Professional Certificate in Health Economics and Market Access

Health Economic Modeling

Absolute Risk Reduction (ARR)
Related terms: Number Needed to Treat, Relative Risk Reduction
Explanation: The difference in event rates between a control group and an intervention group, expressed as a proportion. Example: If 10 % of patients on standard care experience a heart attack versus 6 % on a new drug, ARR = 4 %. Practical application: Used to quantify the clinical benefit of a therapy in cost-effectiveness models. Challenge: Small absolute differences can lead to large uncertainty when sample sizes are limited.

Accelerated Approval Pathway
Related terms: Conditional Marketing Authorization, Early Access Programs
Explanation: A regulatory mechanism that permits earlier market entry based on surrogate endpoints that are reasonably likely to predict clinical benefit. Example: Oncology drugs approved after showing tumor shrinkage rather than overall survival. Practical application: Models often incorporate conditional reimbursement and post-marketing evidence requirements. Challenge: Estimating long-term value is difficult when definitive outcomes are unavailable.

Adverse Event (AE) Costing
Related terms: Event-Based Costing, Resource Utilization
Explanation: Assigning monetary values to the management of side effects, including treatment, monitoring, and hospitalisation. Example: Grade 3 neutropenia may require inpatient care costing $5,000 per episode. Practical application: Integrated into incremental cost-effectiveness ratios (ICERs) to reflect safety profiles. Challenge: Data on AE incidence and resource use may be sparse or heterogeneous across trials.

Agency for Healthcare Research and Quality (AHRQ)
Related terms: Health Services Research, Evidence-Based Guidelines
Explanation: A U.S. Federal agency that produces tools such as the Quality-Adjusted Life-Year (QALY) and disease-specific cost databases. Practical application: Modelers use AHRQ cost estimates for inpatient stays and procedures. Challenge: Aligning U.S. Cost data with international pricing structures can be problematic.

Allocation Rule
Related terms: Decision Rule, Priority Setting
Explanation: A predefined principle that determines how limited resources are distributed among competing health interventions. Example: “First-come, first-served” or “maximise QALYs.”
Practical application: Embedded in budget impact models to simulate policy decisions. Challenge: Ethical considerations and stakeholder preferences may conflict with efficiency goals.

Alternative Discount Rate
Related terms: Time Preference, Present Value
Explanation: The rate used to convert future costs and outcomes to present values, often varied in sensitivity analyses. Typical values: 3 % For costs, 1.5 % For health outcomes. Practical application: Influences the

magnitude of long-term benefits in chronic disease models. Challenge: Selecting an appropriate rate that reflects societal time preferences and inflation.

Amortisation of Capital Costs
Related terms: Depreciation, Fixed Asset Allocation
Explanation: Spreading the expense of capital equipment (e.G., MRI scanner) over its useful life. Example: A $2 million scanner with a 10-year lifespan yields $200 000 annual cost. Practical application: Included in health-system perspective models to capture infrastructure investments. Challenge: Determining appropriate lifespan and residual value for medical technology.

Analytic Horizon
Related terms: Time Horizon, Model Horizon
Explanation: The total period over which costs and outcomes are projected in a model. Common horizons: Lifetime, 5-year, or 10-year. Practical application: Determines whether long-term benefits such as survival gains are captured. Challenge: Longer horizons increase uncertainty and require extrapolation beyond trial data.

Application Programming Interface (API)
Related terms: Data Integration, Software Development Kit
Explanation: A set of protocols that allow software applications to exchange data, often used to pull real-world evidence from electronic health records. Practical application: Automates data extraction for model inputs. Challenge: Ensuring data privacy, standardisation, and compatibility across systems.

Assumption Testing
Related terms: Scenario Analysis, Sensitivity Testing
Explanation: Systematically varying model assumptions to assess their impact on results. Example: Changing disease progression rates from fast to slow. Practical application: Provides robustness checks for decision-makers. Challenge: Identifying which assumptions are most influential without over-complicating the analysis.

Budget Impact Analysis (BIA)
Related terms: Cost-Effectiveness Analysis, Financial Forecasting
Explanation: Estimates the financial consequences of adopting a new intervention within a specific budget context. Example: Projected increase in pharmacy spend after introducing a biologic. Practical application: Required by many HTA bodies to inform reimbursement decisions. Challenge: Requires detailed uptake estimates and may be sensitive to price negotiations.

Cost-Benefit Analysis (CBA)
Related terms: Monetary Valuation, Net Benefit
Explanation: Compares the monetary value of benefits to costs, producing a net benefit figure. Example: Valuing a QALY at $150 000 and subtracting intervention costs. Practical application: Facilitates comparison across sectors (e.G., Health vs. Transportation). Challenge: Assigning a societal willingness-to-pay per QALY can be contentious.

Cost-Effectiveness Threshold

Related terms: Willingness-to-Pay (WTP), Incremental Cost-Effectiveness Ratio (ICER)
Explanation: The maximum amount a payer is prepared to spend for one additional unit of health benefit (e.G., $50 000 Per QALY). Practical application: Determines whether an intervention is deemed "cost-effective."
Challenge: Thresholds vary across jurisdictions and may not reflect budget constraints.

Cost-Effectiveness Plane
Related terms: ICER Plot, Quadrant Analysis
Explanation: A graphical representation dividing outcomes into four quadrants based on cost and effectiveness differences. Quadrants: More effective-more costly, more effective-less costly, less effective-more costly, less effective-less costly. Practical application: Visualises uncertainty via scatter plots from probabilistic sensitivity analysis. Challenge: Interpretation can be ambiguous when points cross multiple quadrants.

Cost-Effectiveness Ratio (CER)
Related terms: ICER, Incremental Ratio
Explanation: The ratio of total costs to total health outcomes for a single intervention (e.G., $30 000 Per QALY). Distinguished from the incremental ratio, which compares two alternatives. Practical application: Provides a baseline efficiency measure. Challenge: May be misleading without a comparator.

Cost-Utility Analysis (CUA)
Related terms: QALY, Health-Adjusted Life Year (HALY)
Explanation: A form of economic evaluation that incorporates quality of life into the measurement of benefits. Example: Calculating cost per QALY gained for a new vaccine. Practical application: Preferred by many HTA agencies for its ability to compare across disease areas. Challenge: Requires robust utility data, often derived from generic instruments like EQ-5D.

Cost-of-Illness (COI) Study
Related terms: Direct Costs, Indirect Costs
Explanation: Quantifies the economic burden of a disease, including medical expenditures and productivity losses. Example: Annual COI for diabetes in the United States exceeds $300 billion. Practical application: Supplies baseline cost inputs for model calibration. Challenge: Capturing intangible costs such as pain and suffering.

Cost-Sharing
Related terms: Co-payment, Deductible, Out-of-Pocket
Explanation: The portion of health expenses paid by patients rather than insurers. Practical application: Influences adherence rates in models of chronic therapies. Challenge: Varying cost-sharing structures across plans complicate generalisation.

Credible Interval
Related terms: Confidence Interval, Bayesian Posterior Interval
Explanation: In Bayesian analysis, the range within which a parameter lies with a specified probability (e.G., 95 %). Practical application: Communicates uncertainty around model parameters. Challenge: Requires prior

distributions that may be subjective.

Decision Analytic Model
Related terms: Markov Model, Discrete Event Simulation, Microsimulation
Explanation: A structured representation of clinical pathways used to estimate costs and outcomes under alternative strategies. Practical application: Core tool in health-economic evaluations. Challenge: Balancing model complexity with data availability.

Discount Rate
Related terms: Present Value, Time Preference
Explanation: The percentage used to convert future costs and health effects to present-day values. Standard rates: 3 % For costs, 1.5 % For health outcomes. Practical application: Affects long-term cost-effectiveness results, especially for chronic diseases. Challenge: Debate exists over appropriate rates for different jurisdictions.

Discrete Event Simulation (DES)
Related terms: Microsimulation, Agent-Based Model
Explanation: A modelling technique that tracks individual entities as they experience events over time, allowing for complex interactions and resource constraints. Practical application: Captures queueing effects in hospital settings. Challenge: Requires detailed data on event timing and often high computational demand.

Deterministic Sensitivity Analysis (DSA)
Related terms: One-Way Sensitivity, Tornado Diagram
Explanation: Varies one parameter at a time while holding others constant to assess impact on outcomes. Practical application: Identifies key drivers of model results. Challenge: May underestimate joint uncertainty when parameters are correlated.

Drug Price Index (DPI)
Related terms: Inflation Adjustment, Price Escalation
Explanation: A measure that tracks changes in pharmaceutical prices over time, often adjusted for inflation. Practical application: Used to update model inputs for future cost projections. Challenge: Variability across therapeutic classes and market-specific pricing agreements.

Dynamic Transmission Model
Related terms: Compartmental Model, Infectious Disease Modeling
Explanation: Simulates the spread of an infectious agent through populations, incorporating time-varying contact patterns and immunity. Practical application: Evaluates vaccination strategies and herd-immunity effects. Challenge: Requires detailed epidemiological data and assumptions about mixing patterns.

Epidemiological Parameter
Related terms: Incidence, Prevalence, Transition Probability
Explanation: Quantitative measures describing disease frequency or progression used as inputs in health-economic models. Example: Annual incidence of myocardial infarction in a 65-year-old cohort. Practical application: Drives the number of events and associated costs. Challenge: Sources may differ in

case definitions and diagnostic criteria.

EQ-5D
Related terms: Utility Measure, Health-Related Quality of Life (HRQoL)
Explanation: A standardized instrument that generates a five-dimension health state profile, convertible to a utility value for QALY calculations. Practical application: Frequently used to collect patient-reported outcomes in clinical trials. Challenge: Ceiling effects and cultural differences may affect comparability.

Extrapolation
Related terms: Survival Analysis, Parametric Modeling
Explanation: Extending observed trial data beyond the follow-up period to estimate long-term outcomes. Common methods: Weibull, exponential, log-logistic distributions. Practical application: Generates lifetime survival curves for cost-effectiveness analysis. Challenge: Choice of distribution can markedly influence results; external validation is essential.

External Validation
Related terms: Model Calibration, Predictive Accuracy
Explanation: Comparing model predictions with independent data sources not used in model development. Practical application: Increases confidence in the model's applicability to real-world settings. Challenge: Availability of high-quality external datasets may be limited.

Factorial Design
Related terms: Orthogonal Design, Interaction Effect
Explanation: A study design that evaluates multiple interventions simultaneously, allowing assessment of combined effects. Example: 2 × 2 Design testing drug A, drug B, both, or neither. Practical application: Provides interaction parameters for models when therapies may be used together. Challenge: Increases sample size requirements and analytical complexity.

Frequentist Approach
Related terms: Confidence Interval, Null Hypothesis Testing
Explanation: A statistical paradigm that interprets probability as the long-run frequency of events. Practical application: Commonly used for hypothesis testing in clinical trials that feed model inputs. Challenge: Does not incorporate prior information, which may be valuable in sparse data contexts.

Future Discounting
Related terms: Present Value, Time Preference
Explanation: The process of applying a discount factor to future costs and outcomes to reflect societal preferences for present consumption. Practical application: Standard practice in health-economic evaluations. Challenge: Choosing a discount rate that balances inter-generational equity and fiscal reality.

Generic Utility Measure
Related terms: EQ-5D, SF-6D, HUI
Explanation: Instruments designed to assess health-related quality of life across a wide range of conditions, enabling cross-disease comparisons. Practical application: Allows aggregation of QALYs in multi-indication models. Challenge: May lack sensitivity for disease-specific symptoms.

Health Technology Assessment (HTA)
Related terms: Reimbursement Decision, Cost-Effectiveness Evaluation
Explanation: A systematic process that evaluates the clinical and economic value of health technologies to inform policy. Examples: NICE (UK), CADTH (Canada), IQWiG (Germany). Practical application: Determines market access and pricing negotiations. Challenge: Varying methodological requirements across agencies.

Health-Adjusted Life Year (HALY)
Related terms: QALY, DALY
Explanation: A generic metric that combines quantity and quality of life, encompassing both QALYs (positive health) and DALYs (burden of disease). Practical application: Facilitates comparison of interventions with differing health impacts. Challenge: Converting between QALY and DALY frameworks may require assumptions about disability weights.

Incremental Cost-Effectiveness Ratio (ICER)
Related terms: Cost-Effectiveness Threshold, Net Monetary Benefit
Explanation: The ratio of the difference in costs to the difference in effectiveness between two alternatives (ΔCost/ΔEffect). Practical application: Core output for decision-makers evaluating new therapies. Challenge: Interpretation becomes ambiguous when the comparator is dominated (more costly and less effective).

Input Parameter Uncertainty
Related terms: Probabilistic Sensitivity Analysis, Monte Carlo Simulation
Explanation: Uncertainty arising from variability in model inputs such as transition probabilities, utilities, or costs. Practical application: Modeled using distributions (e.G., Beta for probabilities). Challenge: Requires specification of appropriate distribution types and parameters.

Intention-to-Treat (ITT) Analysis
Related terms: Per-Protocol Analysis, Efficacy vs. Effectiveness
Explanation: An analytical approach that includes all randomised participants in the groups to which they were assigned, regardless of adherence. Practical application: Provides conservative effectiveness estimates for model inputs. Challenge: May dilute treatment effect if crossover or dropout rates are high.

Item-Response Theory (IRT)
Related terms: Psychometric Modeling, Health-Related Quality of Life
Explanation: A statistical framework that models the probability of a particular response to a questionnaire item based on underlying latent traits. Practical application: Improves the precision of utility measurement from PROMs. Challenge: Requires large sample sizes and complex software.

Joint Modeling
Related terms: Longitudinal Data, Survival Analysis
Explanation: Simultaneously analyses repeated measures (e.G., Biomarkers) and time-to-event data to capture their interdependence. Practical application: Enhances prediction of disease progression in cost-effectiveness models. Challenge: Computationally intensive and demands sophisticated statistical expertise.

Lifetime Horizon

Related terms: Analytic Horizon, Time Horizon
Explanation: Extending the model's projection until the cohort's death, ensuring capture of all relevant costs and benefits. Practical application: Standard for chronic diseases where benefits accrue over many years. Challenge: Requires extrapolation beyond observed data, increasing uncertainty.

Markov Model
Related terms: State-Transition Model, Cycle Length
Explanation: A stochastic model that represents disease progression through a finite set of health states, with transition probabilities applied each cycle. Practical application: Widely used for chronic conditions such as diabetes or cardiovascular disease. Challenge: The "memoryless" property may oversimplify histories that affect future risk.

Markov Chain Monte Carlo (MCMC)
Related terms: Bayesian Inference, Posterior Distribution
Explanation: An algorithm that generates samples from a probability distribution by constructing a Markov chain, enabling Bayesian parameter estimation. Practical application: Used to derive posterior distributions for uncertain model inputs. Challenge: Requires convergence diagnostics and can be computationally demanding.

Micro-Costing
Related terms: Bottom-Up Costing, Resource Enumeration
Explanation: Detailed quantification of each resource used in patient care, assigning unit costs to generate total cost per patient. Practical application: Provides high-resolution cost data for specific interventions. Challenge: Time-consuming and may be limited by data availability.

Microsimulation
Related terms: Individual-Based Model, Discrete Event Simulation
Explanation: Simulates the life course of individual patients, allowing heterogeneity in risk factors and treatment pathways. Practical application: Captures patient-level variability and complex treatment histories. Challenge: Requires extensive data on individual characteristics and can be computationally intensive.

Monte Carlo Simulation
Related terms: Probabilistic Sensitivity Analysis, Random Sampling
Explanation: A technique that repeatedly samples from probability distributions of inputs to generate a distribution of outcomes. Practical application: Quantifies overall model uncertainty and produces cost-effectiveness acceptability curves. Challenge: Number of iterations must be sufficient to achieve stable results.

Net Monetary Benefit (NMB)
Related terms: ICER, Willingness-to-Pay (WTP)
Explanation: A reformulation of the ICER that expresses value in monetary terms: (ΔEffect × WTP) – ΔCost. Practical application: Simplifies probabilistic analysis and decision rules. Challenge: Dependent on the chosen WTP threshold, which may be uncertain.

Net Health Benefit (NHB)

Related terms: QALY, Incremental Benefit
Explanation: The difference in health outcomes (e.G., QALYs) after adjusting for costs using a willingness-to-pay value. Formula: ΔEffect – (ΔCost/WTP). Practical application: Allows comparison across interventions with different cost structures. Challenge: Requires a consensus WTP value.

Network Meta-Analysis (NMA)
Related terms: Indirect Comparison, Mixed Treatment Comparison
Explanation: A statistical method that combines direct and indirect evidence across a network of interventions to estimate relative effects. Practical application: Supplies comparative efficacy inputs when head-to-head trials are absent. Challenge: Assumes transitivity and consistency, which may be violated.

Non-Parametric Bootstrap
Related terms: Resampling, Confidence Interval
Explanation: A resampling technique that draws repeated samples with replacement from the observed data to estimate the sampling distribution of a statistic. Practical application: Generates empirical confidence intervals for cost or effectiveness estimates. Challenge: Requires sufficient original sample size to produce reliable resamples.

Observational Data
Related terms: Real-World Evidence, Registry Data
Explanation: Data collected outside of randomised controlled trials, often from electronic health records, claims databases, or disease registries. Practical application: Informs model inputs such as resource utilisation, adherence, and long-term outcomes. Challenge: Susceptible to confounding and selection bias.

Outcome Measure
Related terms: QALY, DALY, Survival
Explanation: The health endpoint used to assess the benefit of an intervention, ranging from clinical events to utility-adjusted life years. Practical application: Determines the numerator in cost-effectiveness ratios. Challenge: Selecting measures that capture all relevant aspects of patient benefit.

Patient-Reported Outcome Measure (PROM)
Related terms: HRQoL, Utility Instrument
Explanation: Instruments that capture patients' perspectives on their health status, symptoms, and functional abilities. Examples: EQ-5D, SF-36, disease-specific questionnaires. Practical application: Generates utility values for QALY calculations. Challenge: Missing data and cultural differences can affect validity.

Pharmacoeconomic Evaluation
Related terms: Cost-Effectiveness Analysis, Budget Impact
Explanation: The systematic assessment of the value of pharmaceutical products, incorporating both costs and outcomes. Practical application: Supports reimbursement and pricing decisions. Challenge: Rapidly changing market dynamics and confidential discounts complicate analyses.

Placebo Effect
Related terms: Control Arm, Blinding
Explanation: Improvement in patient outcomes attributable to expectations rather than the active

intervention. Practical application: Must be accounted for when translating trial efficacy to real-world effectiveness. Challenge: Quantifying the magnitude of the placebo effect for model inputs is difficult.

Probabilistic Sensitivity Analysis (PSA)
Related terms: Monte Carlo Simulation, Parameter Distributions
Explanation: Simultaneously varies all uncertain parameters according to predefined probability distributions to assess overall model uncertainty. Practical application: Produces cost-effectiveness acceptability curves and probability of being cost-effective. Challenge: Requires specification of appropriate distributions and correlation structures.

Quality-Adjusted Life Year (QALY)
Related terms: HALY, Utility, Cost-Utility Analysis
Explanation: A measure that combines length of life with health-related quality of life, where 1 QALY equals one year in perfect health. Practical application: Standard metric for cost-utility analyses. Challenge: Utility measurement methods and cultural valuation of health states can vary.

Real-World Evidence (RWE)
Related terms: Observational Data, Pragmatic Trial
Explanation: Clinical evidence regarding the usage and potential benefits or risks of a medical product derived from analysis of real-world data. Practical application: Supplements trial data for long-term effectiveness and safety inputs. Challenge: Data quality, standardisation, and privacy concerns.

Reference Case
Related terms: Standardised Analysis, HTA Guidelines
Explanation: A predefined set of methodological assumptions (e.G., Perspective, discount rates, time horizon) used to ensure comparability across evaluations. Practical application: Aligns model outputs with agency expectations. Challenge: May limit flexibility to address specific decision contexts.

Resource Utilisation
Related terms: Costing, Service Use
Explanation: The quantity and type of health-care services consumed (e.G., Hospital stays, physician visits, medication doses). Practical application: Drives cost calculations in economic models. Challenge: Capturing variation across settings and patient pathways.

Scenario Analysis
Related terms: Deterministic Sensitivity, What-If Analysis
Explanation: Evaluates model outcomes under alternative sets of assumptions (e.G., Best-case, worst-case). Practical application: Explores the impact of structural choices such as alternative comparators or policy changes. Challenge: Selecting plausible scenarios without over-complicating the analysis.

Sensitivity Analysis
Related terms: Deterministic, Probabilistic, Scenario
Explanation: A broad term for any systematic variation of model inputs to assess robustness of results. Practical application: Identifies parameters that most influence cost-effectiveness. Challenge: Balancing thoroughness with interpretability.

Simulation Horizon
Related terms: Analytic Horizon, Time Horizon
Explanation: The period over which a simulation runs, often synonymous with analytic horizon but may refer specifically to the computational runtime. Practical application: Determines data storage and processing requirements. Challenge: Longer horizons increase computational load and uncertainty.

Societal Perspective
Related terms: Health-System Perspective, Cost-Benefit Analysis
Explanation: An analytic viewpoint that includes all costs and benefits regardless of who incurs them, encompassing productivity losses, informal care, and taxes. Practical application: Provides a comprehensive assessment of an intervention's economic impact. Challenge: Data on indirect costs are often scarce and methodologically contentious.

Standardised Mortality Ratio (SMR)
Related terms: Observed/Expected Ratio, Epidemiology
Explanation: The ratio of observed deaths in a study population to the number expected based on a reference population. Practical application: Adjusts baseline mortality in models for specific sub-populations. Challenge: Requires accurate baseline mortality data and appropriate standardisation.

Structural Uncertainty
Related terms: Model Assumptions, Scenario Analysis
Explanation: Uncertainty arising from the choice of model type, health states, or the way processes are represented. Practical application: Explored through alternative model structures or scenario analyses. Challenge: Hard to quantify formally; often addressed qualitatively.

Survival Analysis
Related terms: Time-to-Event, Hazard Function
Explanation: Statistical methods for analysing the time until an event occurs, often using Kaplan-Meier curves or Cox proportional hazards models. Practical application: Provides transition probabilities for Markov models. Challenge: Censoring and competing risks must be appropriately handled.

Time-Dependent Transition Probabilities
Related terms: Markov Model, Hazard Rates
Explanation: Transition probabilities that vary over time, reflecting changing risk as patients age or disease progresses. Practical application: Increases model realism for chronic diseases. Challenge: Requires detailed longitudinal data to estimate.

Utility
Related terms: QALY, Preference-Based Measure
Explanation: A numeric representation of the desirability of a health state, anchored at 0 (dead) and 1 (full health). Practical application: Multiplied by time spent in a state to calculate QALYs. Challenge: Preference elicitation methods (e.G., Standard gamble, time trade-off) can produce divergent values.

Value-Based Pricing
Related terms: Cost-Effectiveness, Negotiated Price

Explanation: Setting the price of a health technology based on its estimated health benefit and willingness-to-pay threshold. Practical application: Aligns manufacturer price with the value delivered to the health system. Challenge: Requires robust, transparent cost-effectiveness data and may be resisted by payers.

Variance Reduction Techniques
Related terms: Monte Carlo Simulation, Antithetic Variates
Explanation: Methods used to improve the efficiency of stochastic simulations, reducing the number of iterations needed for stable estimates. Practical application: Speeds up probabilistic sensitivity analyses. Challenge: Implementation may be complex and requires careful validation.

Virtual Twin Modeling
Related terms: Patient-Level Simulation, Counterfactual
Explanation: Creating a simulated counterpart for each real patient to estimate outcomes under alternative treatment strategies. Practical application: Enables personalised cost-effectiveness estimates. Challenge: Demands high-dimensional data and sophisticated modelling platforms.

Willingness-to-Pay (WTP) Threshold
Related terms: Cost-Effectiveness Threshold, Net Monetary Benefit
Explanation: The maximum amount a society or payer is prepared to spend for one additional unit of health gain (e.G., $50 000 Per QALY). Practical application: Determines whether an ICER is considered acceptable. Challenge: Thresholds vary by country, disease severity, and budget constraints.

World Health Organization (WHO) Cost-Effectiveness Benchmarks
Related terms: GDP-Based Thresholds, Global Health Policy
Explanation: Recommendations that interventions costing less than three times a country's gross domestic product per capita per DALY averted are cost-effective. Practical application: Provides a reference for low- and middle-income settings. Challenge: Criticised for being too permissive and not reflecting actual willingness to pay.

Zero-Cost Intervention
Related terms: Cost-Saving, Budget Impact
Explanation: A therapeutic option that incurs no additional costs compared with standard care, often due to existing infrastructure or generic status. Practical application: May still require evaluation of health outcomes to assess overall value. Challenge: Hidden costs such as training or monitoring may be overlooked.