Implications of AI Advancement on Human Lifespan and Considerations for Mortality Assumption Setting

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INTRODUCTION

In recent years, we have observed rapid development of artificial intelligence (AI) across various industries, especially the healthcare system. The advancement of AI presents unprecedented changes in ways of life which could inadvertently affect human lifespan. The key questions that this essay is trying to address are: (1) Could AI be the key to unlocking longer lives? (2) If the answer is yes, then what does this means to the current traditional mortality assumption setting?

EFFECTS OF AI ADVANCEMENT ON HUMAN LIFESPAN

Advancements in AI are expected to significantly extend human lifespan and quality of life. This can be done by improving the healthcare system through the following ways:

- Early detection and intervention of diseases.
- Precision medication tailored to individual needs.
- Enhanced treatment and management of chronic conditions.

EARLY DETECTION AND INTERVENTION

AI-powered diagnostic tools are transforming disease detection and prevention processes. For example, AI can help detect diseases earlier through advanced imaging and biopsy analysis. Or AI would also be able to identify early signs of cognitive decline like Alzheimer's through speech analysis or brain imaging. What this means is that intervention and prevention can start earlier. Unlike now in which some chronic diseases would only be detected at a late stage when intervention can no longer have an effect, early detection and intervention can result in a positive effect on human lifespan.

PRECISION MEDICATION

AI expands medical research, which is inclusive of precision medication and advancement in drug discovery. For example, AI can evaluate all criteria inclusive of DNA data, lifestyle, and clinical information to generate personalized medication. In addition, it will also have the capability of real-time monitoring and adjusting medication dependent on the patient's latest condition. Thus, the recovery process can be accelerated with optimized medication. This precision ensures maximum treatment effectiveness, improving outcomes significantly.

ENHANCED TREATMENT OF CHRONIC DISEASES

AI facilitates treatment of chronic diseases through high-precision surgery and cutting-edge medical robotic technologies. For example, AI robotic systems can assist in cardiovascular related surgery through delicate procedures like valve replacement or bypass surgery. Or for cancer, AI can support in removing tumors while minimizing damage to surrounding healthy tissues. AI also uses real-time imaging and data analysis to enhance surgical precision. This can definitely eliminate operational risk due to human errors or fatigue, especially in long surgeries. In short, we can expect the success probability of chronic disease treatment to increase with AI.

REAL-WORLD AI EXAMPLES

Some of the actual AI tools available in the healthcare system are Google DeepMind (which is an AI model capable of detecting over 50 eye diseases), IBM Watson Health (which is capable of assisting in creating personalized cancer treatment plans by analyzing patient data and providing recommendations), Intuitive Surgical's da Vinci System (which is an advanced robotic surgery platform that enhances precision in cardiovascular and cancer surgeries), and many others. With this in mind, it is essential for us to understand that there are already cutting-edge AI tools that are in development stages and likely to be adopted in the future. The next step is understanding the implications of change in human lifespan to current traditional mortality assumptions.

IMPLICATIONS OF CHANGE IN HUMAN LIFESPAN DUE TO AI TO CURRENT MORTALITY ASSUMPTIONS

Typically, our mortality assumptions would have accounted for mortality improvement assumptions, which are meant to project longevity trends. These mortality improvement assumptions normally would incorporate both current observable medical and societal advancements.

Now that AI has come into the picture, in which has the power to significantly extend human longevity, the question comes down to how we should incorporate the advancement of AI into the mortality assumptions. The challenges with this lie in the fact that the timeline and magnitude of AI advancement is largely uncertain at this stage; however, its transformative potential cannot be ignored.

There are several strategies of incorporating AI advancements into mortality assumptions that can be considered at this stage, mainly:

- Leveraging expert insights.
- Identifying and monitoring core leading indicators.
- Conducting scenario testing.
- Adopting a conservative approach on mortality assumptions.

LEVERAGE EXPERT INSIGHTS

Consultation with healthcare AI experts would be needed. Sample insights that would be needed are as follows:

- Healthcare AI tools under development.
- Stage of the development of AI tools, whether it is early stage or close to full development.
- Number of healthcare institutions using AI for diagnostics and treatment.
- Any plan timelines for broader adoption.

These insights are essential such that we can have a view of where AI stands now, how it is going to be integrated, and when it is expected to be achieved. With this insight, we can estimate the timeline for AI adoption, helping us determine when noticeable improvements in mortality rates may become observable.

IDENTIFY AND MONITOR CORE LEADING INDICATORS

It is also essential to identify the core leading indicators. Collaboration across healthcare and insurance industries would be needed to pool resources on monitoring of these indicators. Below are examples of core leading indicators for monitoring:

- Tracking of reductions of late-stage chronic disease with adoption of AI early detection imaging tools.
- Declines in neurodegenerative diseases with the adoption of AI brain imaging tools.
- Increase in surgery success rates with the assistance of AI robotic systems.
- Comparative analysis of AI diagnostic tools versus traditional methods.

By tracking these indicators, we can identify trends and establish evidence-based benchmarks that can help monitor the potential impact of AI on longevity. Additionally, continuous monitoring is essential such that we can refine mortality assumptions to reflect emerging evidence of AI's effectiveness over time.

CONDUCT SCENARIO TESTING

Scenario testing remains an essential approach to evaluate AI advancement impact. Various scenario testing would be needed in different perspectives inclusive of:

- Speed of AI adoption – test scenarios assuming AI adoption from short-term (3-5 years), mid-term (5-10 years) and long-term (>10 years).
- Intensity of AI adoption – test scenarios assuming minimal effects (only have marginal effects), moderate effects (improves efficiency without dramatic change in results), and transformative effects (significant change in current practices, leading to significant increase in human lifespan).
- Effects of AI on different age groups – test scenarios considering different effects on different age groups. For age <18, consider AI impacts on early genetics or disease detection and effects of precision medication. For ages 18-40, consider AI impacts on early chronic disease detection and intervention. For ages >40, consider AI impacts on neurodegenerative disease detection and prevention.
- Effects of AI on lifespan extension on different products – test different levels of increase in lifespan due to AI-driven healthcare on different products. For example, +5 / +10 / +15 years and others. It is expected that reserving needs for different product types would differ if human lifespan were prolonged. For annuity / long-term care / retirement products, there would be a need to analyze the jump in reserve needs on different levels of lifespan extension.

ADOPT A CONSERVATIVE APPROACH ON MORTALITY ASSUMPTIONS

Given the uncertainty surrounding AI advancement, one of the strategies would be to adopt a conservative approach on mortality assumption setting. The timelines of AI enhancements and adoptions are currently unknown: developments could shift from incremental to transformational stage on varying periods. Additionally, while AI advancement shows promises of its ability to extend human longevity, it is not expected to have immediate effects in the short term. Rather this is a long-term process, in which on our current stage now, there is no clearly observable evidence of improvement in longevity.

With the above in mind, it is essential that we be careful to avoid overestimation of medical advancements, as this could lead to under-reserving of life insurance type products. Additionally, underestimation of reserving could also occur for annuity type or long-term care type products if AI breakthroughs lead to increase in longevity than initially assumed. Therefore, there needs to be a balance between applying expert judgement while also aligning it with evidence-based AI medical advancements on the mortality improvement assumptions.

However, what we can do is allow for margins within mortality improvement rates, for example assuming gradual improvements for mortality rates for certain age groups or causes of deaths depending on emerging evidence of AI adoption and its effectiveness. In addition to basing this on observable evidence, it is also essential to consider if there is a need to apply a forward-looking view on the AI advancement, largely dependent on the sensitivity of the underlying business to various scenarios of AI advancement.

SUMMARY

In summary, AI's huge potential to extend human longevity introduces both opportunities and challenges on mortality assumption setting. A lot of uncertainty remains on how AI could affect human longevity. Actuaries would need to approach this with agility and innovation given the changing environment. There needs to be a continuous process of monitoring of new evidence, leveraging expert insights, performing sensitivity, and adjusting assumptions accordingly if needed to ensure robust models.

As AI continues to evolve, the actuarial profession has the opportunity to lead in adapting methodologies that balance observable medical advancements with forward-looking insights. The future of mortality modeling lies in anticipating and responding to these advancements, ensuring accurate and sustainable assumptions in a constantly changing landscape.

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