EE685

The Artificial Intelligence Era in Health Economic Modeling

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Introduction

- Artificial Intelligence (AI) is increasingly reshaping health economic modeling by enhancing the precision of cost-effectiveness analyses and streamlining healthcare resource allocation.
- This study explores the application of AI across the full life cycle of model development—from initial conceptualization to final implementation.

Objectives

- Evaluate the capabilities of AI in the development of health economic models
- Compare AI-assisted modeling with traditional approaches in terms of efficiency, accuracy, and resource utilization

Discussion

- AI offers a promising avenue for advancing health economic modeling, enabling faster, more transparent, and strategically focused evaluations.
- AI integration with modern coding environments and intuitive interfaces allows researchers to redirect efforts toward higher-order analytical tasks.
- Nonetheless, challenges remain—particularly the need for expert supervision and broader validation across clinical domains.

Conclusions

AI represents a paradigm shift in health economic modeling, with the potential to enhance the robustness and scalability of health technology assessment (HTA) frameworks. Future research should prioritize the refinement of data-extraction methods, interface usability, and model adaptability across diverse therapeutic contexts.

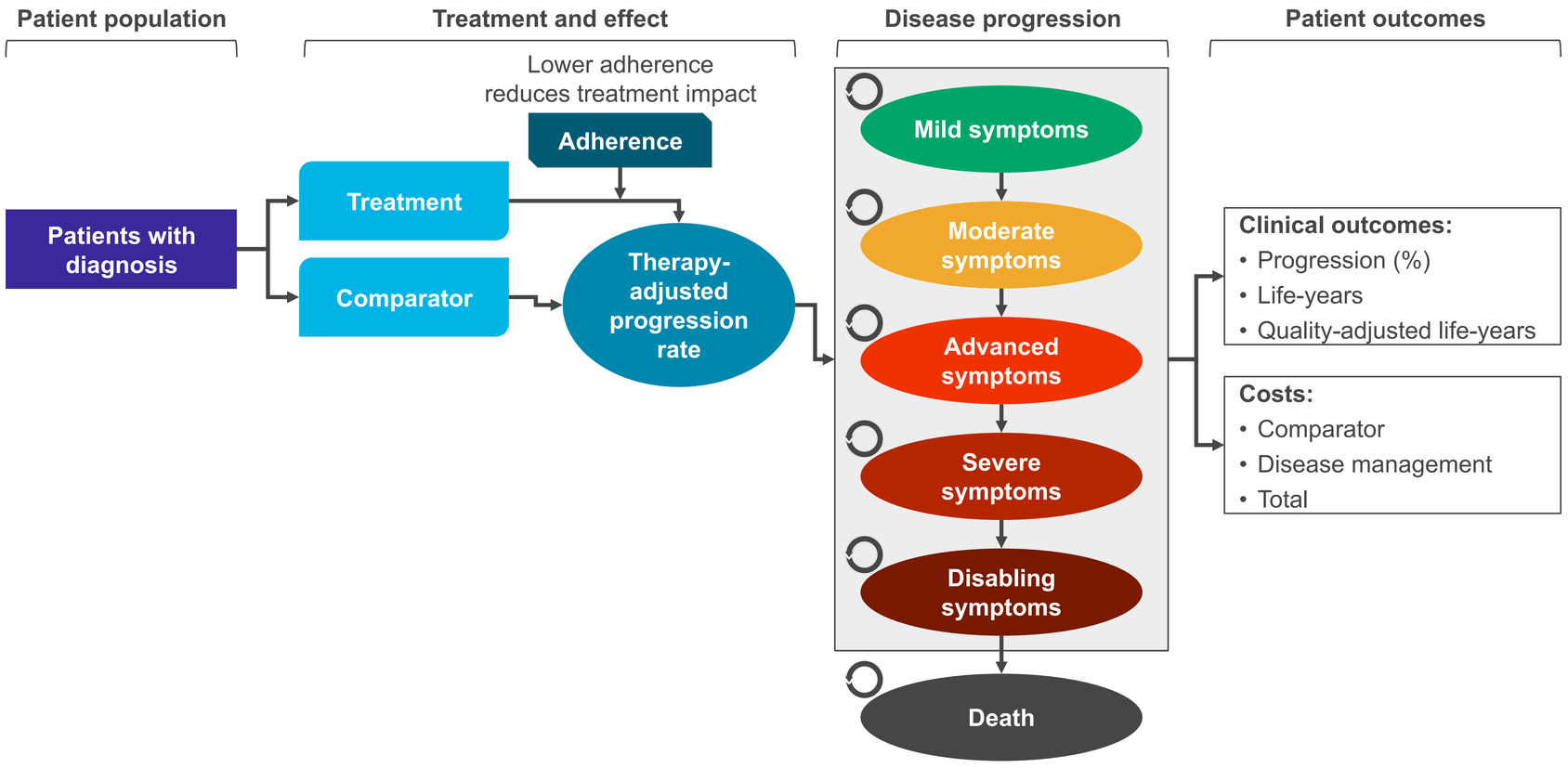
Future directions

- Expand AI applications across a wider range of disease areas and interventions.
- Advance the development of AI-enabled HTA models with enhanced transparency and reproducibility.
- Address current limitations to improve model robustness, interpretability, and stakeholder confidence.

Methods

- Two cost-effectiveness Markov models were constructed to examine a progressive disease with 6 health states (mild symptoms to death).
  1. **AI-assisted model:** Developed using AI technologies
  2. **Traditional model:** Built using a conventional approach in Microsoft Excel

Figure 1. Model health states



Both models conformed to the **National Institute for Health and Care Excellence reference case** to ensure methodological consistency.

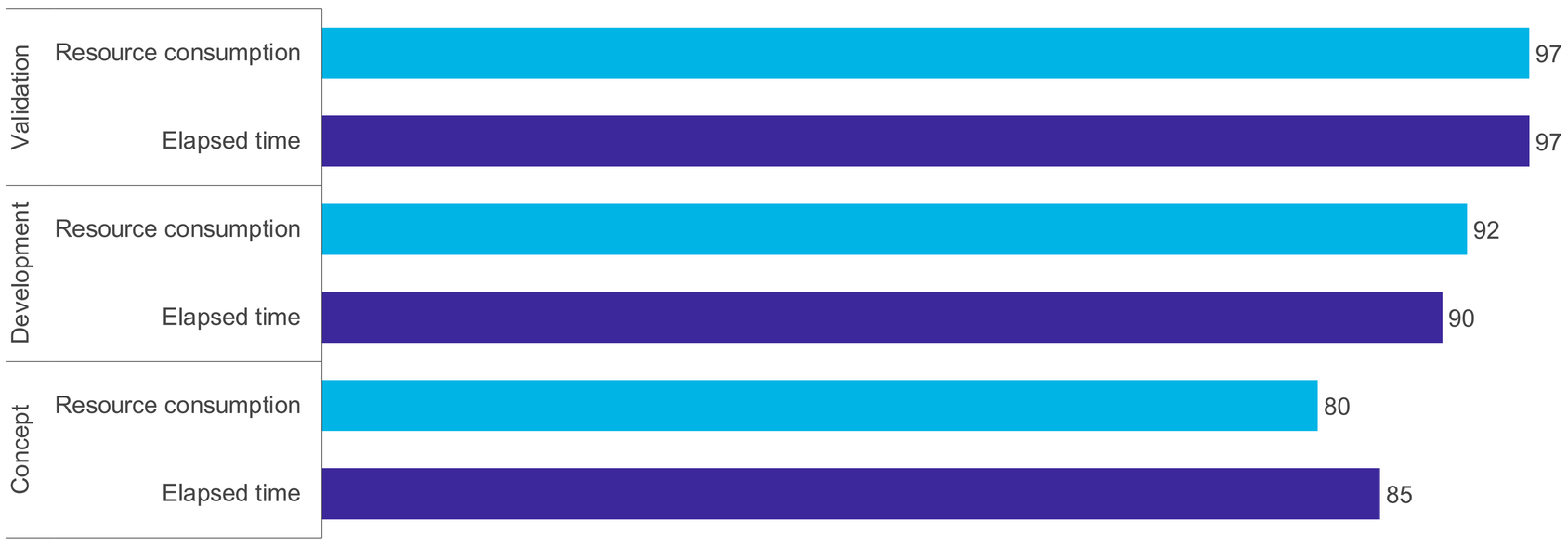
Comparative metrics included:

1. Development time
2. Resource consumption
3. Model accuracy
4. Outcome validation

Results

- **Development efficiency:** AI substantially accelerated model conceptualization and reduced resource demands.

Figure 2. AI as a percent of the traditional modeling approach



- No differences in model accuracy and validation were found.
- **Data integration:** AI effectively synthesized heterogeneous data sources and generated proxy estimates for missing inputs.
- **Technical development:** Advanced code and formulas for dynamic calculations were produced by AI, along with suggestions for user-friendly interfaces, resulting in further resource utilization benefits.
- **Identified limitations:**
  - Health economic expert oversight was essential for defining health states and transition dynamics and ongoing development guidance.
  - Python-based AI outputs demonstrated superior reliability compared to those generated in Excel and R.
  - There is limited generalizability across therapeutic areas without further validation.
  - AI tools are sensitive to input formatting and structure.
  - Constraints exist in free-access AI platforms due to messaging limitations.

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