Leveraging Python Dash and R Shiny for Advanced Health Economic Model Development

MSR94

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CONCLUSIONS

Utilizing Python Dash and R Shiny for health economic modeling enables the creation of interactive and accessible tools that enhance usability and stakeholder engagement, making economic models more approachable for non-modelers. Integrating these platforms into health economics research supports complex calculations, simulation, and time-heterogeneous Markov models, enabling the development of advanced, adaptable models suited to evolving healthcare environments. These tools can be especially valuable in early modeling stages, where a single adaptable model can be easily modified for multiple interventions or indications, supporting efficient and flexible decision-making.

INTRODUCTION

- Health economic models are essential tools for evaluating the cost-effectiveness and budget impact of healthcare interventions.
- Microsoft Excel has typically been used to build health economic models, but as model complexity and processing requirements expand, more sophisticated technologies like Python Dash and R-shiny are being employed.
- Excel-based health economic models face challenges with scalability, collaboration, error-proneness, limited flexibility, lack of transparency, inefficient simulations, restricted interactivity, and resource-intensive maintenance, making them less ideal for modern modeling needs.
- The ability to develop and deploy these models in an interactive, user-friendly manner significantly enhances their accessibility and utility for stakeholders.
- Further, Excel-based models are often rigid and lack the flexibility needed for adaptation, making it difficult to apply a single model across multiple indications or interventions without extensive rework.
- This highlights the need for flexible, interactive modeling platforms that can streamline adjustments and support diverse healthcare scenarios with ease and efficiency.
- R Shiny and Python Dash platforms promise these flexible and interactive solutions, and this study is designed to explore their effectiveness in addressing these needs, as well as other advantages they offer for health economic modeling.

OBJECTIVE

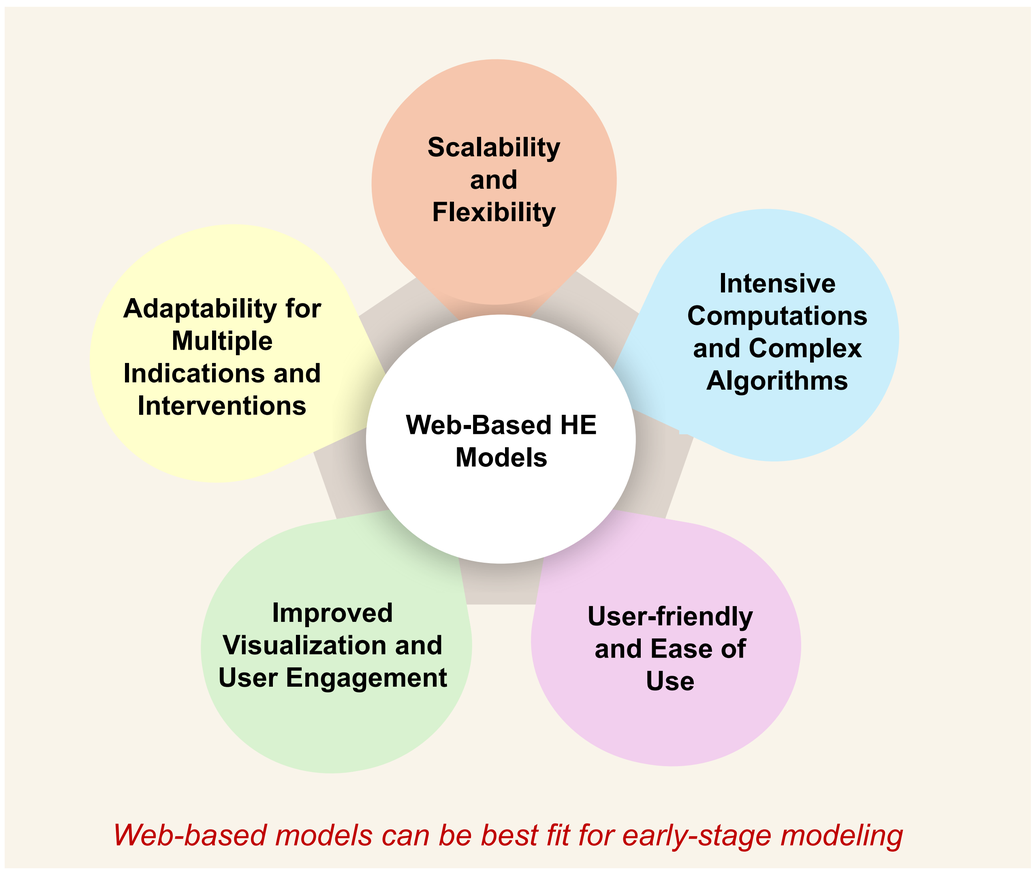
- This study explored the use of Python Dash and R Shiny, two leading platforms for building interactive web applications, in the development of advanced health economic models (including simulation and state transition models).

METHODS

Python Dash and R Shiny frameworks were used to develop interactive web-based economic models, as shown in Figure 3. Various in-built libraries were utilized to handle different tasks related to the web-based economic models:

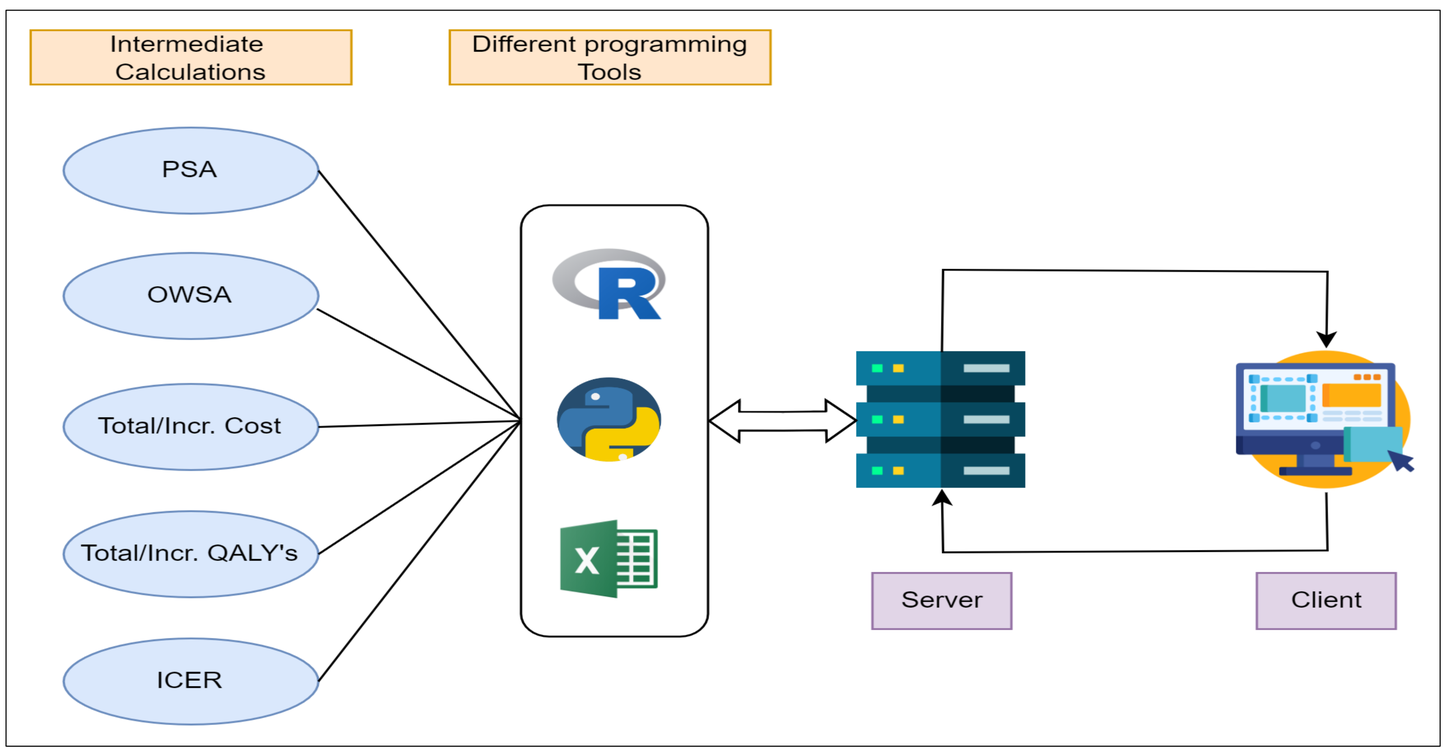
- Data manipulation libraries (i.e. DT, dplyr, rhandsontable, etc.) were used to prepare and process the input data.
- Model development libraries (hesim, flexsurv, etc.) were employed to build the underlying economic models.
- Visualization libraries (plotly, ggplot2, highcharts, etc.) were leveraged to create interactive charts and graphs for the models.
- Reporting libraries (rmarkdown, process, etc.) were used to generate the dynamic report either in word or HTML format

Figure 1: Advantages of Web-based HE Models



Web-based models can be best fit for early-stage modeling

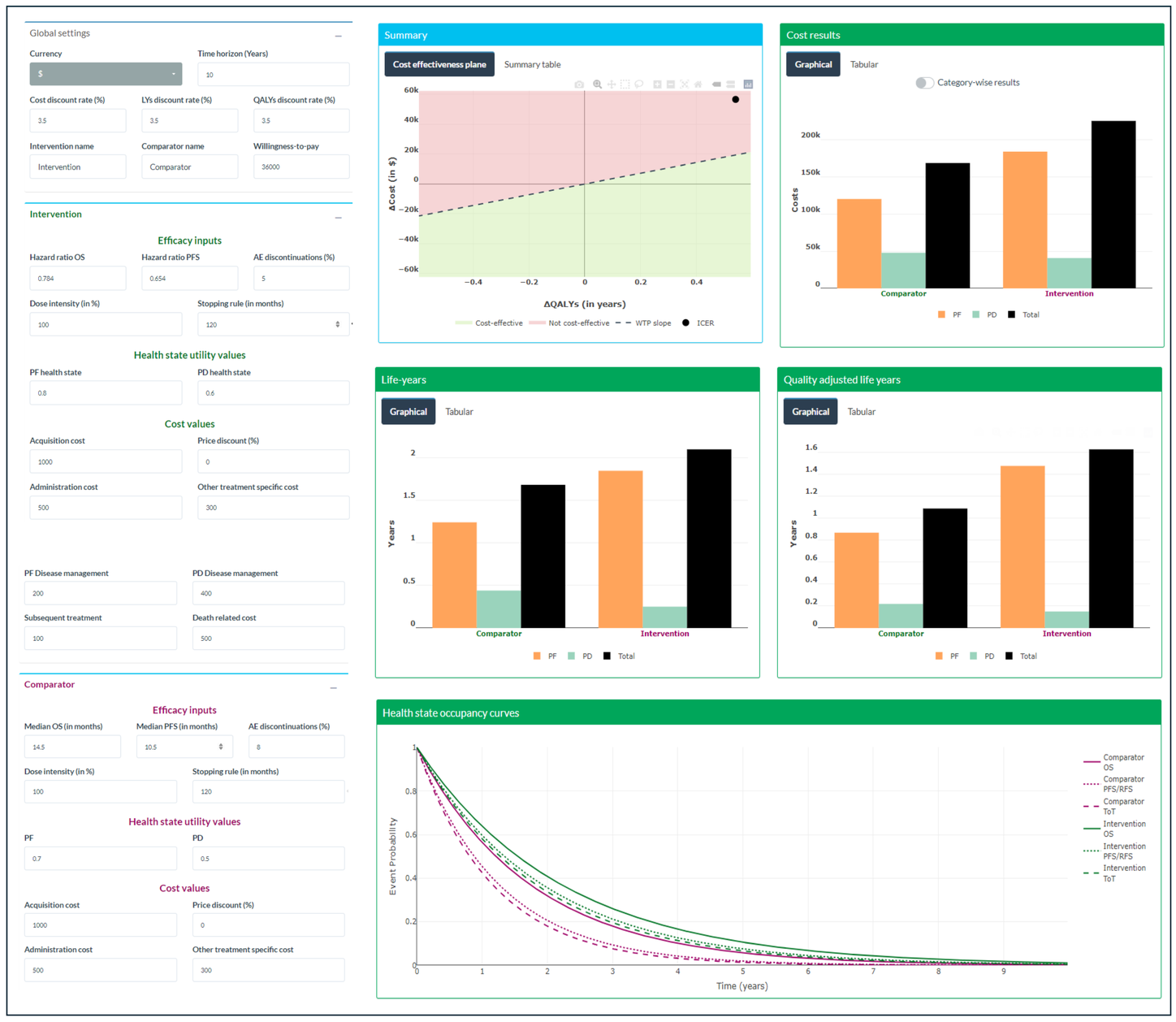
Figure 2: Workflow architecture of Python Dash/R Shiny model for Health economic model



Comparison of Web-Based vs. Excel-Based Models

- ✓ Processing Efficiency: Web-based models demonstrated substantial improvements in computation speed. The R Shiny and Python Dash models processed complex simulations, probabilistic sensitivity analyses (PSA), threshold analyses, and scenario analyses up to 60% faster than Excel models, especially for large datasets containing thousands of parameters.
- ✓ Usability and Flexibility: Web-based models provided an intuitive user interface, allowing users to adjust inputs, select subgroups, and run sensitivity analyses with ease. In contrast, Excel models required complex macro coding and were prone to errors when inputs were altered, making them less user-friendly for non-technical users.
- ✓ Scalability: Unlike Excel models, which often experienced performance degradation with increased complexity—such as structural changes or the addition of comparators—web-based models maintained stable performance regardless of data size, enabling smoother management of scenarios involving extensive patient-level simulations or Markov calculations.

Figure 3: R shiny web interface of Health economic model



References

1. Felizzi et al. *Value Health*. 2023;26(12):S1-S2
2. Smith et al. *Wellcome Open Res*. 2022;7
3. Degeling et al. *Med Decis Making*. 2020;40(3):348-363

Disclosures

RK, BS and SP authors declare that they have no conflict of interest

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