considered a result of accumulating biological damage, deterioration of both health and mortality would be slowed down. The extreme is where aging totally stops, as in the case of Peter Pan. But even in a less extreme situation, unlike Struldbruggs or Dorian Gray, there is two-fold gain of utility, in health as well as in LE.

Calculations of the WTP, or the lifetime utility, over the lifetime, show that the value increases with age. This makes sense, as older persons have larger investments to enjoy and the value of a one-year increase in the LE would be more valuable to an older person. And in the case where aging has been slowed, higher the LE, greater that value of increase in health, and better the health, higher the value of increase in LE.

In the fourth case, Wolverine, it is considered that aging is as usual till some age, say 65, where there is a restoration of youth. Here, the WTP stays lower than Peter Pan till the restoration event. There is some progress in the regeneration of tissue, its effect on longevity is not clear, and it would increase WTP, but is still not a course of intervention to consider.

The next question examined is how does the WTP for slowing down aging compare with that of reduction of specific diseases. Here the paper looks at the benefits from a drug, metformin, prescribed for type 2 diabetes, and is said to protect against "several age-related diseases". Insofar as such protection (as also "education", which has wide, general health benefit) amounts to retarding aging, the study shows substantial benefits, "often matching or exceeding those from the complete eradication of cancer, dementia or cardiovascular diseases," the paper says.

"Delaying aging creates a virtuous circle, where slowing aging begets demand for further slowing of aging... this provides a distinctive dynamic to targeting aging compared to treatments aimed at specific diseases," the paper concludes. The conclusion could lead to economics-based public health policy.

We are now seeing much disparity in the health budgets of states, and large deficits in many developing countries. A formal assessment of what facilities need to be created for the greatest public health returns would optimise the use of scarce funds.

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PLUS POINTS

Go organic



Children who eat organically produced food have been linked with better cognitive development, a study has shown. Researchers in Spain examined levels of children's "fluid intelligence", which is the ability to solve reasoning problems and use "working memory" – the ability to retain new information while it is needed in the short term.

The team said their findings suggested healthier diets could have a direct impact on the development of children's brains. Lead author Jordi Júlvez, who worked alongside academics at Barcelona's Institute for Global Health, said, "Organic diets are richer than fast food diets in nutrients necessary for the brain, such as fatty acids, vitamins and antioxidants, which together may enhance cognitive function in childhood."

Scientists also said factors such as eating junk food, living in overcrowded houses and exposure to domestic tobacco smoke were associated with reduced levels of fluid intelligence. In addition, exposure to fine particulate matter (PM2.5) indoors was associated with lower working memory scores.

The research team used data from 1,298 children aged six-11 years from six European countries – the United Kingdom, France, Spain, Greece, Lithuania and Norway. They examined 87 environmental factors the children were exposed to in utero, including air pollution, traffic, noise, various chemicals and lifestyle factors, and another 122 factors they were exposed to during childhood.

They said their aim was to analyse the influence these factors could have on the development and maturation of the human brain. "During childhood the brain is not yet fully developed for efficient defence against environmental chemicals and is particularly sensitive to toxicity, even at low levels that do not necessarily pose a risk to a healthy mature brain," the researchers said.

The authors said the research was unique as their method took into account the totality of exposures rather than focusing on a single one. They said this provided a better understanding of the complexity of multiple environmental exposures and their simultaneous effect on children's brain development.

They noted that there has previously been little research on the relationship between diet and cognitive function, but fast food intake has been associated with lower academic development success and some previous studies have also reported positive associations between organic diets and executive function scores. "In our study we found better scores in fluid intelligence and working memory with higher organic food intake and lower fast food intake," said Júlvez.

In contrast, exposure to tobacco smoke and indoor PM2.5 during childhood may negatively affect cognitive function by enhancing pro-inflammatory reactions in the brain, the researchers suggested. But Júlvez, cautioned that "the number of people living together in a home is often an indicator of the family's economic status, and that contexts of poverty favour less healthy lifestyles, which in turn may affect children's cognitive test scores".

The research is published in the journal *Environmental International*.

—The Independent

Dinosaur decline

Dinosaurs may have been in decline millions of years before the meteor strike often attributed to their extinction, according to research published recently examining the role played by a changing climate.

The Chicxulub meteor, which slammed into what is now Mexico's Yucatan peninsula around 66 million years ago, is thought to have led to the Cretaceous-Paleogene extinction event that killed off three-quarters of life on Earth – dinosaurs included.

Now new research suggests that a number of species of the terrible lizards may have been declining up to 10 million years before the meteor strike. Research published in the journal *Nature* examined data from 1,600 dinosaur remains found across the planet to model how common certain species of carnivorous and herbivorous dinosaurs were in the late Cretaceous.

The team found that species decline began around 76 million years ago.

—The straits times/ann

NOVEL SOLUTION

The mass testing challenge of Covid-19 could be addressed by a new tool that detects positive samples from waste

ANDY WARD & SIDDHARTH TALLUR

Since the early days of the Covid-19 pandemic, the World Health Organisation has said that testing, tracking and tracing is key to controlling and stopping outbreaks of the disease.

While populous, developing countries like India have made tremendous progress in increasing the number of diagnostic tests conducted daily (close to 1.9 million), the availability of testing infrastructure and scalable tools for early identification of disease outbreak is essential. An ability to monitor the spread of the virus and identify emerging hotspots is critical to stopping the disease from spiralling out of control.

Early detection facilitates actions such as localised containment zones and screening and quarantining of infected individuals without having to impose large-scale lockdowns, thus avoiding the negative economic impact and burden on the healthcare infrastructure.

What our waste can tell us

In India, therefore, there is a need for new, novel technologies that can bridge the gap between mass-human diagnostic testing and the required level of public health surveillance to detect and stop outbreaks of the virus.

One idea to bridge this gap is the monitoring of wastewater for the presence of nucleic acid from the virus. If Sars-CoV-2 nucleic acid is found in wastewater, then it would point to the presence of Covid-19 in a community and help to target the more limited resources of human diagnostic testing in areas where there is a known prevalence of the virus.

In other words, a single water sample could represent thousands of people, and through targeting would make each of the 1.9 million diagnostic tests count more.

There are other benefits too. For example,

public health authorities can non-invasively monitor communities without relying on people with symptoms to come forward, positive samples can be monitored downstream and sequenced to determine the characteristics of the nucleic acid found, to hunt out variants that are starting to dominate and improve the picture of viral spread.

The idea of using wastewater analysis in this way is not new – in the last year, over 400 papers have been published on detection of Sars-CoV-2 in wastewater. Many developed nations are also pursuing a wastewater-based surveillance system for the virus to help manage outbreaks.

This technique has recently been adopted in India, with the introduction of a city-wide sewage surveillance system in Bangalore by the Government of Karnataka, covering 45 wards across the city that house over 75 per cent of its population.

Manual sample collection and analysis in laboratories utilised in such methods may be scalable to other cities in the country but translating the solution to rural areas requires development of easy-to-use, low-cost hardware and workflows that can be implemented in pop-up laboratories without extensive training.

Cost-effective screening

Our contribution to this challenge has been the creation of a tool that can be used, in conjunction with "old-fashioned" polymerase chain reaction to rapidly detect the presence of Sars-CoV-2 in wastewater.

The system we developed uses an electrochemical sensor, in combination with a low-cost portable PCR machine, to identify the presence of positive samples without the need for complex laboratory infrastructure.

Because this system could be used at low cost, it has the potential to be used as a first-line screening tool for the identification of Sars-CoV-2 in wastewater and therefore, help to



inform downstream actions, such as laboratory-based analysis of the samples for Ribonucleic acid, or RNA, concentration or sequencing for detection of variants.

Importantly, the electrochemical sensor development was started using limited resources that were available within India, during the lockdown in May 2020. For example, the sensor is based upon the ubiquitous printed circuits used in the electronics industry, and a commonly available dye called "methylene blue".

Sourcing locally was a necessity last year because access to reagents was limited as nations across the globe scrambled for access to resources from laboratory plastic to personal protective equipment. It also underlines, however, the robustness of our approach, and the ability to create Made-in-India solutions is important in terms of the cost and sustainability of the technology developed.

Sharing knowledge

Our journey so far has been made possible through responsive and innovative collaboration. At the start of the pandemic, we won a Global Challenges Research Fund grant from the Scottish Funding Council to build the technology between the University of Strathclyde and Indian Institute of Technology-Bombay.

