1.02 Review article = Pregledni znanstveni članek

Global Demographic Change - On Longevity

Hans Groth[1]

Abstract: In this paper the author examines patterns and prospects for the leading causes of death in countries across the globe. An explicit focus is on the diversity and ongoing dynamics of mortality. New factors promising to contribute to a longer and healthier life help to draw a picture of our life in the decades to come and its opportunities for business and society. Based on this the author presents several scenarios for forecasting of life expectancy with different degrees of probability.

Keywords: nominal demographic change; longevity; forecasting life expectancy

JEL classification: J11

Globalne demografske spremembe – o dolgoživosti

Povzetek: Avtor v članku obravnava vzorce in pričakovanja za vodilne vzroke smrti na svetu. Ekspliciten poudarek raziskave je na različnosti tekoče dinamike smrtnosti. Novi dejavniki, ki bi lahko prispevali k daljšemu in bolj zdravemu življenju, omogočajo prikazati, kako bo izgledalo naše življenje v prihodnjih dekadah in kakšne bodo zato nove priložnosti za poslovanje in za družbo sploh. S pomočjo izbranih podatkov iz mednarodnih študij avtor predstavi različne scenarije za napovedovanje pričakovane življenjske dobe z različnimi stopnjami verjetnosti.

Ključne besede: demografske spremembe; dolgoživost; napovedovanje pričakovane življenjske dobe

JEL klasifikacija: J11

[1] WDA Forum, Kornhausstrasse 18, 9001 St. Gallen, Switzerland, and University of St. Gallen, Duforustrasse 50, 9001 St. Gallen, Switzerland, info@wdaforum.org

How to cite this paper = Kako citirati ta članek: Growth, H. (2019). Global Demographic Change – On Longevity. *Mednarodno inovativno poslovanje = Journal of Innovative Business and Management*, 11(2), 15-21. DOI: 10.32015/JIMB/2019-11-2-2

Mednarodno inovativno poslovanje = Journal of Innovative Business and Management
ISSN: 1855-6175

1 Introduction

This paper examines patterns and prospects for the leading causes of death in countries across the globe. An explicit focus on the diversity and ongoing dynamics of mortality, and new factors promising to contribute to a longer and healthier life helps to draw a picture of our life in the decades to come and its opportunities for business and society. Based on this, several scenarios forecasting life expectancy with different degrees of probability are presented.

2 Leading causes of death in 2015

Using the World Bank classification of countries with regards to income, the World Health Organization (WHO, 2018a) looks at the leading causes of death in low-income countries (gross national income (GNI) of USD 1,025 or less), lower-middle-income countries (GNI between USD 1,026 and USD 4,035), upper-middle-income countries (GNI between USD 4,036 and USD 12,475) and high-income countries (GNI above USD 12,476) in 2015. The WHO classifies these causes of death in three categories: communicable, maternal, neonatal and nutritional conditions (Group I); non-communicable diseases (Group II); and injuries (Group III).

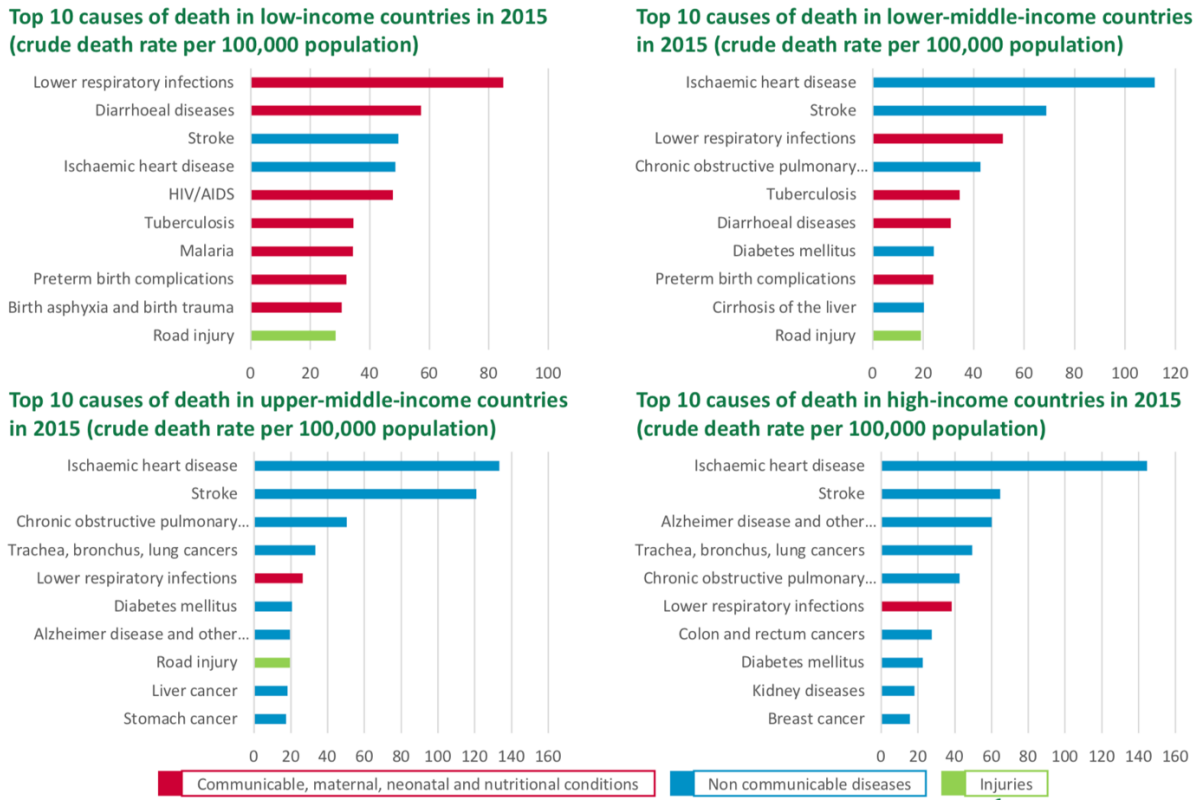

Figure 1: Top 10 causes of death by gross national income (GNI) in 2015
Source: WHO, 2018b.

As illustrated in figure 1, the mortality patterns look very different depending on whether when a country is in the low-income cluster or in the high-income cluster. The most striking difference between these brackets is the importance of communicable diseases (Group I), which represents 52% of all deaths for low-income countries and only 7% for high-income countries. Overall, one can see that the richer a country is, the more it can reduce or even virtually eliminate deaths from communicable, maternal, neonatal and nutritional conditions, with the exception of lower respiratory infections. In effect, we witness an epidemiologic transition, in which the leading causes of death eventually become non-communicable diseases at higher income and development levels.

Mednarodno inovativno poslovanje = Journal of Innovative Business and Management 11(2), 15-21, DOI: 10.32015/JIMB/2019-11-2-2

A closer look at the leading causes of death in high-income countries reveals that the leading causes are ischemic heart disease, stroke, Alzheimer disease/ dementia and a variety of cancers such as trachea, bronchus, lung, colon, rectum and breast cancers. Causes and treatments of each of these diseases is beyond the scope of this paper, but one can clearly state that these are age-related diseases to a high extent. In short, today mankind increasingly dies from the consequences of longer lives. But there are additional causes of mortality as part of the experience of growing old: It is loneliness and isolation. Their evidence base in older adults is growing, but at present the extent of the public health challenge posed by loneliness and isolation and the potential gains from intervention are not fully recognized.

3 The science behind ageing

If further increases of longevity are the goal, one needs to understand the science behind ageing. The problem is that, even today, the process of ageing eludes scientists. The WHO (2018b) explains it as follows: *"At the biological level, ageing results from the impact of the accumulation of a wide variety of molecular and cellular damage over time. This leads to a gradual decrease in physical and mental capacity, a growing risk of disease, and ultimately, death".* But what causes these damages? What are the factors affecting ageing? And is there something that can be treated and even cured? This is subject on to ongoing research and ongoing debate in the scientific community.

The numerous mechanisms by which humans actually age still puzzle researchers. But the factors impacting ageing are relatively straightforward. They are classified in two principle categories: genetics and environment. The first category, genetics, has mostly to do with the DNA-damage-theory of ageing. People with "good" genes have a higher chance of living longer and most frequently in better conditions. In the past decades, there has been considerable progress – mostly in laboratory settings – to understand what genes might influence the ageing process. Whether one can identify these genes in humans and modify them to delay or even eliminate the process of ageing is subject to ongoing research with unclear outcome.

However, having good or bad genes is not the only determinant of ageing. The second influencing force is the environment a person lives in. To give a very simple example, assuming that two twins share the same DNA, how is it possible that they still can show significant differences in terms of their actual life expectancy? In their paper "Human longevity: Genetics or Lifestyle? It takes two to tango" Passarino, De Rango, and Montesanto (2016) argue that only 25% of the variation in human longevity is due to genetics and that environmental factors play a very large role. Following a healthy diet, exercising on a regular basis, sleeping enough, not smoking, not getting sunshine for too long, balancing stress and having a rewarding social network all decrease the chances of getting age-related diseases and thus lead to longer life expectancies. Of course, there are still many questions such as to what extent each of these behaviors affects ageing and what the best practices of these behaviors are. Air pollution is also starting to become an important factor in a third of all deaths from stroke, lung cancer and respiratory diseases. And finally, climate change is another phenomenon starting to affect mortality at all ages but particularly older age cohorts.

In Western medicine the standard way of dealing with age-related diseases is to treat them when they become evident or symptomatic. If a given treatment is successful, the patient gets to live longer, and this process is repeated until the patient dies. This approach has been used for centuries and has been very effective particularly for infectious diseases. But as human beings age more and more, this method will reach its limits at some time. For how many times and how long can we patch someone cure and successfully rehabilitate? One should always keep in mind: Each intervention increases the chances of further and often unexpected complications or debilitating side effects. We are now witnessing a move from reactive/rehabilitative to preventive medicine, which aims at combating actively the mechanisms of ageing, for instance with healthy lifestyle programs and research in genetics.

4 Technology applied to healthcare

We are witnessing an unprecedented information technology shift in all aspects of our life and this affects also healthcare and healthcare provision. New biotech players are challenging existing practices. They are trying to come

up with innovative solutions backed up by big data and information technology. However, it is important to note that even though these players are new, there is still a strong tendency to work alongside traditional healthcare actors, such as large pharmaceutical companies, hospitals and ambulatory care networks.

The first and most predominant trend is the rise of artificial intelligence (AI) and machine learning. While they seem out of place and far off in certain industries, they are very much on point when it comes to efficient and affordable access to healthcare all across the world. Two business cases may exemplify their potential. First, in terms of disease identification and diagnosis, we have relied in the past on highly trained medical experts. Recently, they have been supported by advanced instruments such as scanners, X-rays and the likes. But nowadays, this trend is being taken even further. For example, a recently developed AI system was found to diagnose skin cancer more accurately than dermatologists. Another important application of AI and machine learning is in drug discovery. Pharmaceutical companies spend an average of 12 years and billions of US-dollars in research and development to finally launch just one new medicine. It is a fact that companies have only been able to grab the most obvious drugs and do not have the capacity to go much further with our brains alone. Using big data of established players, new players apply AI and machine learning, especially deep learning, to identify and test new drugs, offer potential leads, and draw new connections. Two players are very important to mention: Google with Deep Mind Health and IBM, with Watson for Drug Discovery.

Another trend is the mainstream use of tracking devices and its underlying potential for disease prevention and monitoring. Electronic alert systems had a very limited use in the past. People would only go to their generalists or to the hospital once in a while, and only when they had a "visible" or "tangible" problem. The weakness of this approach is that it simply reacts to selected urgency situations and mostly relies on limited data. Smartphones, smartwatches and fitness tracking devices are becoming customary all across the world with unprecedented speed. This has profound consequences as they are constantly collecting data. With the consent of patients, medical providers can now make alert warnings much more accurately, inform people who present early signs of a given disease and even recommend tailored healthy behaviors such as diet, exercise and changing drinking and smoking habits. One category of these new actors is the device industry. But other players such as insurance providers are also entering the scene. An interesting example is Discovery, a South African insurance provider offering lower premiums to policyholders going to the gym on a regular basis and using tracking devices. Another example is from Singapore: AIA Vitality is offering lower premiums to members who purchase healthy food in supermarkets with a special credit card.

These tracking devices will reinvent research in and for healthcare. They are closely related to AI and machine learning as they will feed them with data that can be analyzed for further medical research.

5 Forecasting the increase of life expectancy

It is very important for governments and their social security systems to have scenarios of life expectancy of their populations. They have to anticipate and to prepare for what is coming, encourage the many actors that will be affected to anticipate and adapt to change. However, demographic forecasting [as opposed to just offering projections] can be a difficult exercise and it is very common for economists and scientists to get it wrong. A new approach is combining a series of scenarios, based on historical data and current understandings of modern healthcare, but excluding the latest technological improvements out of the model. Another attempt are the Washington Longevity scenarios for 2030, focusing on potential technological advancements. Because of its many uncertainties this model is highly speculative.

Based on the paper "Future life expectancy in 35 industrialized countries: projections with a Bayesian model ensemble" by Kontis et al. (2017), the first model encompasses 21 different forecasting models with weighted probabilities, to forecast the life expectancy increase between 2010 and 2030 in 35 high-income countries. This probabilistic model known as Bayesian model averaging (BMA) is increasingly used for weather and climate forecasts. It does not restrict itself to one theoretical model. Instead it encompasses on a broad range of views. For instance, both the optimistic model predicting a continuous increase in life expectancy at a similar rate as the one witnessed for the past two

centuries, and the pessimistic model predicting life expectancy to stall due to obesity and other health hazards, are included.

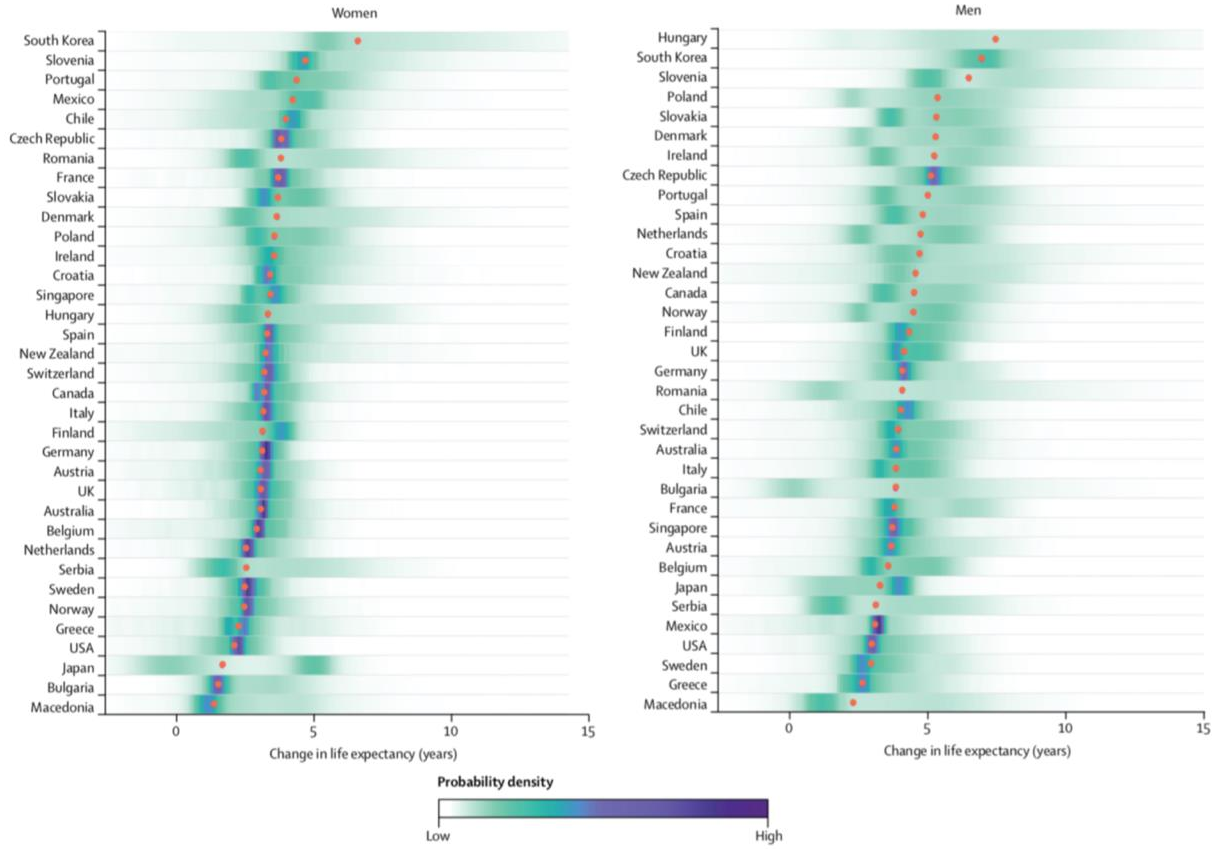

Figure 2: Posterior distribution of projected change in life expectancy at birth from 2010 to 2030
Source: Kontis et al., 2017

As can be seen in figure 2, the likelihood that life expectancy continues to increase is very high. The authors state that there is a 65% chance that life expectancy for women increases in all 35 countries, and an 85% chance for men. South Korea leads in terms of gains both for men, with a second place, and women, with the first spot. The life expectancy at birth for South Korean women in 2030 is expected to be higher than 86.7 years with a 90% probability, and higher than 90 years with a 57% probability, placing South Korea not only as the winner in term of gains, but even in absolute terms.

When considering countries in the Central and South-East Europe the results demonstrate quite good ranking of Slovenia, Hungary and other transition countries. The results are no doubt to be treated as a consequence of different effective measures on a national scale. At the same time, one must however also consider the relatively low starting point in different countries. This cannot be without any reserve said for Slovenia, which is why a separate study would be needed to cover the meaning of the results presented.

Overall, the expected average gain remains below 5 years for women and very close to 5 years for men. The pessimistic forecast for women is still a solid increase of around 2 years, while the positive forecast exceeds the 5-year threshold in most countries, even reaching 10 years in 4 countries. For men, the pessimistic forecast is also an increase of around 2 years, though slightly superior to the one observed for women. The optimistic forecast all exceeds the 5-year threshold and a 10-year increase is possible in more than 10 countries, even though it is very unlikely. This BMA model represents a good synthesis of most commonly accepted forecast models, but it fails to acknowledge the possible revolution that information technologies could bring. That is where the "Washington Longevity Scenarios for 2030" (Wang, 2013) come in. They present 4 different scenarios for life expectancy increase focusing on technological aspects. Scenario A, small change, is the one they consider the most likely to happen. It says that these technologies

will have limited effects and, as a result, there will be little change to today's predictions. This first scenario is then very similar to the results shown previously. Scenario B, drooling on their shoes, postulates that these technologies will allow people to live significantly longer, but that we won't increase our healthy life expectancy. In short, we would just spend more time in retirement homes, trying to survive from one operation to the other. The costs for society in this scenario would be very important and we would have to rethink the whole pension system. Scenario C considers the possibility that these technologies, not only increase our life expectancy, but also our healthy life expectancy. In these cases, we would be able to live until 150 years old in healthy conditions. This would obviously change human life and society as we know it, offering people choices they never envisioned before. Scenario D is the most extreme one and the least likely to happen. In this scenario, we would have overcome ageing and would be able to live forever, barring injuries. Even though it is highly improbable, they do not rule it out as they explain that, if the improvement brought by digital technologies increase at a faster rate than we age, we could in theory live forever.

6 Conclusion

For the past two centuries, life expectancy has for the most part continuously increased, with an average increase of around 0.25 years each year in developed countries. Among the many factors that contribute to these increases, the decline of communicable, maternal, neonatal and nutritional diseases played an important role. Today, these diseases are still dominant in low- and lower-middle-income countries. Wealthier countries have managed to overcome many of these diseases and their populations now mostly die of age-related physical and mental diseases.

The processes of ageing are the next obstacle that humankind faces in order to improve both its life expectancy, but also and most importantly its healthy life expectancy. While these processes are not yet fully understood by scientists, its mysteries are slowly unraveling. Moreover, in the digital age, one can expect new technologies keep pushing our life expectancy upward, though still uncertain to what extent.

Overall, for numerous reasons life expectancy is very likely to continue to increase all across the globe. The only difference on a country or a regional level will be the speed of this change.

References

1. Garreau, J. (2013). Drooling on Your Shoes or Living Long and Prospering? Slate. Retrieved on 28 October 2018 from https://slate.com/technology/2013/09/four-scenarios-for-our-future-lifespans.html.
2. Ghosh, S. (2018). Google's DeepMind AI can accurately detect 50 types of eye disease just by looking at scans. Business Insider. Retrieved on 28 October 2018 from http://uk.businessinsider.com/google-deepmind-ai-detects-eye-disease-2018-8?r=US&IR=T.
3. Gore, A. (2015). How Discovery keeps innovating. McKinsey Quarterly. Retrieved on 28 October 2018 from https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/how-discovery-keeps-innovating.
4. Kontis, V., Bennet, J. E., Mathers, C. D, Li, G., Foreman, K., and Ezzati, M., (2017) Future life expectancy in 35 industrialised countries: projections with a Bayesian model ensemble. Lancet 389(10076), 1323-1335.
5. Passarino, G., De Rango, F., & Montesanto, A. (2016). Human longevity: Genetics or Lifestyle? It takes two to tango. Immunity & ageing: I & A, 13, 12. doi:10.1186/s12979-016-0066-z.
6. The Conversation (2014). Why do humans deteriorate with age? It's a biological puzzle. Retrieved on 28 October 2018 from https://theconversation.com/why-do-humans-deteriorate-with-age-its-a-biological-puzzle-21824.
7. Tucker, I. (2018). AI cancer detectors. The Guardian. Retrieved on 28 October 2018 from https://www.theguardian.com/technology/2018/jun/10/artificial-intelligence-cancer-detectors-the-five.
8. Wang, B. (2013). "Washington Longevity Scenarios for 2030". Next Big Future [online], 26 September 2013. Retrieved on 28 October 2018 from: www.nextbigfuture.com.
9. World Bank (2016). New country classifications by income level: 2016-2017. Retrieved on 28 October 2018 from http://blogs.worldbank.org/opendata/new-country-classifications-2016.

10. World Health Organization (2018a). Ageing and Health. Retrieved on 28 October 2018 from http://www.who.int/news-room/fact-sheets/detail/ageing-and-health.
11. World Health Organization (2018b). Leading causes of death by economy income group. Retrieved on 28 October 2018 from http://www.who.int/mediacentre/factsheets/fs310/en/index1.html.
12. World Health Organization (2018c). The top 10 causes of death. Retrieved on 28 October 2018 from http://www.who.int/en/news-room/fact-sheets/detail/the-top-10-causes-of-death.
13. Wray, B. (2018). The ambitious quest to cure ageing like a disease. BBC [online] 5 February 2018. Retrieved on 28 October 2018 from http://www.bbc.com/future/story/20180203-the-ambitious-quest-to-cure-ageing-like-a-disease.