Algorithmic Longevity: How AI and LLMs Could Reshape Retirement Planning by Predicting Health, Lifespan, and Spending Needs

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INTRODUCTION

Retirement is often described as the final chapter of financial planning—a period meant for rest, reflection, and fulfilment. Yet for many individuals, it may also be a chapter shrouded in uncertainty. How long will one live? Will accumulated savings last? How can unforeseen health challenges be managed? Many retirees in the U.S. may be underprepared for longevity risk, highlighting the fragility of conventional retirement strategies.

Historically, these questions have been addressed through actuarial science: mortality tables, life expectancy estimates, and risk-pooling frameworks. While foundational, these approaches rely on averages that may not fully capture the individualized trajectories of human life. The result is a system that is precise in theory but can be impersonal in practice.

Artificial Intelligence (AI) and Large Language Models (LLMs) are emerging as transformative tools capable of redefining prediction and personalization. From healthcare to finance, AI processes massive datasets, identifies subtle patterns, and generates insights that were previously unattainable. In retirement planning, these capabilities may promise not just efficiency but a fundamental shift in anticipating the future. Imagine a system that integrates health records, lifestyle patterns, and financial behaviors to forecast longevity and spending needs with far greater precision than traditional methods.

Consider a hypothetical example: Jane, a 64-year-old teacher in Chicago. Despite saving diligently, a sudden diagnosis of type 2 diabetes forced her to rethink withdrawals, healthcare budgeting, and lifestyle choices. Traditional actuarial projections offered little guidance, highlighting the need for AI-assisted, personalized planning.

Yet this promise carries profound ethical, practical, and professional implications. As AI begins shaping decisions that affect financial security and well-being, retirees and professionals alike must confront questions of bias, privacy, and predictive reliability. How can actuaries ensure algorithms do not perpetuate inequality? What frameworks are necessary for responsible integration? Most importantly, how can the precision of AI be balanced with human judgment and values?

This essay explores these questions, demonstrating that AI and LLMs—when thoughtfully applied—can fundamentally reshape retirement planning. By examining current practices, emerging opportunities, and ethical challenges, it envisions a future that is technologically sophisticated while remaining profoundly human-centered.

THE CURRENT LANDSCAPE OF RETIREMENT PLANNING

Retirement planning has long rested on two pillars: actuarial science and financial prudence. At its core, actuarial methodology quantifies uncertainty—the likelihood of surviving to a given age, incurring medical expenses, or

outliving savings. Tools such as life tables, stochastic simulations, and deterministic projections have underpinned pension design, annuity pricing, and personal retirement planning for decades.

Despite their utility, traditional methods have limitations. Life tables and population-based mortality models operate on averages, often obscuring individual variability. Two people of the same age and demographic profile may experience vastly different health outcomes, yet some early conventional models may treat them as statistically equivalent. Similarly, stochastic simulations, while incorporating variability, may be constrained by historical assumptions and may not fully account for emerging health trends or lifestyle shifts.

Financial planning for retirement adds further complexity. Spending patterns fluctuate in response to health changes, family needs, and economic conditions. While actuaries can project population-level expenditures, individual-level prediction is more challenging. Early-onset chronic conditions, unexpected medical emergencies, or lifestyle changes may leave retirees over-prepared, sacrificing present quality of life, or under-prepared, risking financial instability in later years.

The evolution of retirement products may compound these challenges. Defined benefit pensions, once standard, have largely given way to defined contribution plans in the private sector in the US, transferring longevity risk to individuals. Annuities, though effective at hedging lifespan uncertainty, are often underutilized due to cost, complexity, or limited consumer understanding. Advisors and actuaries then may navigate a growing array of options while ensuring risk assessments remain actionable.

- In the U.S., defined contribution plans now cover 70% of private-sector employees, shifting longevity risk to individuals.[1]
- In Germany, the combination of private and public pension systems reduces longevity risk but still requires individualized planning for healthcare expenditures.

Given this context, AI and LLMs may emerge not as replacements for human expertise but as tools to augment it. By analyzing vast datasets and identifying subtle patterns invisible to traditional models, they can offer the potential to enhance precision, personalize recommendations, and transform the retirement planning landscape.

AI AND LLMS: PREDICTING HEALTH AND LONGEVITY

AI and LLMs redefine prediction, offering potential capabilities far beyond traditional actuarial methods. Unlike conventional models, which rely on averages and historical trends, AI can process heterogeneous datasets—including electronic health records (EHRs), wearable device data, and financial histories. This may evolve to generating individualized forecasts of health, lifespan, and retirement spending.

One key application is health and longevity prediction. AI algorithms may potentially be able to identify patterns in medical histories signaling increased risk for conditions like cardiovascular disease, diabetes, or cognitive decline. LLMs synthesize unstructured data such as physician notes, clinical reports, and lifestyle records that may in the future anticipate health events. For instance, correlations between sleep patterns, diet, and medication adherence

[1] U.S. Bureau of Labor Statistics. (2025, September 25). *Employee benefits in the United States – March 2025* (USDL-25-1464). https://www.bls.gov/news.release/ebs2.nr0.htm

may provide a more accurate lifespan estimate than a standard life table. Combined with financial modeling, retirees would be able to align savings and spending strategies with anticipated healthcare needs.

AI may also be able to account for behavioral and lifestyle factors often overlooked by traditional methods. A secure retirement may be characterized not just on biological age but on activity levels, social engagement, and financial behaviors. LLMs can analyze text inputs, survey responses, and digital footprints that may eventually infer spending habits, health adherence, and risk behaviors. This would allow actuaries to model scenarios reflecting real-world complexity, producing recommendations that could be more accurate and actionable.

Dynamic, continuously updated modeling may be another breakthrough. Traditional projections may be static, updated periodically, and may lag behind changes. AI systems, on the other hand, may eventually incorporate real-time data, revising predictions immediately after a diagnosis, lifestyle shift, or market fluctuation. This responsiveness could represent a paradigm shift: retirement planning moves from a static, one-size-fits-all approach to a personalized, adaptive strategy.

- Biofourmis' AI-enabled wearable and remote monitoring platform has been reported to support earlier detection of clinical deterioration and reductions in hospital readmissions among heart failure patients, indicating potential improvements in clinical and economic outcomes in real-world deployments.[2] [3] [4]
- Babylon Health developed an AI-powered symptom assessment and triage system that was widely used in the UK and internationally to provide users with triage recommendations based on reported symptoms, with clinical evaluations suggesting comparable safety to physician-led triage in simulated settings.[5]
- JPMorgan Chase has deployed AI-driven predictive analytics to estimate customer lifetime value and analyze spending behavior, demonstrating how large financial institutions use AI to inform product strategy and customer engagement decisions.[6]

By integrating health-related insights, retirees can potentially adjust withdrawals and healthcare budgets dynamically, in turn, potentially reducing the risk of outliving savings. Challenges remain, however. Algorithms should best be transparent, interpretable, and validated against real-world outcomes. Ethical questions around privacy, bias, and equitable representation also should be addressed. Despite these hurdles, AI and LLMs may offer a transformative opportunity, bridging population-level averages and individual realities, empowering retirees and professionals with precision and foresight.

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[2] PR Newswire. (n.d.). *Beacon Health System to leverage Biofourmis solution for post-discharge remote patient monitoring program to reduce readmissions and optimize outcomes across complex chronic conditions*. https://www.prnewswire.com/news-releases/beacon-health-system-to-leverage-biofourmis-solution-for-post-discharge-remote-patient-monitoring-program-to-reduce-readmissions-and-optimize-outcomes-across-complex-chronic-conditions-301737607.html

[3] Biofourmis. (n.d.). *News & insights*. https://biofourmis.com/news-insights?d2bdab09_page=2

[4] Applied Clinical Trials. (n.d.). *Biofourmis and Yale-Mayo CERSI study heart failure patients*. https://www.appliedclinicaltrialsonline.com/view/biofourmis-and-yale-mayo-cersi-study-heart-failure-patients-0

[5] Baker, A., Perov, Y., Middleton, K., Baxter, J., Mullarkey, D., Sangar, D., Butt, M., DoRosario, A., & Johri, S. (2020). *A comparison of artificial intelligence and human doctors for the purpose of triage and diagnosis*. *Frontiers in Artificial Intelligence, 3*, 543405. https://pmc.ncbi.nlm.nih.gov/articles/PMC7861270/

[6] SuperAGI. (n.d.). *Industry-specific AI strategies for boosting customer lifetime value: Case studies from retail, telecom, and finance*. https://superagi.com/industry-specific-ai-strategies-for-boosting-customer-lifetime-value-case-studies-from-retail-telecom-and-finance/

OPPORTUNITIES FOR RETIREES AND PROFESSIONALS

The integration of AI and LLMs into retirement planning may potentially offer numerous benefits for both retirees and professionals. For retirees, the most immediate advantage may be personalized planning. Traditional models provide broad estimates, sometimes that may result in overly cautious or risky decisions. AI tools can potentially generate tailored projections of lifespan, healthcare costs, and income needs. For example, with such potential, a retiree with early cardiovascular risk indicators could receive adjusted spending recommendations, balancing healthcare preparation with discretionary spending.

For the financial sector, AI may enable smarter annuities and drawdown strategies, thereby aligning payouts more closely with projected needs and reducing inefficiencies in conventional approaches. AI can also optimize portfolio management dynamically, mitigating both longevity and market risks.

Retirement professionals may benefit from enhanced decision support and efficiency. LLMs may automate tasks like data aggregation, reporting, and compliance documentation, freeing professionals to focus on complex analysis and personalized advice. They may also improve risk communication, generating clear visualizations and plain-language explanations for retirees. Potential shortfalls may possibly be identified proactively, allowing timely adjustments to contribution strategies, investments, or long-term care planning.

Studies and industry research suggest that AI-informed financial guidance can enhance retirement planning outcomes by providing more personalized, accessible, and responsive advice that may reduce the risk of retirement shortfalls. AI-driven tools are increasingly being used to help both advisers and individuals tailor investment and savings strategies to better align with long-term retirement goals.[7]

Industry research indicates that AI adoption in financial services can enhance operational efficiency, improve risk management and customer service, and support better allocation of resources across business functions, although precise efficiency gains vary by context and implementation.[8] In essence, AI may empower retirees with actionable insights while equipping professionals to deliver precise, ethical, and personalized guidance. The union of human judgment and AI precision could potentially transform retirement planning from a calculation of averages into a strategy tailored to individual realities.

RISKS AND ETHICAL CHALLENGES

Despite significant benefits, AI adoption may carry ethical and professional risks:

- Data privacy: AI may rely on sensitive information, including health, lifestyle, and financial data. Unauthorized access or misuse could cause identity theft or discrimination. Robust encryption, safeguards, and transparent policies are essential.

[7] World Economic Forum. (2025). *AI could make financial advice more accessible*. https://www.weforum.org/stories/2025/06/ai-financial-advice-accessible/

[8] World Economic Forum. (2025). *Artificial intelligence in financial services 2025*. https://reports.weforum.org/docs/WEF_Artificial_Intelligence_in_Financial_Services_2025.pdf

- Algorithmic bias: AI models may reflect historical disparities. Systems trained primarily on affluent populations risk overestimating longevity or financial resilience for underserved groups. Ongoing validation and diverse data representation would be required.
- Inequality and access: Those lacking digital tools or comprehensive health records may be excluded from AI benefits, exacerbating disparities. Inclusive design and accessibility measures are critical.
- Interpretability: Black-box models may lead professionals or retirees to over-rely on predictions. Ensuring transparency, interpretability, and clear communication is essential.
- Regulatory accountability: Existing frameworks are designed for traditional financial advice. Professionals must consider ethical and legal oversight to AI-driven systems.

IMPLICATIONS FOR ACTUARIES AND RETIREMENT PROFESSIONALS

AI may potentially reshape the roles of actuaries and advisors, in turn, demanding new skill sets and ethical vigilance.

- Skill evolution: Professionals may need to understand machine learning, data preprocessing, model validation, and interpretability alongside traditional actuarial expertise.
- Product innovation: Dynamic annuities and personalized portfolios may potentially be designed with AI insights, improving sustainability and client satisfaction.
- Professional responsibility: Actuaries may act in the capacity of interpreters, validating algorithms, mitigating bias, and communicating uncertainties clearly.
- Operational efficiency: Automation of routine tasks can allow focus on strategic problem-solving, scenario planning, and client engagement.

More broadly, insurers and actuarial teams are increasingly collaborating with data scientists to explore how machine learning and predictive analytics can enhance retirement risk modeling and product design. In this landscape, professionals may become orchestrators of intelligent systems, leveraging AI precision while embedding human values in financial planning. The actuarial profession—long assessing uncertainty—may now also be involved in the fairness and foresight of algorithmic systems.

FUTURE OUTLOOK AND RECOMMENDATIONS

The future of AI in retirement planning may be potentially transformative yet would be contingent on responsible adoption. The following are potential scenarios:

- Best-case scenario: AI provides highly personalized, ethically sound guidance, enhancing retiree confidence and professional effectiveness.
- Worst-case scenario: Bias, privacy breaches, and opaque models erode trust and exacerbate inequalities.
- Likely trajectory: Iterative adoption with rigorous validation and oversight.

Industry research indicates that AI and machine learning applications are increasingly being considered for retirement planning, investment portfolio optimization, and risk assessment by financial advisory firms and institutional investors. Global industry reports highlight growing interest among pension funds and asset managers

in using AI-enabled analytics to enhance investment decision-making and risk management, particularly with respect to longevity and healthcare cost considerations.[9]

Recommendations as AI Evolves:

1. Invest in AI literacy for professionals.
2. Ensure model transparency and interpretability.
3. Prioritize inclusivity and fairness in data and design.
4. Implement robust governance frameworks.
5. Communicate proactively with retirees, explaining predictions and uncertainties.

The potential of over-personalization may even carry hidden risks: by atomizing risk, it may erode the collective principle of pooling that underlies pensions and insurance. The goal would be for AI to augment pooling rather than undermining it.

CONCLUSION

AI and LLMs may evolve to bridge population-level averages and individual realities, enabling retirement planning that is potentially more scientifically precise, personalized, and human-centered. But technology alone may not secure the future of retirees. Success can depend on the expertise, ethics, and empathy of the professionals who guide it.

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[9] World Economic Forum. (2025). *Artificial intelligence in Financial services 2025*. https://reports.weforum.org/docs/WEF_Artificial_Intelligence_in_Financial_Services_2025.pdf