Health Economic Model Conceptualization: Case Studies Using HEM-X™

Tushar Srivastava (Director, HEOR and Gen-AI Lead)
ConnectHEOR, London, UK
November 17, 2024

Disclaimer: This research is part of an ongoing manuscript on use of LLM in health economic model conceptualization

Key Questions!

? Is it possible to optimally integrate Generative-AI and Human Expertise?

? Is it possible to conceptualize health economic models using Generative-AI?

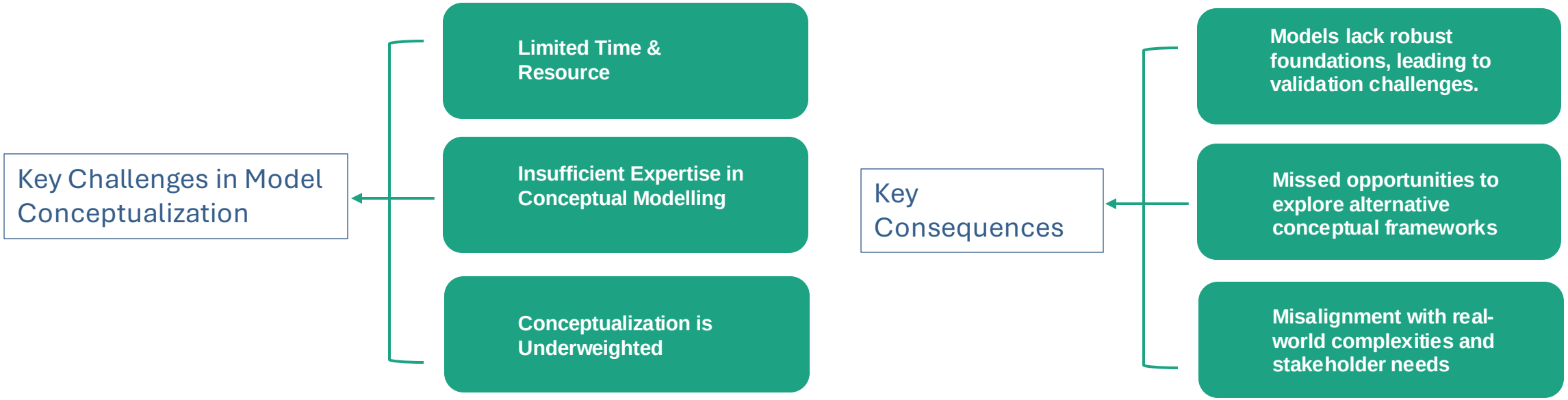
? Can we emulate human-like reasoning through Generative-AI?

? Can Generative-AI will replace human?

? Should we leverage Generative-AI in our HEOR workflows?

connectHEOR

Gen-AI in model conceptualization?



Can Gen-AI bridges the gap with faster, smarter and more impactful health economic models?

Let's find out...

connectHEOR

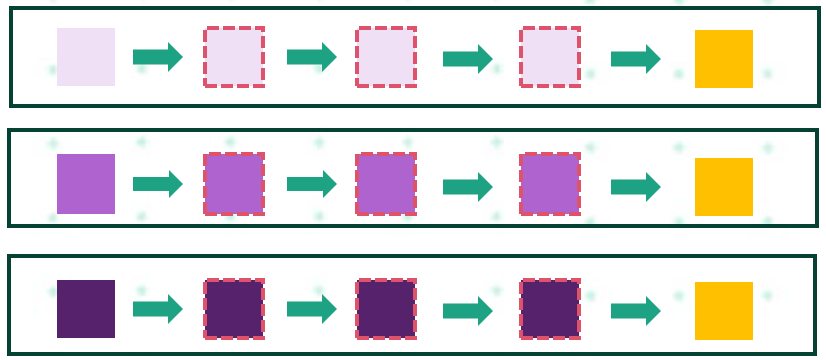
Human-way of model conceptualization and reasoning approach

Human modeler thought process during the model development

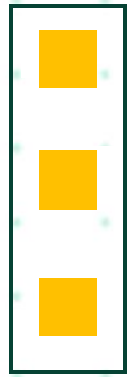
Decision Problem

Problem broken in multiple segments for conceptualization

Each segment then thought through in step-by-step fashion



Potential solution by synthesizing all information together



connectHEOR

Potential of Generative-AI in this whole process (multiple approaches)

AI: Artificial Intelligence
HI: Human Intelligence

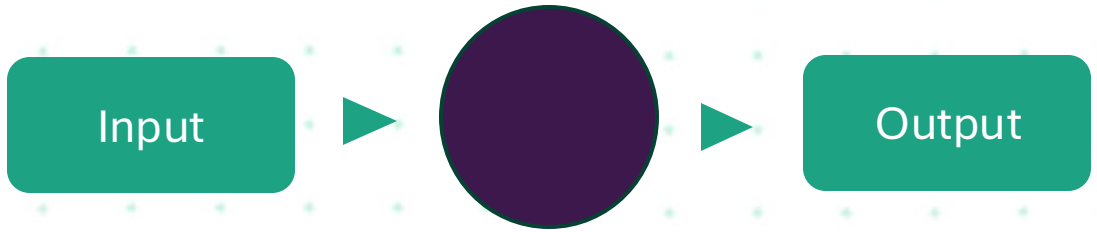
connectHEOR

Gen-AI Reasoning Algorithm

LLM capabilities in reasoning

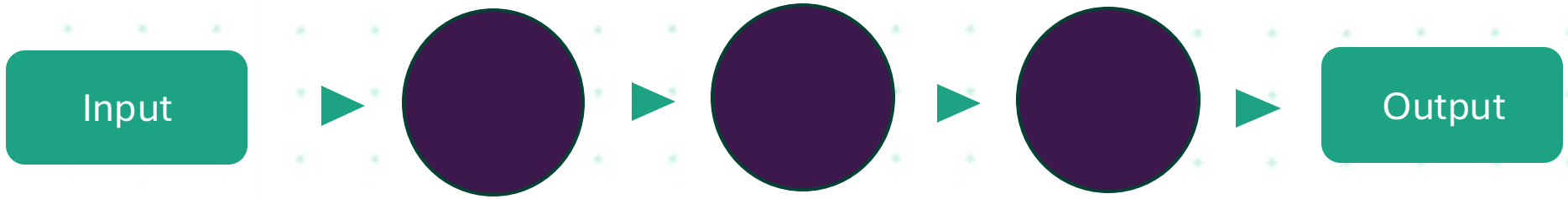
1

Basic Input-Output approach (I-O)



2

Chain of Thoughts (CoT)



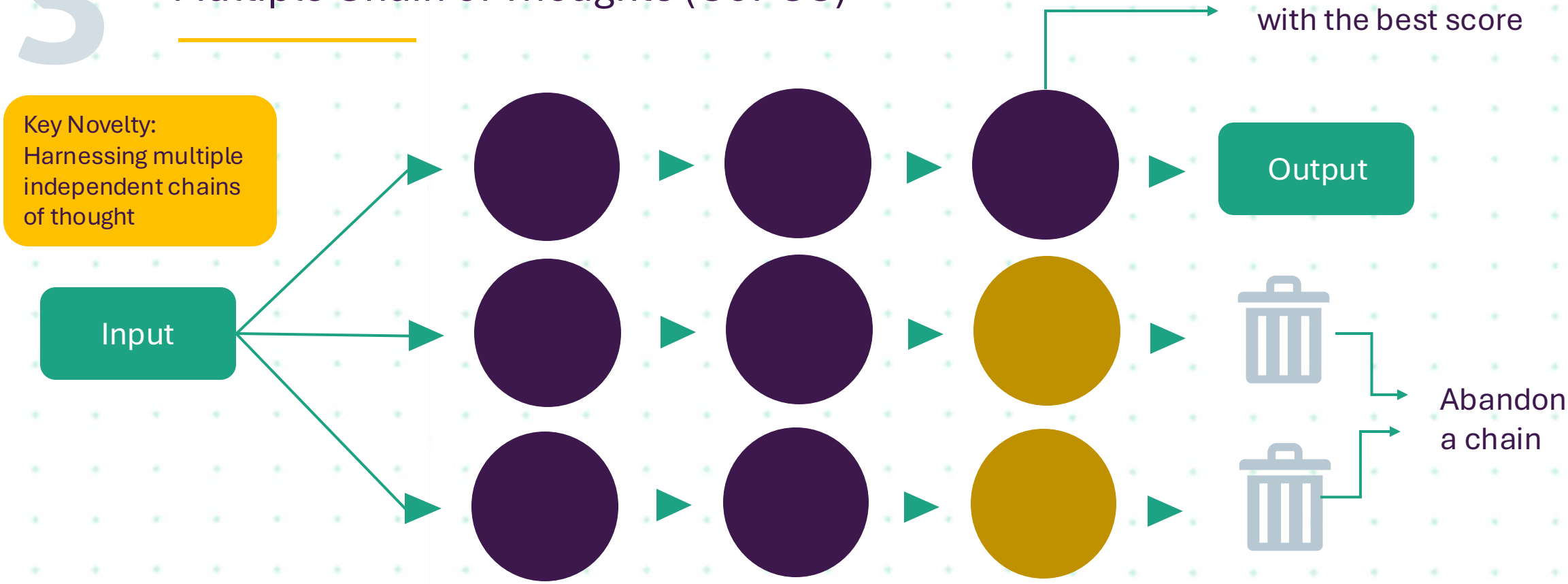
Key Novelty: Intermediate LLM thoughts within a chain

connectHEOR

LLM capabilities in reasoning (established algorithms)

3

Multiple Chain of Thoughts (CoT-SC)

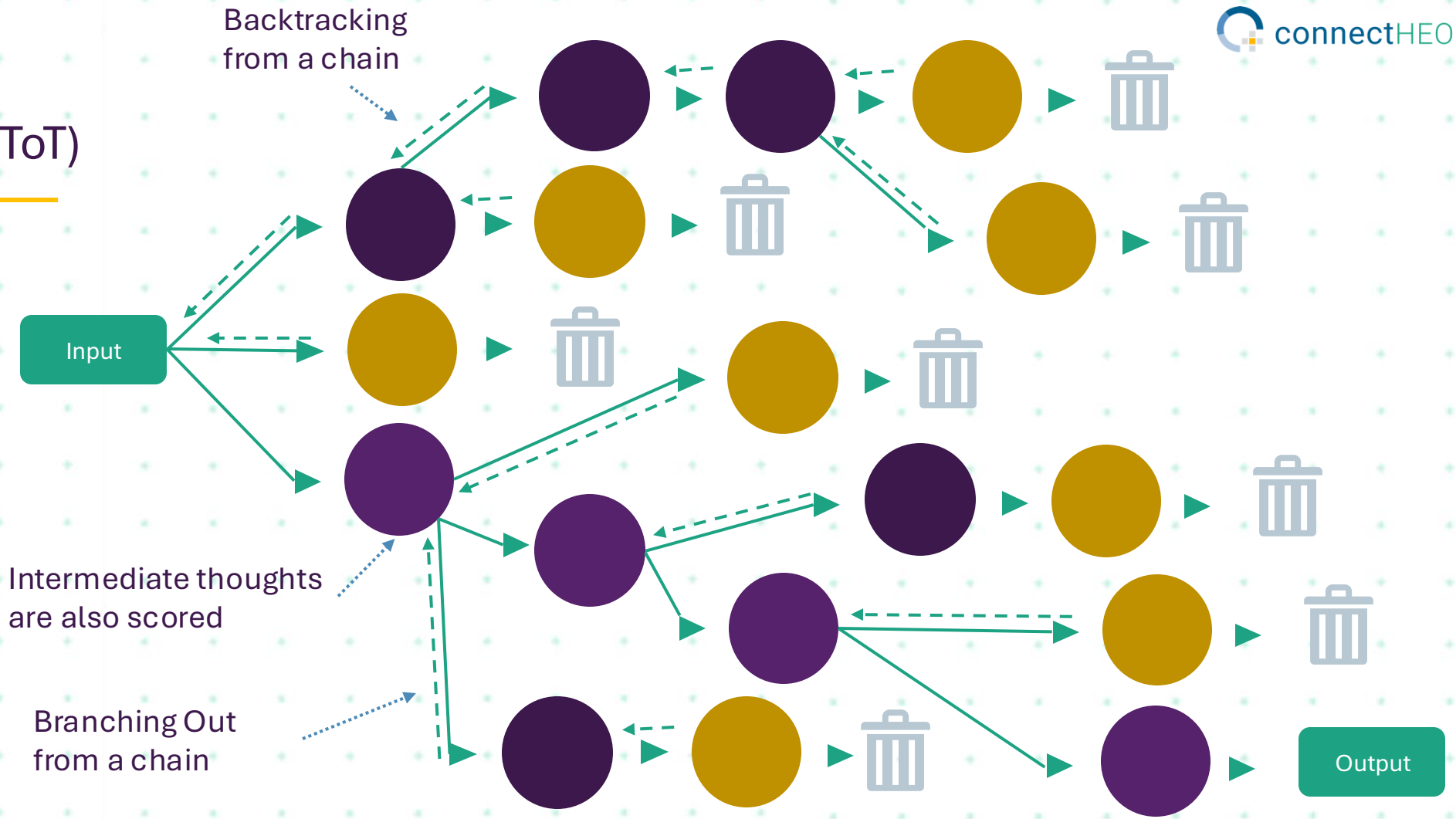


connectHEOR

LLM capabilities in reasoning (established algorithms)

4 Tree of Thoughts (ToT)

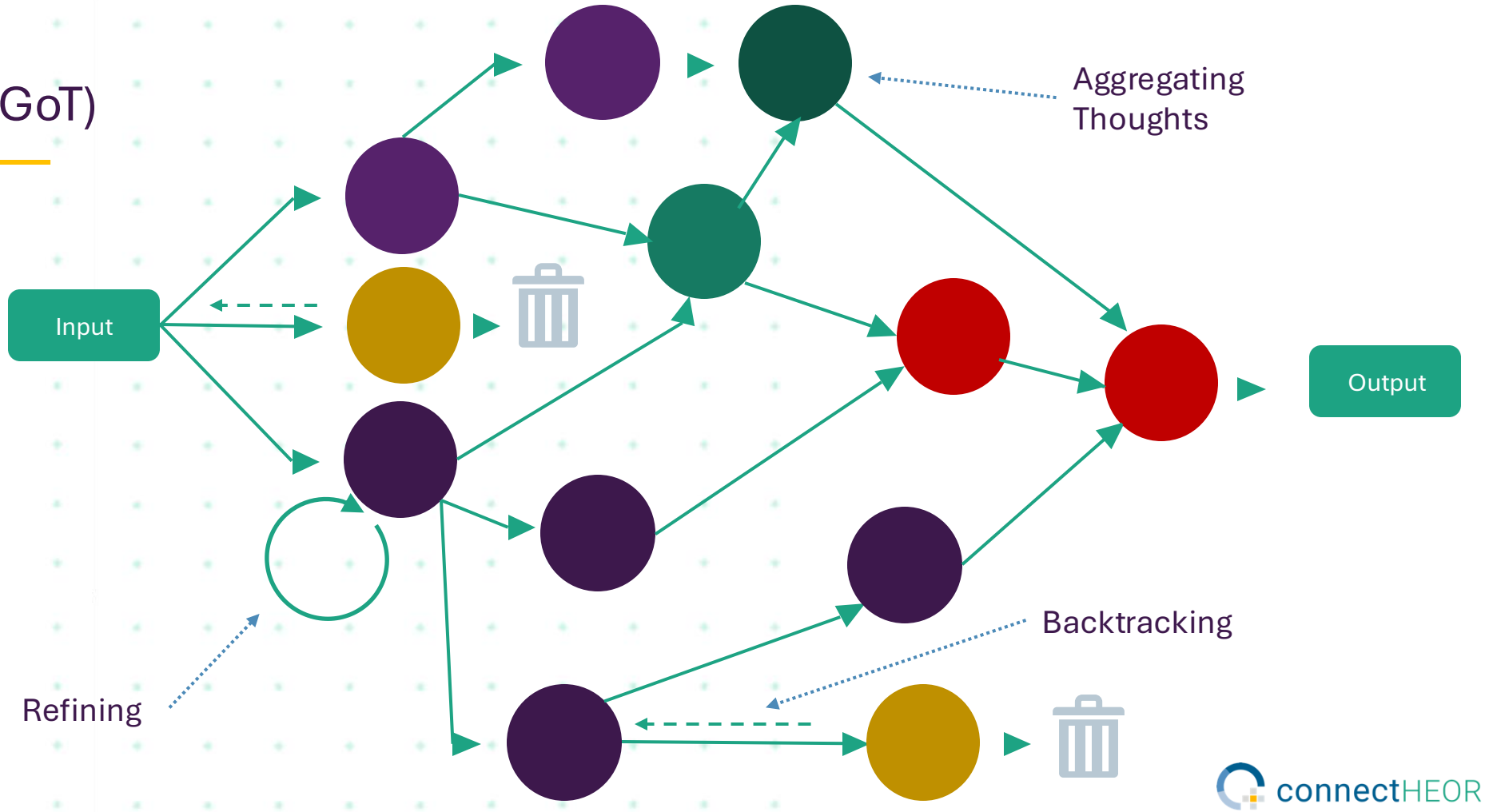
Key Novelty (beyond CoT-SC): Generating several new thoughts based on a given arbitrary thought, exploring it further and possibly backtracking from it



LLM capabilities in reasoning (established algorithms)

5 Graph of Thoughts (GoT)

Key Novelty (beyond ToT): Arbitrary graph-based transformations (aggregating thoughts into a new one, looping over a thought to refine it)



connectHEOR

Introducing HEM-X™

connectHEOR

HEM-X is powered by Gen-AI and Human Intelligence

Image Credits: Human and DALL-E

Why

Integrating Gen-AI with human expertise lacks a clear systematic approach. HEM-X is built to provide a structured, process-driven framework, ensuring **optimal use of AI and human expertise.**

connectHEOR

HEM-X is powered by Gen-AI and Human Intelligence

Image Credits: Human and DALL-E

HEM-X is your co-pilot for health economic model conceptualization

connectHEOR

Highlighted Features

❑ Accelerated and Balanced Modeling Workflow

Speeds up model conceptualization with proprietary AI workflows (2-3 months of concepts development reduces to 1 week of task)

❑ Transparent AI

Generates traceable knowledge maps as powered by Graph-RAG, ensuring no black-box processes

❑ Delivering outputs designed for target audience

Disease process diagrams for clinicians; Detailed model structures and model design plan for HEOR teams; Easy-to-understand summaries for commercial teams; Plain English summary

❑ Validation features

Integrates human and sister-LLMs for validation at every stage with cross-comparison of multiple versions

connectHEOR

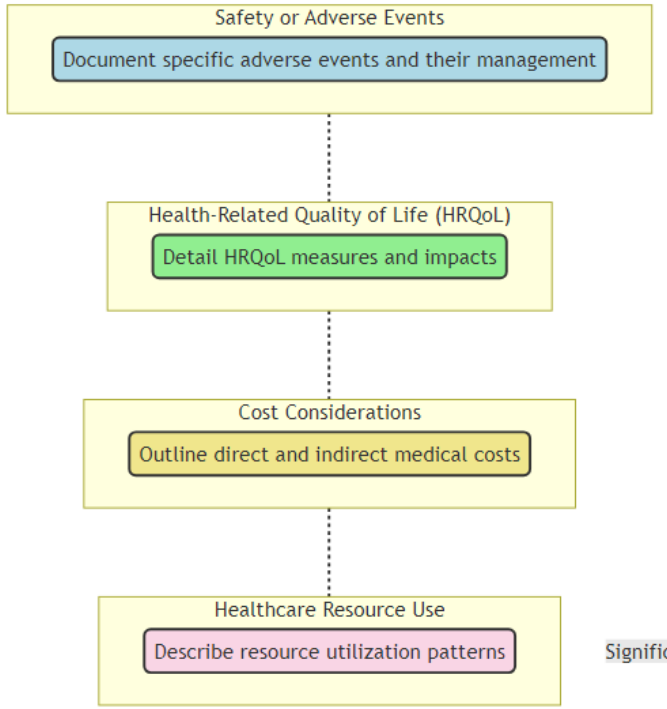
Let's walk the talk:

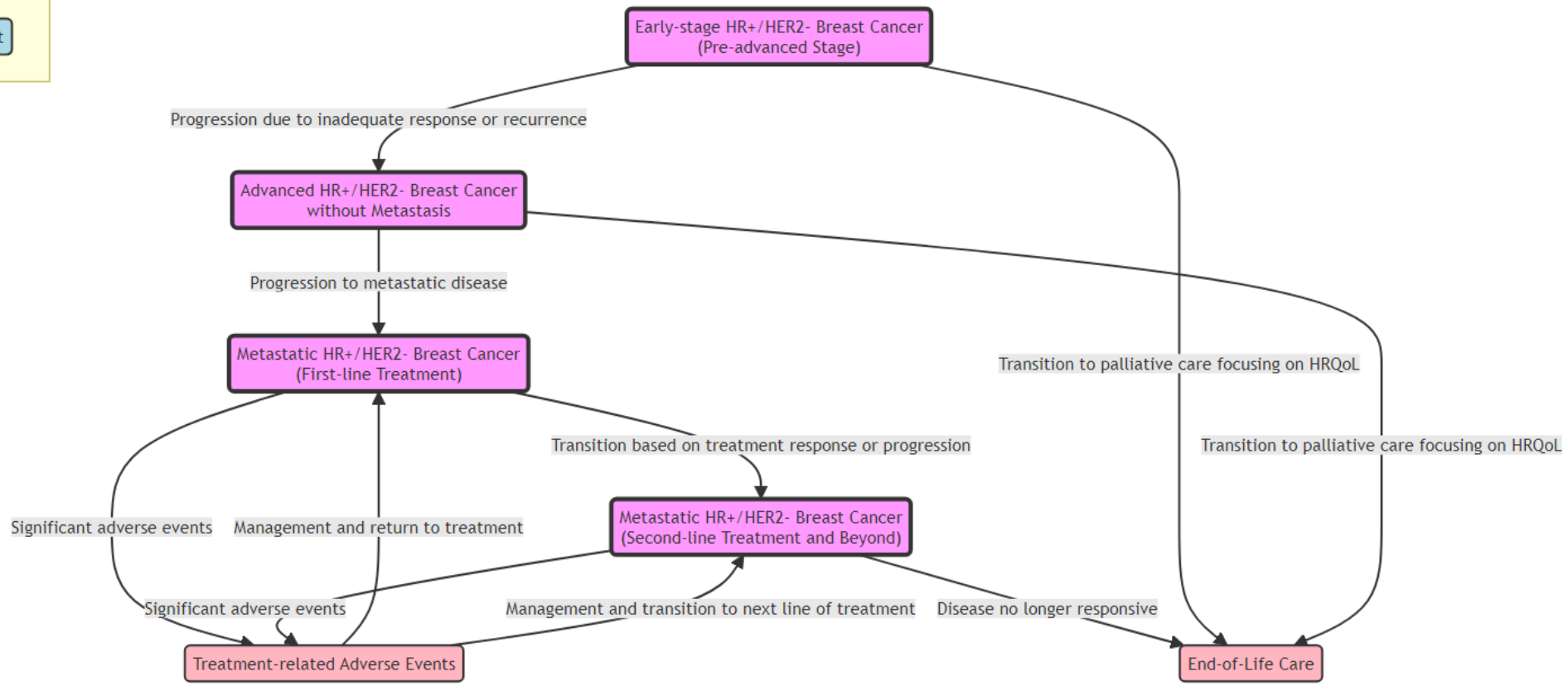
Case Studies on HEM-X™

connectHEOR

Model Concept Mapping: CEM for metastatic Breast Cancer

Oncology Use Case
(relatively rich in data)





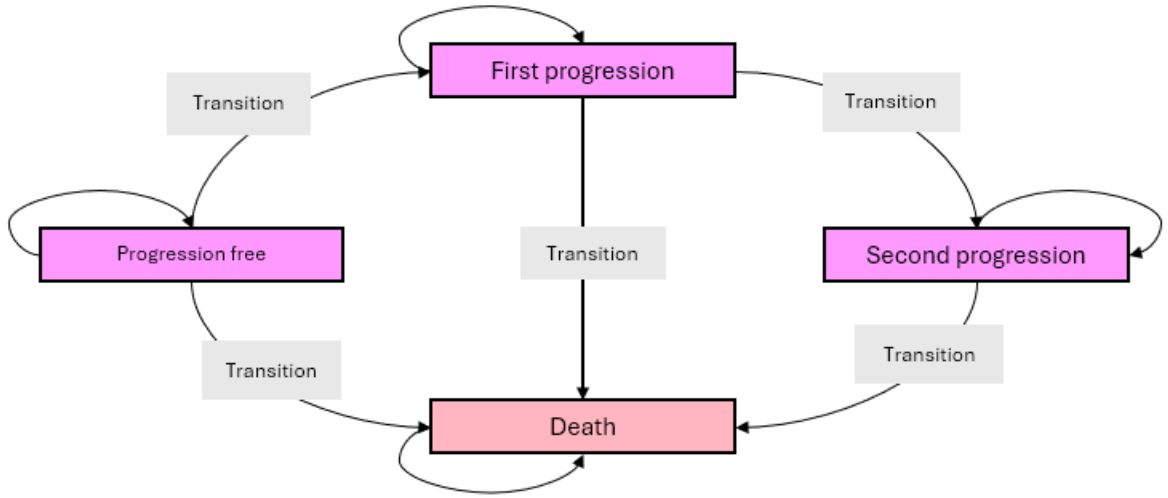
connectHEOR

Model Structure Recommendation: CEM for metastatic Breast Cancer

Oncology Use Case
(relatively rich in data)

Model type recommended by HEM-X:

Four health states Markov Model
"Disease-Free," "First Progression," "Second Progression," and "Death," to capture the disease's natural history and the impact of treatment interventions.



Auto-programmed in HEM-X

With very high-level assumption, early cost-effectiveness analysis estimates for R+F vs F were:

Incremental QALY: 0.63
Incremental costs: $520K

ICER (/QALY): $825K

Compared to published Yang J et al (2020)

Incremental QALY: 0.47
Incremental costs: $382K

ICER (/QALY): $813K

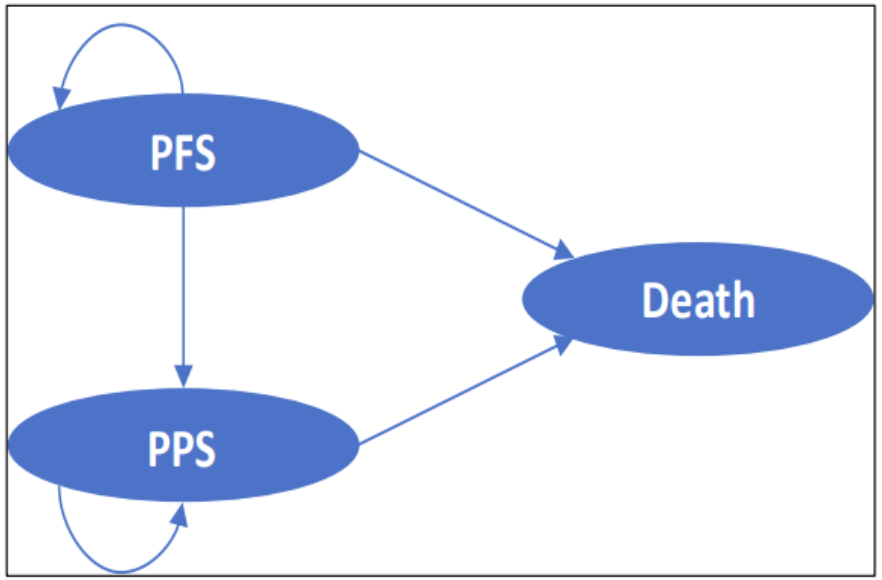
connectHEOR

Cross-comparison with Published models

Model Schematic and Simulation approach

NICE TA 687

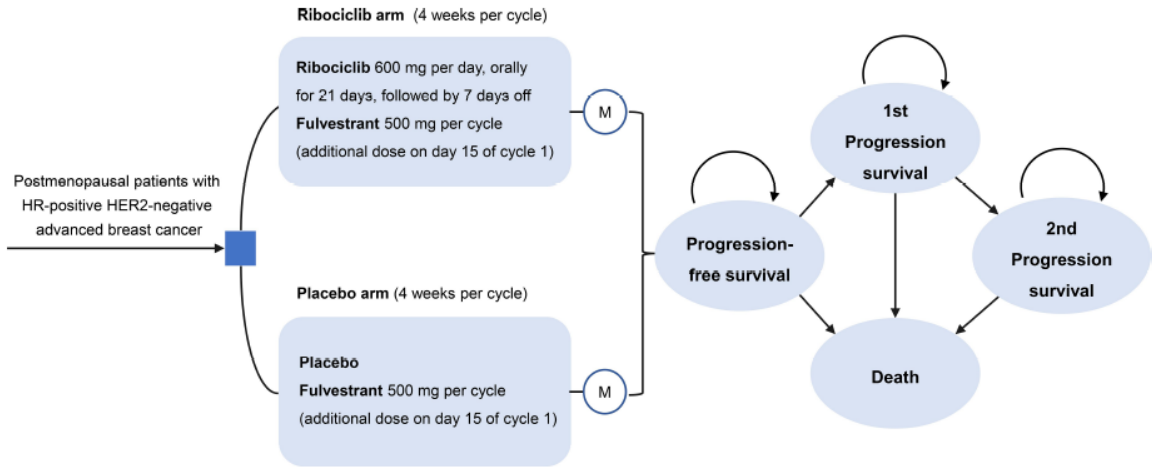
Markov model with three health states



PFS, progression-free survival; PPS, post-progression survival.

Yang J et al (2020)

Markov model with **four** health states



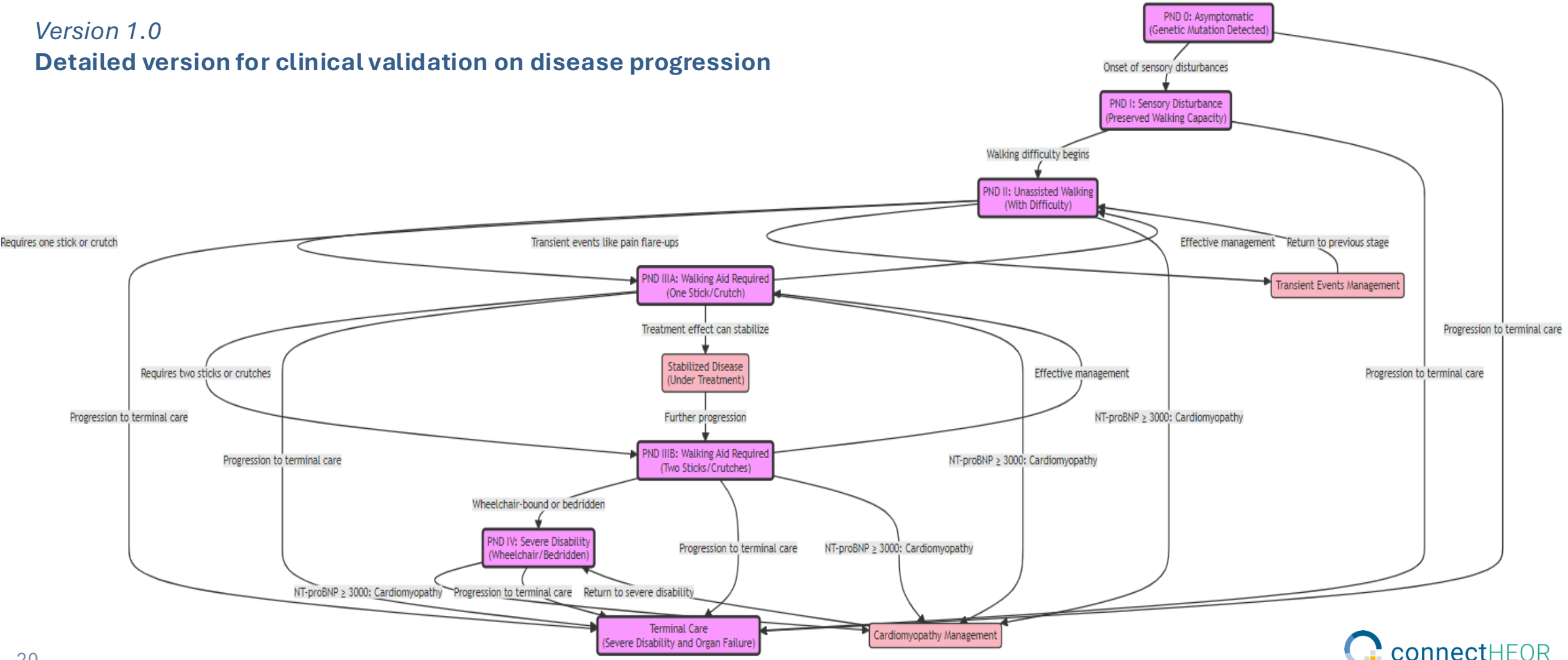
connectHEOR

Model Concept Mapping: CEM for ATTR-Polyneuropathy

Rare Disease Use Case
(very less data available)

Version 1.0

Detailed version for clinical validation on disease progression

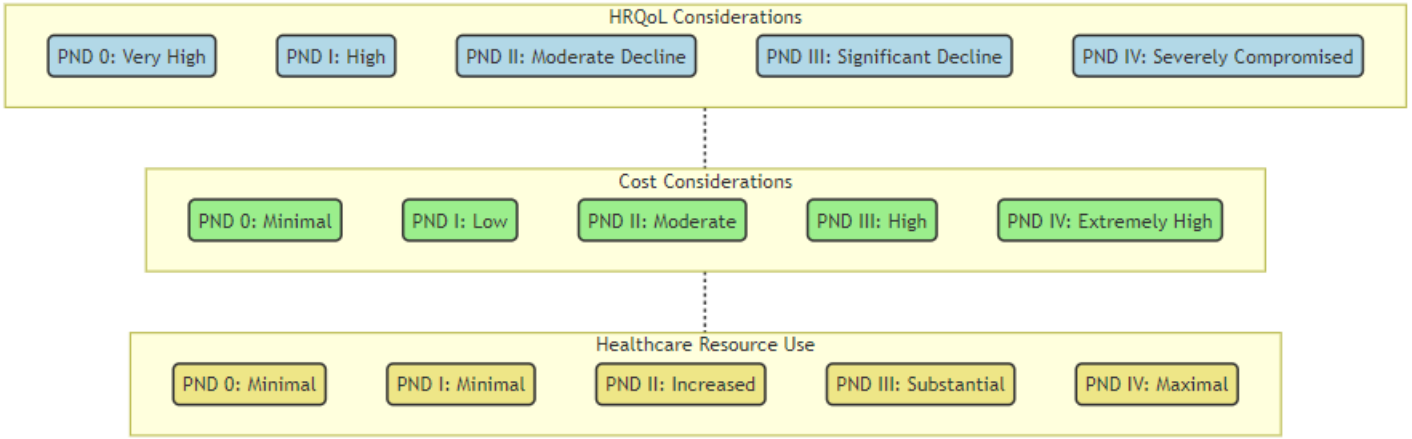


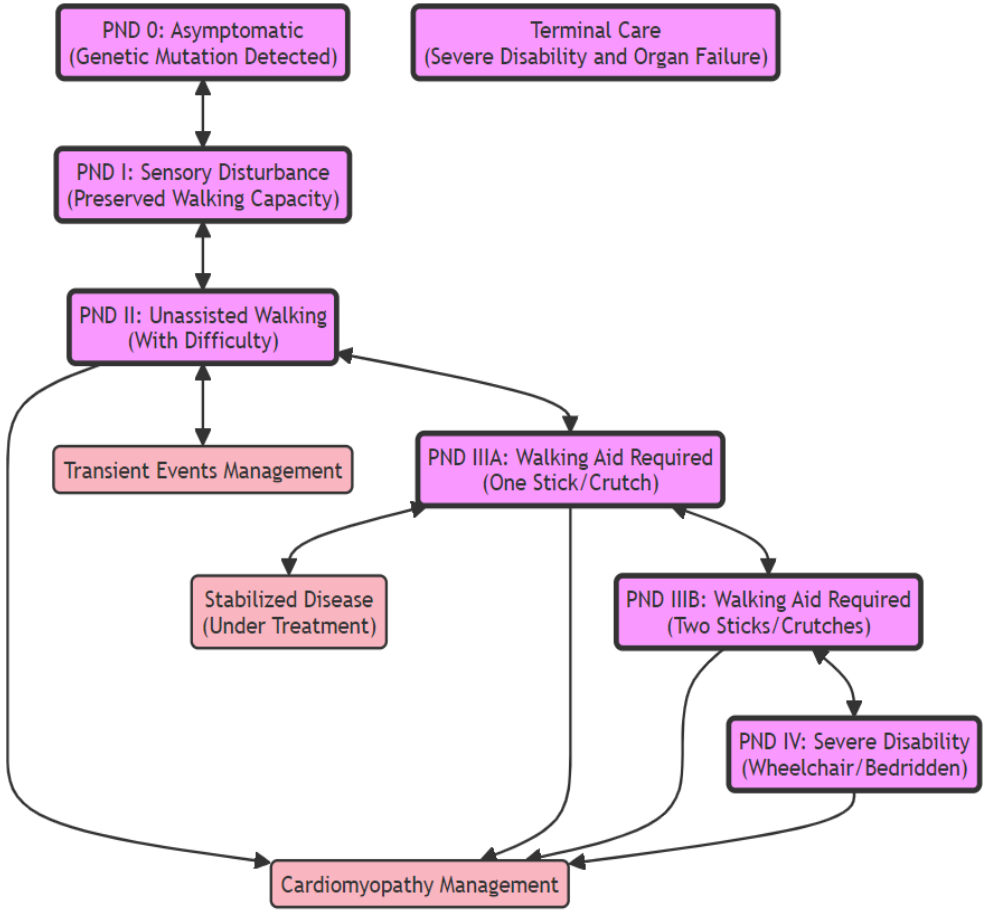
connectHEOR

Model Concept Mapping: CEM for ATTR-Polyneuropathy

Rare Disease Use Case
(very less data available)

Version 2.0
Simplified version for modelers for health economic modeling





connectHEOR

Time taken for this conceptualization exercise with HEM-X (including both human and AI efforts)

Specific Tasks Undertaken in this Case Study:

- Published clinical trial information and guidelines
- Run 1 of HEM-X (1 hour)
- First review by expert modeler and providing feedback to HEM-X
- Run 2 of HEM-X (1 hour)
- Additional peer-reviews by internal clinicians and modelers (not involved in the project)
- Final run of HEM-X (1 hour)
- Ready for discussion with KOLs

Output generated in every run: Model Concept Diagram, Model Structure Schematic, & Full Model Design Plan in MS-Word

Total time using HEM-X's optimally integrated AI-Human framework:
3 days — a significant reduction compared to the typical **3 months** required by a human-only modeler.

connectHEOR

Model Design Plans by HEM-X

Rare Disease Use Case (very less data available)

Cost-Effectiveness of RNAi therapy for the treatment of ATTR-PN

MDP Generated by Hem-X™(ConnectHEOR)

17 November 2024

Introduction

Table of Contents:

List of Tables:

List of Figures:

~40 pages well-written MDP

connectHEOR

Key Takeaways

Takeaways

? Is it possible to optimally integrate Generative-AI and Human Expertise? **Yes**

? Is it possible to conceptualize health economic models using Generative-AI? **Yes**

? Can we emulate human-like reasoning through Generative-AI? **Yes**

? Can Generative-AI will replace human? **No. It is there to make human more efficient. Human-in-loop is must.**

? Should we leverage Generative-AI in our HEOR workflows? **Yes. We should embrace this technology and evolve together.**

connectHEOR

What's Next?

Let's unite to embrace Gen-AI—exploring the unexplored and proving that AI and humans can thrive together. With a shared mission, we can bring more proof-of-concepts to life, drive deployment, and create a transformative future for HEOR.

connectHEOR

Experience the Future Today at ISPOR EU 2024!

We warmly invite you to visit ConnectHEOR Booth #**1400** to witness HEM-X and other groundbreaking tools live in action.

Thank You!

connectHEOR

United Kingdom | Canada | Switzerland | Asia

connectHEOR

United Kingdom | Canada | Switzerland | Asia

Thank You!

W: www.connectHEOR.com

E: info@connectheor.com

T: +44 (0) 753 598 8369

A: ConnectHEOR Limited, 5 St John's Lane, London, EC1M4BH