Decluttering Complexity: A Pragmatic Framework for Simplifying Global Health Economic Models for HTA

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OBJECTIVE

Health economic models developed for NICE often contain more detail than required by other HTA agencies. Hence, NICE models may not always be applicable for use in other settings for affiliates with limited modeling expertise. In the absence of formal guidance on how model simplification should be conducted, we propose a systematic methodology to simplify and streamline global cost-effectiveness (CE) and budget impact (BI) models used for HTA submissions into simplified user- friendly models (SUFM) while preserving analytical integrity. The methodology is illustrated using Ferrer's inhaled treprostinil model for pulmonary hypertension associated with interstitial lung disease (PH-ILD).

1. **Qualitative Alignment** — Ensures consistency with complex model
2. **Intuitive Interface** — Enables real-time adjustments without requiring modelling expertise
3. **Adaptability & Flexibility** — Adapts easily to different scenarios and decision-making needs

METHODOLOGY

We analyzed the existing combined CE and BI model to identify sources of complexity, including redundant inputs, dispersed settings across multiple sheets, and intricate data flows. Three simplification principles were applied[1]:

- **Omission (removing non-influential parameters) -** *Eliminated drop-down options lacking supporting data to ensure only valid selections were shown.*
- **Aggregation (combining similar parameters) -** *Created a dedicated "Input Adaptation" tab consolidating all user-adjustable parameters.*
- **Substitution (replacing complex settings) -** *Subgroups inconsistent across arms were replaced with aligned selections to ensure valid comparisons and reduce complexity.*

One-way sensitivity analysis was leveraged to classify inputs by their impact (%) on incremental cost effectiveness ratio (ICER) as well as considering clinical and access relevance:

- **Potentially Not Needed (<10% impact on ICER)**
  - *For example: treatment specific utilities, within-trial analysis.*
- **Nice to Have (10-30% impact on ICER)**
  - *For example: severity modifier, instant & gradual waning.*
- **Must-Have (>30% impact on ICER)**
  - *For example: health state specific utilities, parametric analysis.*

1. **As-Is Analysis** — Identifying model elements to retain, refine, or remove for simplicity while preserving core structure
2. **Stakeholder Validation** — Confirming pain points and challenges with relevant stakeholders
3. **Model Restructuring** — Separating CE and BI models into standalone frameworks
4. **Data Updates** — Incorporating latest efficacy and safety data
5. **User Engagement** — Ensuring broad team involvement, involving non-modelers

RESULTS

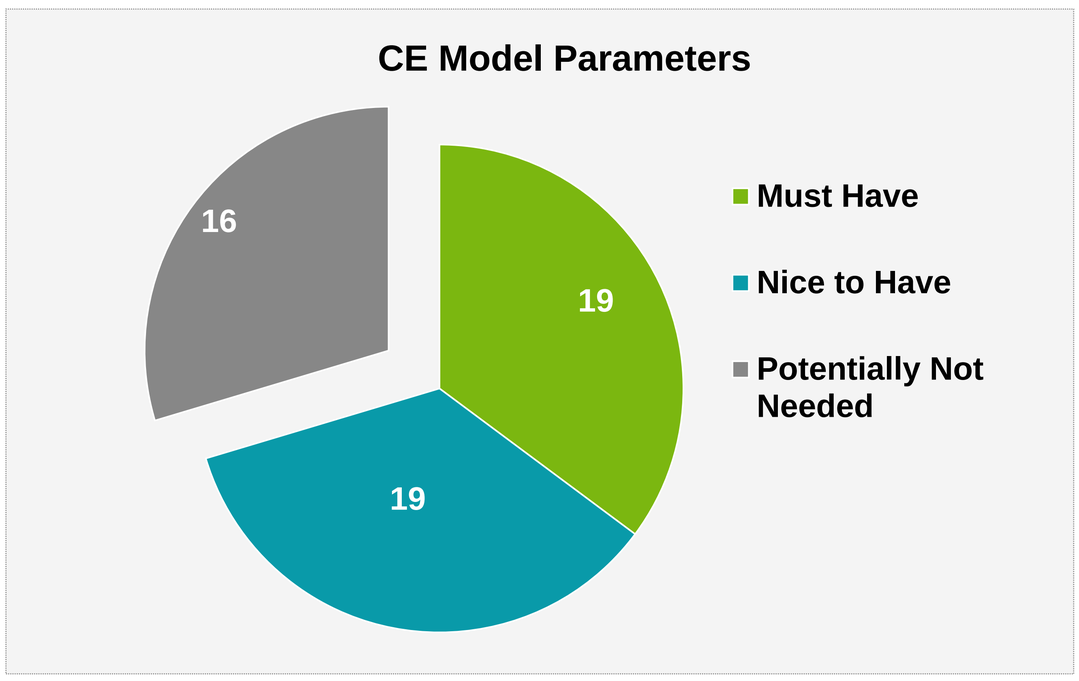
>User-centric improvements included **centralized input sheets** and **intuitive interfaces.**

>Simplification consolidated the **user inputs into four primary sheets** and **reduced** the number of **model sheets** overall from over 50 to 30.

>Parameters were **restructured** into two groups: localized "**Country & Costs**" sheets for adaptation and centralized "**Efficacy & Quality of Life**" sheets for core effectiveness inputs.

>**CE** and **BI models were decoupled** to allow independent customization.

>User testing confirmed **improved model transparency and usability**, while validation demonstrated analytical equivalence with the original model.



VALIDATION

The SUFM was developed in line with ISPOR[2] best practice modeling guidelines. Following the approach described by Zwerling et al.[3], one-way sensitivity analyses from the original complex model was used to identify parameters with a >10% impact on the ICER or incremental net monetary benefit. The same approach was applied to the simplified version to confirm that structural modifications did not introduce substantive analytical deviations. Validation demonstrated that while numerical results may differ marginally, directional consistency and decision-relevant outcomes were preserved between the original and simplified models.

LIMITATIONS

>**Analytical Equivalence:** While the SUFM was validated against the original CE and BI models, exact numerical alignment may not be achievable due to the removal or modification of certain parameters and structural settings. However, consistency in directional outcomes and overall conclusions was maintained.

>**Reduction Trade-offs:** The simplification process inherently involves a balance between usability and analytical granularity. Certain low-impact parameters or subgroup analyses were omitted to enhance transparency and efficiency, which may limit exploration of niche clinical or payer scenarios.

CONCLUSION

This framework enables **structured simplification of global health economic models without compromising robustness**. It **enhances usability** and **adaptability for global HTA needs**. Further research could refine the methodology through broader use cases and stakeholder-informed criteria.

REFERENCES

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Abbreviations: HTA: Health Technology Assessment; NICE: National Institute for Health and Care Excellence