**Key Features and Requirements for your decision model**

Adapted from the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) 2 checklist

**For assignment 1 you only have to answer No 1-5. During the rest of the course you might be able to answer the other questions.**

| **Section/Item** | **No** | **Description** | **Details about your study (if applicable)** |
| --- | --- | --- | --- |
| Background and objectives | 1a | Define the study question and its relevance for health policy or practice decisions. | Is Throat Culture More Cost-Effective than Rapid Antigen Diagnostic Testing (RADT) for diagnosing Group A Streptococcus (GAS) in Pediatric Sore Throat Patients?  Relevance:   * Throat infections are often viral, yet antibiotics are frequently overprescribed, contributing to antibiotic resistance * Overuses of antibiotic 🡪 unnecessary risks * Optimizing decision making can improve patient outcome, reduce healthcare costs   The insights from the study can help healthcare policymakers and clinicians determine the most economically efficient and clinically effective approach to diagnosing (and treating) GAS infections. |
| 1b | Are there any decision models out there already answering your research question? | Several decision models focus on diagnostic strategies (using rapid strep tests) or cost-effectiveness of diagnosis options for sore throat. Examples include models evaluating the sensitivity/specificity of testing for group A streptococcus infections and the benefits of delaying antibiotics for watchful waiting.  E.g.,  "Management of Sore Throats in Children – A Cost-effectiveness Analysis"  (https://jamanetwork.com/journals/jamapediatrics/fullarticle/347278) |
| Study population and subgroups | 2 | Describe characteristics of the base case population (such as age range, demographics, socioeconomic or clinical characteristics). | Base case populations:  - Children aged 5-15 years presenting with throat infections  - Adults 18 years and older (prevalence of getting infected with GAS 0.1)  - Children with higher risk of bacterial infections  Socioeconomic characteristics: There exist geographic and socioeconomics variations, depending mainly on where access to rapid diagnostic testing or healthcare is limited/accessible.  Clinical characteristics: Common symptoms include sore throat, fewer, swollen lymph nodes and tonsillar exudate |
| Setting and location | 3 | State to which setting and location this decision model applies. | Primary care clinics (general practitioners) or emergency departments   * areas with access to rapid strep tests * Areas where diagnosis relies on clinical presentation |
| Study perspective | 4 | Decide on the perspective of the study and relate this to the costs being evaluated. | The decision model should adopt the healthcare payer perspective, which aligns with cost-effectiveness analyses commonly used in health technology assessments (HTAs). This perspective considers direct medical costs incurred by healthcare systems, insurance providers, or government payers rather than societal or patient-borne costs.   1. Diagnostic Costs  * Cost of Rapid Antigen Diagnostic Test (RADT) * Cost of Throat Culture (including laboratory processing and personnel time)  1. Treatment Costs 🡪 this is not used for decision modeling  * Antibiotics (Penicillin or other first-line treatments for GAS) * Costs related to unnecessary antibiotic prescriptions for false positives |
| Comparators | 5 | Which interventions or strategies are being compared? | The model evaluates the cost-effectiveness of throat culture vs. RADT for diagnosing Group A Streptococcus (GAS) pharyngitis in a primary care setting.  If test positive, then antibiotics are immediately prescribed. (this is not included in the decision model) |
| Model type | 6 | What type of decision model you think you need? How important is the effect of time in the question you are trying to answer? | The type of decision model we used is microsimulation because the prevalence of getting infected with GAS is per individual different because it is age-dependent. The model simulates individual trajectories, making it suitable for age-dependent risks of GAS infections. state-transitions are determined using probability distribution and incorporate uncertainty analysis. |
| Model structure | 7 | What are the most important health states / events / pathways that will be in your model | The model defines three key health states: healthy (H), Sick (S), and dead (D). the transition probabilities are modeled using age-dependent probabilities. The code initializes individuals as healthy and tracks their progression over 24 cycles (2 years). |
| Time horizon | 8 | Choose a time horizon(s) over which costs and consequences are being evaluated. | The time horizon is 2 years (evaluated in 24 monthly cycles). This choice reflects a short-term diagnosis outcomes, but also for the long term health consequences |
| Discount rate | 9 | Report the choice of discount rate used for costs and outcomes and say why. | We used 3% discount rate used for costs and outcomes. This is in cost-effectiveness analysis commonly used. Without discounting, future costs (e.g., complications) may appear overestimated. Discounting ensures a realistic valuation of long-term economic and health outcomes. |
| Choice of health outcomes | 10 | Determine which health outcomes will be used as the measure(s) of benefit in the evaluation (e.g. LYs, QALYs). | The health outcomes that will be used as a measure of benefit in the evaluation are the QALYs. The QALY capture the utility for the cost effectiveness analysis.   * Cost and QALY outputs are calculated using calculate\_ce\_out() function * ICERs compare the cost and benefits of RADT vs Throat culture * Cost-effectiveness acceptability curve determines the probability of each strategy being optimal at different WTP thresholds |
| Measurement of effectiveness | 11 | What type of data you have available to estimate the effectiveness (RCT, expert opinion etc)? Will evidence synthesis be used? | To ensure reliability, we used systematic reviews and meta-analyses, integrating data from various sources to provide a comprehensive numbers. We relied on validated probabilities, including the likelihood of testing positive in diagnostic tests. However, certain analyses yielded unrealistic outcomes, which needed adjustments in the model. In such cases, we made reasonable estimations to align the model with real-world expectations. |
| Measurement and valuation of (preference based) outcomes | 12 | If you are doing a cost-utility analysis, do you have HRQoL data? With which methods and in which population were the outcome measures measured? | Not applicable. |
| Estimating resources and costs | 13 | Describe data sources used to estimate costs/resource use associated with model health states | Costs included:   1. RADT test price 2. Throat culture price (including lab processing)   Maybe include when you test positive you get treated with antibiotics (Penicillin). The costs can be found in reviews per different country. |
| Characterizing uncertainty | 14 | What methods will you use to characterize uncertainty in your analysis? | The methods we’ll use to characterize uncertainty start with defining distributions for key probabilities. For instance, we’ll apply a beta distribution to model probabilities related to mortality and complications. For diagnostic accuracy, we’ll use a triangular distribution to represent the sensitivity and specificity of RADT vs. Throat Culture, ensuring a more realistic variation in test performance. Afterwards we can run a sensitivity analysis and a probability sensitivity analysis. |
| Assumptions | 15 | Describe assumptions underlying your model | 1. Everyone that tests positive will get treated immediately with antibiotics. 2. RADT is the standard of care. 3. No complications will occur when treating them with antibiotics. 4. Patients who recover form GAS return to healthy health state. 5. No indirect costs are considered. |
| Relevant stakeholders | 16 | Who are the relevant stakeholders affected by or making the decision? How could you insure their perspectives are taken into consideration? | Healthcare Providers (Doctors, Nurses)   1. Need cost-effective and accurate diagnostics. 2. Avoid overprescription of antibiotics to reduce resistance risks.   Patients & Parents (For Pediatric Cases)   1. Concerned with rapid diagnosis and effective treatment. 2. Prefer minimizing unnecessary antibiotics.   Payers & Policymakers   1. Want cost-effective testing strategies to reduce healthcare expenditures. 2. Interested in long-term impact on public health (e.g., antibiotic resistance control or prevent rheumatic fever or prevent allergies for antibiotics 🡪 anaphylactic shock) |

Adopted from: Husereau D, Drummond M, Augustovski F, de Bekker-Grob E, Briggs AH, Carswell C, Caulley L, Chaiyakunapruk N, Greenberg D, Loder E, Mauskopf J, Mullins CD, Petrou S, Pwu RF, Staniszewska S; CHEERS 2022 ISPOR Good Research Practices Task Force. Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) Statement: Updated Reporting Guidance for Health Economic Evaluations.

Note: CHEERS II was developed as a reporting guideline, not as a tool for study design, however, we are using the guideline as such for teaching purposes. The full, non-adjusted reporting guideline can be accessed via <https://www.equator-network.org/reporting-guidelines/cheers/>