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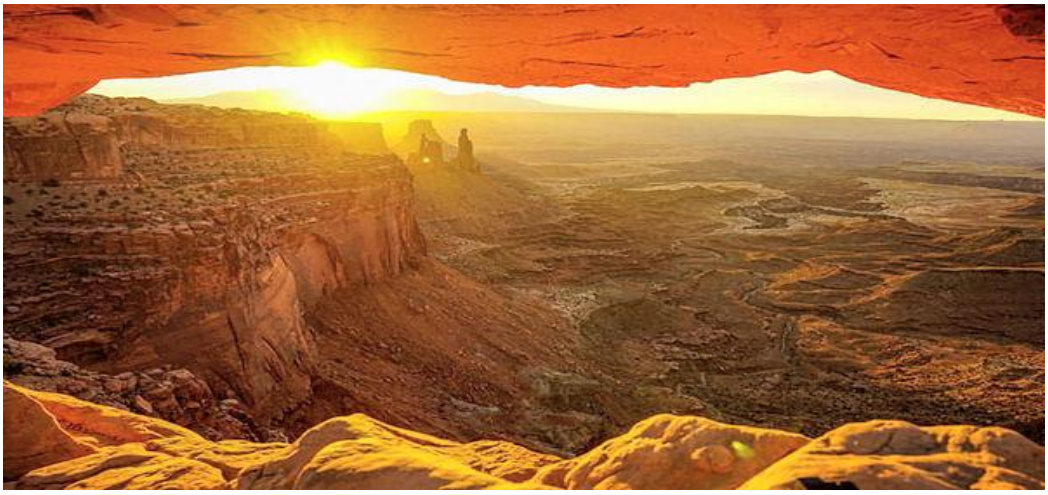
ARTIFICIAL INTELLIGENCE LARGE LANGUAGE MODEL INTERROGATION



REPRESENTATIONAL MEASUREMENT FAILURE IN HEALTH TECHNOLGY ASSESSMENT

CANADA: ACADEMIC RESEARCHAND THE ENDORSEMENT OF MEASUREMENT FAILURE IN HEALTH TECHNOLOGY ASSESSMENT

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FOREWORD

HEALTH TECHNOLOGY ASSESSMENT: A GLOBAL SYSTEM OF NON-MEASUREMENT

This Logit Working Paper series documents a finding as extraordinary as it is uncomfortable: health technology assessment (HTA), across nations, agencies, journals, and decades, has developed as a global system of non-measurement. It speaks the language of numbers, models, utilities, QALYs, "value for money," thresholds, discounting, incremental ratios, extrapolations, and simulations. It demands arithmetic at every turn, multiplication, division, summation, aggregation, discounting, yet it never once established that the quantities to which these operations are applied are measurable. HTA has built a vast evaluative machinery on foundations that do not exist. The probabilities and normalized logits in the country reports that follow provide the empirical confirmation of this claim. They show, with unsettling consistency, that the global HTA system consistently support measurement failure.

The objective of this study is to evaluate the epistemic foundations of Canadian academic health technology assessment research centers and equivalent university-based institutions using the canonical 24-item diagnostic grounded in representational measurement theory. The analysis does not seek to assess the technical sophistication of modeling methods, the quality of statistical execution, or the policy relevance of academic outputs. Its purpose is more fundamental: to determine whether the knowledge environment within which academic HTA research is produced recognizes and enforces the axioms required for quantitative inference. These axioms include the logical precedence of measurement over arithmetic, the necessity of unidimensionality, the distinction between ordinal, interval, and ratio scales, the requirement of invariance, and the conditions under which latent constructs may be transformed into quantities.

The study treats Canadian academic research centers as a distinct epistemic corpus rather than as extensions of national HTA agencies. Universities occupy a critical role in HTA systems, functioning simultaneously as producers of methodological legitimacy and as training grounds for future analysts. The diagnostic therefore examines whether academic HTA discourse provides a conceptual foundation capable of supporting credible, evaluable, and replicable value claims, or whether it reproduces a system in which numerical reasoning proceeds independently of measurement validity.

The canonical assessment demonstrates that Canadian academic HTA research centers exhibit a highly consolidated epistemic structure characterized by the near-total absence of representational measurement principles as governing constraints. Propositions defining the necessary conditions for quantitative science consistently collapse toward the floor of endorsement, while propositions that violate those conditions receive strong reinforcement. Measurement does not function as an admissibility criterion for arithmetic within academic HTA discourse. Numerical operations are permitted by convention rather than by representational justification.

At the same time, strong endorsement is observed for the assumptions that sustain cost-utility analysis. Preference-based utilities are treated as interval or ratio measures, negative values are

accepted on purported ratio scales, summated ordinal responses are assumed to generate quantities, and QALYs are regarded as aggregable and multiplicative. Rasch measurement principles, which provide the only lawful framework for transforming ordinal responses into quantitative latent-trait measures, are almost entirely absent. The resulting probability–logit profile is internally coherent and structurally invariant with patterns observed across other HTA jurisdictions, indicating not misunderstanding but systematic non-possession of measurement theory. The findings confirm that Canadian academic HTA does not misuse measurement principles but operates without them, producing numerical outputs that cannot support empirically testable value claims.

The starting point is simple and inescapable: *measurement precedes arithmetic*. This principle is not a methodological preference but a logical necessity. One cannot multiply what one has not measured, cannot sum what has no dimensional homogeneity, cannot compare ratios when no ratio scale exists. When HTA multiplies time by utilities to generate QALYs, it is performing arithmetic with numbers that cannot support the operation. When HTA divides cost by QALYs, it is constructing a ratio from quantities that have no ratio properties. When HTA aggregates QALYs across individuals or conditions, it is combining values that do not share a common scale. These practices are not merely suboptimal; they are mathematically impossible.

The modern articulation of this principle can be traced to Stevens' seminal 1946 paper, which introduced the typology of nominal, ordinal, interval, and ratio scales [1]. Stevens made explicit what physicists, engineers, and psychologists already understood: different kinds of numbers permit different kinds of arithmetic. Ordinal scales allow ranking but not addition; interval scales permit addition and subtraction but not multiplication; ratio scales alone support multiplication, division, and the construction of meaningful ratios. Utilities derived from multiattribute preference exercises, such as EQ-5D or HUI, are ordinal preference scores; they do not satisfy the axioms of interval measurement, much less ratio measurement. Yet HTA has, for forty years, treated these utilities as if they were ratio quantities, multiplying them by time to create QALYs and inserting them into models without the slightest recognition that scale properties matter. Stevens' paper should have blocked the development of QALYs and cost-utility analysis entirely. Instead, it was ignored.

The foundational theory that establishes *when* and *whether* a set of numbers can be interpreted as measurements came with the publication of Krantz, Luce, Suppes, and Tversky's *Foundations of Measurement* (1971) [2] . Representational Measurement Theory (RMT) formalized the axioms under which empirical attributes can be mapped to numbers in a way that preserves structure. Measurement, in this framework, is not an act of assigning numbers for convenience, it is the discovery of a lawful relationship between empirical relations and numerical relations. The axioms of additive conjoint measurement, homogeneity, order, and invariance specify exactly when interval scales exist. RMT demonstrated once and for all that measurement is not optional and not a matter of taste: either the axioms hold and measurement is possible, or the axioms fail and measurement is impossible. Every major construct in HTA, utilities, QALYs, DALYs, ICERs, incremental ratios, preference weights, health-state indices, fails these axioms. They lack unidimensionality; they violate independence; they depend on aggregation of heterogeneous attributes; they collapse under the requirements of additive conjoint measurement. Yet HTA proceeded, decade after decade, without any engagement with these axioms, as if the field had

collectively decided that measurement theory applied everywhere except in the evaluation of therapies.

Whereas representational measurement theory articulates the axioms for interval measurement, Georg Rasch's 1960 model provides the only scientific method for transforming ordered categorical responses into interval measures for latent traits [3]. Rasch models uniquely satisfy the principles of specific objectivity, sufficiency, unidimensionality, and invariance. For any construct such as pain, fatigue, depression, mobility, or need, Rasch analysis is the only legitimate means of producing an interval scale from ordinal item responses. Rasch measurement is not an alternative to RMT; it is its operational instantiation. The equivalence of Rasch's axioms and the axioms of representational measurement was demonstrated by Wright, Andrich and others as early as the 1970s. In the latent-trait domain, the very domain where HTA claims to operate; Rasch is the only game in town [4].

Yet Rasch is effectively absent from all HTA guidelines, including NICE, PBAC, CADTH, ICER, SMC, and PHARMAC. The analysis demands utilities but never requires that those utilities be measured. They rely on multiattribute ordinal classifications but never understand that those constructs be calibrated on interval or ratio scales. They mandate cost-utility analysis but never justify the arithmetic. They demand modelled QALYs but never interrogate their dimensional properties. These guidelines do not misunderstand Rasch; they do not know it exists. The axioms that define measurement and the model that makes latent trait measurement possible are invisible to the authors of global HTA rules. The field has evolved without the science that measurement demands.

How did HTA miss the bus so thoroughly? The answer lies in its historical origins. In the late 1970s and early 1980s, HTA emerged not from measurement science but from welfare economics, decision theory, and administrative pressure to control drug budgets. Its core concern was *valuing health states*, not *measuring health*. This move, quiet, subtle, but devastating, shifted the field away from the scientific question "What is the empirical structure of the construct we intend to measure?" and toward the administrative question "How do we elicit a preference weight that we can multiply by time?" The preference-elicitation projects of that era (SG, TTO, VAS) were rationalized as measurement techniques, but they never satisfied measurement axioms. Ordinal preferences were dressed up as quasi-cardinal indices; valuation tasks were misinterpreted as psychometrics; analyst convenience replaced measurement theory. The HTA community built an entire belief system around the illusion that valuing health is equivalent to measuring health. It is not.

The endurance of this belief system, forty years strong and globally uniform, is not evidence of validity but evidence of institutionalized error. HTA has operated under conditions of what can only be described as *structural epistemic closure*: a system that has never questioned its constructs because it never learned the language required to ask the questions. Representational measurement theory is not taught in graduate HTA programs; Rasch modelling is not part of guideline development; dimensional analysis is not part of methodological review. The field has been insulated from correction because its conceptual foundations were never laid. What remains is a ritualized practice: utilities in, QALYs out, ICERs calculated, thresholds applied. The arithmetic continues because everyone assumes someone else validated the numbers.

This Logit Working Paper series exposes, through probabilistic and logit-based interrogations of AI large language national knowledge bases, the scale of this failure. The results display a global pattern: true statements reflecting the axioms of measurement receive weak endorsement; false statements reflecting the HTA belief system receive moderate or strong reinforcement. This is not disagreement. It is non-possession. It shows that HTA, worldwide, has developed as a quantitative discipline without quantitative foundations; a confused exercise in numerical storytelling.

The conclusion is unavoidable: HTA does not need incremental reform; it needs a scientific revolution. Measurement must precede arithmetic. Representational axioms must precede valuation rituals. Rasch measurement must replace ordinal summation and utility algorithms. Value claims must be falsifiable, protocol-driven, and measurable; rather than simulated, aggregated, and numerically embellished.

The global system of non-measurement is now visible. The task ahead is to replace it with science.

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DISCLAIMER

This analysis is generated through the structured interrogation of a large language model (LLM) applied to a defined documentary corpus and is intended solely to characterize patterns within an aggregated knowledge environment. It does identify, assess, or attribute beliefs, intentions, competencies, or actions to any named individual, faculty member, student, administrator, institution, or organization. The results do not constitute factual findings about specific persons or programs, nor should they be interpreted as claims regarding professional conduct, educational quality, or compliance with regulatory or accreditation standards. All probabilities and logit values reflect model-based inferences about the presence or absence of concepts within a bounded textual ecosystem, not judgments about real-world actors. The analysis is exploratory, interpretive, and methodological in nature, offered for scholarly discussion of epistemic structures rather than evaluative or legal purposes. Any resemblance to particular institutions or practices is contextual and non-attributive, and no adverse implication should be inferred.

1. INTERROGATING THE LARGE LANGUAGE MODEL

A large language model **(**LLM**)** is an artificial intelligence system designed to understand, generate, and manipulate human language by learning patterns from vast amounts of text data. Built on deep neural network architectures, most commonly transformers, LLMs analyze relationships between words, sentences, and concepts to produce contextually relevant responses. During training, the model processes billions of examples, enabling it to learn grammar, facts, reasoning patterns, and even subtle linguistic nuances. Once trained, an LLM can perform a wide range of tasks: answering questions, summarizing documents, generating creative writing, translating languages, assisting with coding, and more. Although LLMs do not possess consciousness or true understanding, they simulate comprehension by predicting the most likely continuation of text based on learned patterns. Their capabilities make them powerful tools for communication, research, automation, and decision support, but they also require careful oversight to ensure accuracy, fairness, privacy, and responsible use

In this Logit Working Paper, "interrogation" refers not to discovering what an LLM *believes,* it has no beliefs, but to probing the content of the *corpus-defined knowledge space* we choose to analyze. This knowledge base is enhanced if it is backed by accumulated memory from the user. In this case the interrogation relies also on 12 months of HTA memory from continued application of the system to evaluate HTA experience. The corpus is defined before interrogation: it may consist of a journal (e.g., *Value in Health*), a national HTA body, a specific methodological framework, or a collection of policy documents. Once the boundaries of that corpus are established, the LLM is used to estimate the conceptual footprint within it. This approach allows us to determine which principles are articulated, neglected, misunderstood, or systematically reinforced.

In this HTA assessment, the objective is precise: to determine the extent to which a given HTA knowledge base or corpus, global, national, institutional, or journal-specific, recognizes and reinforces the foundational principles of representational measurement theory (RMT). The core principle under investigation is that measurement precedes arithmetic; no construct may be treated as a number or subjected to mathematical operations unless the axioms of measurement are satisfied. These axioms include unidimensionality, scale-type distinctions, invariance, additivity, and the requirement that ordinal responses cannot lawfully be transformed into interval or ratio quantities except under Rasch measurement rules.

The HTA knowledge space is defined pragmatically and operationally. For each jurisdiction, organization, or journal, the corpus consists of:

- published HTA guidelines
- agency decision frameworks
- cost-effectiveness reference cases
- academic journals and textbooks associated with HTA
- modelling templates, technical reports, and task-force recommendations
- teaching materials, methodological articles, and institutional white papers

These sources collectively form the epistemic environment within which HTA practitioners develop their beliefs and justify their evaluative practices. The boundary of interrogation is thus

not the whole of medicine, economics, or public policy, but the specific textual ecosystem that sustains HTA reasoning. . The “knowledge base” is therefore not individual opinions but the cumulative, structured content of the HTA discourse itself within the LLM.

THE CANADIAN ACADEMIC RESEARCH KNOWLEDGE BASE

The Canadian academic health technology assessment knowledge base consists of a network of university-based research centers, health economics groups, outcomes research units, and graduate training programs that collectively define the intellectual boundaries of HTA practice. This knowledge base extends beyond individual institutions to include peer-reviewed journals, methodological textbooks, conference proceedings, doctoral curricula, and collaborative research networks. Together, these elements form the epistemic environment through which HTA concepts are taught, validated, and reproduced.

Within this environment, numerical reasoning occupies a privileged position. Economic evaluation is framed as the central analytic task, and quantitative outputs are treated as the primary markers of scientific legitimacy. Academic research centers play a foundational role in reinforcing this orientation. They generate methodological frameworks, refine modeling conventions, and supply the analytic language through which HTA claims are justified. In doing so, they shape not only research outputs but also the professional identities of analysts trained within these programs.

A defining feature of the academic knowledge base is its reliance on preference-based instruments and reference-case modeling. Health outcomes are routinely represented through utilities derived from instruments such as the EQ-5D and related derivatives. These utilities are treated as quantitative measures suitable for arithmetic operations, despite being constructed from ordinal responses and population valuation exercises. The transformation from preference to quantity is assumed rather than demonstrated. Measurement validity is inferred from widespread use rather than established through representational criteria.

Graduate education plays a critical role in stabilizing these assumptions. Students are taught how to construct cost-utility models, perform sensitivity analyses, and interpret incremental cost-effectiveness ratios. They are not taught the axioms of representational measurement theory or the logical conditions under which arithmetic is permissible. As a result, numerical techniques are learned independently of their conceptual prerequisites. By the time students enter professional practice, the quantitative status of utilities and QALYs is already internalized as unquestioned fact.

The academic knowledge base is further reinforced through publication norms. Journals emphasize statistical sophistication, model transparency, and adherence to reference-case conventions. Rarely are manuscripts evaluated on the basis of scale type, unidimensionality, or invariance. Measurement theory does not function as a criterion for acceptance or rejection. This absence of scrutiny contributes to the reproduction of numerical assumptions across successive generations of research.

Analytic infrastructure also plays a stabilizing role. Modeling software, standardized templates, and reusable economic frameworks embed assumptions about arithmetic permissibility directly

into code. These assumptions become invisible to users, further insulating them from conceptual examination. What appears as technical necessity is in fact epistemic inheritance.

Importantly, the Canadian academic HTA knowledge base is not unified by explicit theoretical agreement. There is no articulated position asserting that utilities satisfy the axioms of measurement. Instead, coherence emerges through routine practice. Numerical outputs are used consistently, and consistency substitutes for justification. What is not articulated cannot be contested.

The result is a closed epistemic system in which measurement theory does not function as a governing authority. Without recognition of scale-type constraints, unidimensionality, or invariance, no quantitative claim can be empirically evaluated in principle. The academic HTA knowledge base thus produces analytically elaborate models whose outputs cannot be tested, replicated, or falsified. Numerical reasoning persists not because it is valid, but because it is institutionally entrenched.

This structural condition explains the remarkable stability of HTA methodology despite decades of critique. Challenges grounded in measurement theory cannot gain traction because the knowledge base lacks the conceptual resources required to recognize them as relevant. The problem is not methodological inertia but epistemic closure.

CATEGORICAL PROBABILITIES

In the present application, the interrogation is tightly bounded. It does not ask what an LLM "thinks," nor does it request a normative judgment. Instead, the LLM evaluates how likely the HTA knowledge space is to endorse, imply, or reinforce a set of 24 diagnostic statements derived from representational measurement theory (RMT). Each statement is objectively TRUE or FALSE under RMT. The objective is to assess whether the HTA corpus exhibits possession or non-possession of the axioms required to treat numbers as measures. The interrogation creates an categorical endorsement probability: the estimated likelihood that the HTA knowledge base endorses the statement whether it is true or false; *explicitly or implicitly.*

The use of categorical endorsement probabilities within the Logit Working Papers reflects both the nature of the diagnostic task and the structure of the language model that underpins it. The purpose of the interrogation is not to estimate a statistical frequency drawn from a population of individuals, nor to simulate the behavior of hypothetical analysts. Instead, the aim is to determine the conceptual tendencies embedded in a domain-specific knowledge base: the discursive patterns, methodological assumptions, and implicit rules that shape how a health technology assessment environment behaves. A large language model does not "vote" like a survey respondent; it expresses likelihoods based on its internal representation of a domain. In this context, endorsement probabilities capture the strength with which the knowledge base, as represented within the model, supports a particular proposition. Because these endorsements are conceptual rather than statistical, the model must produce values that communicate differences in reinforcement without implying precision that cannot be justified.

This is why categorical probabilities are essential. Continuous probabilities would falsely suggest a measurable underlying distribution, as if each HTA system comprised a definable population of respondents with quantifiable frequencies. But large language models do not operate on that level. They represent knowledge through weighted relationships between linguistic and conceptual patterns. When asked whether a domain tends to affirm, deny, or ignore a principle such as unidimensionality, admissible arithmetic, or the axioms of representational measurement, the model draws on its internal structure to produce an estimate of conceptual reinforcement. The precision of that estimate must match the nature of the task. Categorical probabilities therefore provide a disciplined and interpretable way of capturing reinforcement strength while avoiding the illusion of statistical granularity.

The categories used, values such as 0.05, 0.10, 0.20, 0.50, 0.75, 0.80, and 0.85, are not arbitrary. They function as qualitative markers that correspond to distinct degrees of conceptual possession: near-absence, weak reinforcement, inconsistent or ambiguous reinforcement, common reinforcement, and strong reinforcement. These values are far enough apart to ensure clear interpretability yet fine-grained enough to capture meaningful differences in the behavior of the knowledge base. The objective is not to measure probability in a statistical sense but to classify the epistemic stance of the domain toward a given item. A probability of 0.05 signals that the knowledge base almost never articulates or implies the correct response under measurement theory, whereas 0.85 indicates that the domain routinely reinforces it. Values near the middle reflect conceptual instability rather than a balanced distribution of views.

Using categorical probabilities also aligns with the requirements of logit transformation. Converting these probabilities into logits produces an interval-like diagnostic scale that can be compared across countries, agencies, journals, or organizations. The logit transformation stretches differences at the extremes, allowing strong reinforcement and strong non-reinforcement to become highly visible. Normalizing logits to the fixed ±2.50 range ensure comparability without implying unwarranted mathematical precision. Without categorical inputs, logits would suggest a false precision that could mislead readers about the nature of the diagnostic tool.

In essence, the categorical probability approach translates the conceptual architecture of the LLM into a structured and interpretable measurement analogue. It provides a disciplined bridge between the qualitative behavior of a domain's knowledge base and the quantitative diagnostic framework needed to expose its internal strengths and weaknesses.

The LLM computes these categorical probabilities from three sources:

1. **Structural content of HTA discourse**
   If the literature repeatedly uses ordinal utilities as interval measures, multiplies non-quantities, aggregates QALYs, or treats simulations as falsifiable, the model infers high reinforcement of these false statements.
2. **Conceptual visibility of measurement axioms**
   If ideas such as unidimensionality, dimensional homogeneity, scale-type integrity, or Rasch transformation rarely appear, or are contradicted by practice, the model assigns low endorsement probabilities to TRUE statements.

3. **The model's learned representation of domain stability**
   Where discourse is fragmented, contradictory, or conceptually hollow, the model avoids assigning high probabilities. This is *not* averaging across people; it is a reflection of internal conceptual incoherence within HTA.

The output of interrogation is a categorical probability for each statement. Probabilities are then transformed into logits [ln(p/(1–p)], capped to ±4.0 logits to avoid extreme distortions, and normalized to ±2.50 logits for comparability across countries. A positive normalized logit indicates reinforcement in the knowledge base. A negative logit indicates weak reinforcement or conceptual absence. Values near zero logits reflect epistemic noise.

Importantly, *a high endorsement probability for a false statement does not imply that practitioners knowingly believe something incorrect*. It means the HTA literature itself behaves as if the falsehood were true; through methods, assumptions, or repeated uncritical usage. Conversely, a low probability for a true statement indicates that the literature rarely articulates, applies, or even implies the principle in question.

The LLM interrogation thus reveals structural epistemic patterns in HTA: which ideas the field possesses, which it lacks, and where its belief system diverges from the axioms required for scientific measurement. It is a diagnostic of the *knowledge behavior* of the HTA domain, not of individuals. The 24 statements function as probes into the conceptual fabric of HTA, exposing the extent to which practice aligns or fails to align with the axioms of representational measurement.

INTERROGATION STATEMENTS

Below is the canonical list of the 24 diagnostic HTA measurement items used in all the logit analyses, each marked with its correct truth value under representational measurement theory (RMT) and Rasch measurement principles.

This is the definitive set used across the Logit Working Papers.

Measurement Theory & Scale Properties

1. Interval measures lack a true zero — TRUE
2. Measures must be unidimensional — TRUE
3. Multiplication requires a ratio measure — TRUE
4. Time trade-off preferences are unidimensional — FALSE
5. Ratio measures can have negative values — FALSE
6. EQ-5D-3L preference algorithms create interval measures — FALSE
7. The QALY is a ratio measure — FALSE
8. Time is a ratio measure — TRUE

Measurement Preconditions for Arithmetic

9. Measurement precedes arithmetic — TRUE
10. Summations of subjective instrument responses are ratio measures — FALSE

11. Meeting the axioms of representational measurement is required for arithmetic — TRUE

Rasch Measurement & Latent Traits

12. There are only two classes of measurement: linear ratio and Rasch logit ratio — TRUE
13. Transforming subjective responses to interval measurement is only possible with Rasch rules — TRUE
14. Summation of Likert question scores creates a ratio measure — FALSE

Properties of QALYs & Utilities

15. The QALY is a dimensionally homogeneous measure — FALSE
16. Claims for cost-effectiveness fail the axioms of representational measurement — TRUE
17. QALYs can be aggregated — FALSE

Falsifiability & Scientific Standards

18. Non-falsifiable claims should be rejected — TRUE
19. Reference-case simulations generate falsifiable claims — FALSE

Logit Fundamentals

20. The logit is the natural logarithm of the odds-ratio — TRUE

Latent Trait Theory

21. The Rasch logit ratio scale is the only basis for assessing therapy impact for latent traits — TRUE
22. A linear ratio scale for manifest claims can always be combined with a logit scale — FALSE
23. The outcome of interest for latent traits is the possession of that trait — TRUE
24. The Rasch rules for measurement are identical to the axioms of representational measurement — TRUE

AI LARGE LANGUAGE MODEL STATEMENTS: TRUE OR FALSE

Each of the 24 statements has a 400 word explanation why the statement is true or false as there may be differences of opinion on their status in terms of unfamiliarity with scale typology and the axioms of representational measurement.

The link to these explanations is: https://maimonresearch.com/ai-llm-true-or-false/

INTERPRETING TRUE STATEMENTS

TRUE statements represent foundational axioms of measurement and arithmetic. Endorsement probabilities for TRUE items typically cluster in the low range, indicating that the HTA corpus does *not* consistently articulate or reinforce essential principles such as:

- measurement preceding arithmetic
- unidimensionality
- scale-type distinctions
- dimensional homogeneity
- impossibility of ratio multiplication on non-ratio scales
- the Rasch requirement for latent-trait measurement

Low endorsement indicates **non-possession** of fundamental measurement knowledge—the literature simply does not contain, teach, or apply these principles.

INTERPRETING FALSE STATEMENTS

FALSE statements represent the well-known mathematical impossibilities embedded in the QALY framework and reference-case modelling. Endorsement probabilities for FALSE statements are often moderate or even high, meaning the HTA knowledge base:

- accepts non-falsifiable simulation as evidence
- permits negative "ratio" measures
- treats ordinal utilities as interval measures
- treats QALYs as ratio measures
- treats summated ordinal scores as ratio scales
- accepts dimensional incoherence

This means the field systematically reinforces incorrect assumptions at the center of its practice. *Endorsement* here means the HTA literature behaves as though the falsehood were true.

2. SUMMARY OF FINDINGS FOR TRUE AND FALSE ENDORSEMENTS: CANADA ACADEMIC RESEARCH

Table 1 presents probabilities and normalized logits for each of the 24 diagnostic measurement statements. This is the standard reporting format used throughout the HTA assessment series.

It is essential to understand how to interpret these results.

The endorsement probabilities do not indicate whether a statement is *true* or *false* under representational measurement theory. Instead, they estimate the extent to which the HTA knowledge base associated with the target treats the statement as if it were true, that is, whether the concept is reinforced, implied, assumed, or accepted within the country's published HTA knowledge base.

The logits provide a continuous, symmetric scale, ranging from +2.50 to –2.50, that quantifies the degree of this endorsement. the logits, of course link to the probabilities (p) as the logit is the natural logarithm of the odds ratio; logit = ln[p/1-p].

- Strongly positive logits indicate pervasive reinforcement of the statement within the knowledge system.
- Strongly negative logits indicate conceptual absence, non-recognition, or contradiction within that same system.
- Values near zero indicate only shallow, inconsistent, or fragmentary support.

Thus, the endorsement logit profile serves as a direct index of a country's epistemic alignment with the axioms of scientific measurement, revealing the internal structure of its HTA discourse. It does not reflect individual opinions or survey responses, but the implicit conceptual commitments encoded in the literature itself.

TABLE 1: ITEM STATEMENT, RESPONSE, ENDORSEMENT AND NORMALIZED LOGITS CANADA ACADEMIC RESEARCH

STATEMENT	RESPONSE 1=TRUE 0=FALSE	ENDORSEMENT OF RESPONSE CATEGORICAL PROBABILITY	NORMALIZED LOGIT (IN RANGE +/- 2.50)
INTERVAL MEASURES LACK A TRUE ZERO	1	0.20	-1.40
MEASURES MUST BE UNIDIMENSIONAL	1	0.15	-1.75
MULTIPLICATION REQUIRES A RATIO MEASURE	1	0.15	-1.75

TIME TRADE-OFF PREFERENCES ARE UNIDIMENSIONAL	0	0.85	+1.75
RATIO MEASURES CAN HAVE NEGATIVE VALUES	0	0.90	+2.20
EQ-5D-3L PREFERENCE ALGORITHMS CREATE INTERVAL MEASURES	0	0.85	+1.75
THE QALY IS A RATIO MEASURE	0	0.90	+2.20
TIME IS A RATIO MEASURE	1	0.80	+1.40
MEASUREMENT PRECEDES ARITHMETIC	1	0.10	-2.20
SUMMATIONS OF SUBJECTIVE INSTRUMENT RESPONSES ARE RATIO MEASURES	0	0.90	+2.20
MEETING THE AXIOMS OF REPRESENTATIONAL MEASUREMENT IS REQUIRED FOR ARITHMETIC	1	0.10	-2.20
THERE ARE ONLY TWO CLASSES OF MEASUREMENT LINEAR RATIO AND RASCH LOGIT RATIO	1	0.05	-2.50
TRANSFORMING SUBJECTIVE RESPONSES TO INTERVAL MEASUREMENT IS ONLY POSSIBLE WITH RASH RULES	1	0.05	-2.50
SUMMATION OF LIKERT QUESTION SCORES CREATES A RATIO MEASURE	0	0.90	+2.20
THE QALY IS A DIMENSIONALLY HOMOGENEOUS MEASURE	0	0.85	+1.75
CLAIMS FOR COST-EFFECTIVENESS FAIL THE AXIOMS OF REPRESENTATIONAL MEASUREMENT	1	0.05	-2.50
QALYS CAN BE AGGREGATED	0	0.90	+2.20
NON-FALSIFIABLE CLAIMS SHOULD BE REJECTED	1	0.30	-0.95
REFERENCE CASE SIMULATIONS GENERATE FALSIFIABLE CLAIMS	0	0.90	+2.20
THE LOGIT IS THE NATURAL LOGARITHM OF THE ODDS-RATIO	1	0.40	-0.45
THE RASCH LOGIT RATIO SCALE IS THE ONLY BASIS FOR ASSESSING THERAPY IMPACT FOR LATENT TRAITS	1	0.05	-2.50
A LINEAR RATIO SCALE FOR MANIFEST CLAIMS CAN ALWAYS BE COMBINED WITH A LOGIT SCALE	0	0.80	+1.40

THE OUTCOME OF INTEREST FOR LATENT TRAITS IS THE POSSESSION OF THAT TRAIT	1	0.05	-2.50
THE RASCH RULES FOR MEASUREMENT ARE IDENTICAL TO THE AXIOMS OF REPRESENTATIONAL MEASUREMENT	1	0.05	-2.50

CANADA: CANONICAL EPISTEMIC ASSESSMENT OF ACADEMIC HTA RESEARCH CENTERS

The canonical diagnostic profile for Canadian academic research centers reveals an epistemic structure that is not merely aligned with national HTA agencies but exceeds them in the intensity of its numerical commitments. The probability–logit distribution does not suggest ambiguity, internal disagreement, or methodological pluralism. Instead, it reflects a deeply consolidated belief system in which the legitimacy of quantitative reasoning is taken as axiomatic while the axioms of measurement themselves are almost entirely absent.

At the core of this profile lies a pronounced epistemic asymmetry. Propositions defining the preconditions for quantitative science cluster at the extreme negative end of the logit scale, while propositions that violate those preconditions are endorsed with near-ceiling certainty. This asymmetry is not accidental. It reflects the institutional role of academic research centers as producers, defenders, and transmitters of HTA methodology. The proposition that measurement must precede arithmetic collapses to $p = 0.10$ (-2.20). This result is decisive. It indicates that within Canadian academic HTA discourse, numerical manipulation is not governed by prior demonstration of measurement validity. Arithmetic is treated as foundational rather than conditional. Numbers are assumed to be meaningful because they are used, not because they have been shown to represent empirical attributes.

Closely aligned with this is the rejection of the proposition that arithmetic must satisfy the axioms of representational measurement. At $p = 0.10$ (-2.20), scale-type admissibility does not function as a governing rule. The distinction between ordinal, interval, and ratio scales has no practical authority in analytic reasoning. This absence explains why cost-utility modeling proceeds without concern for whether the quantities involved support multiplication or aggregation.

The rejection of the proposition that multiplication requires a ratio measure reinforces this structure. Endorsed at $p = 0.15$ (-1.75), the item reveals that academic HTA discourse treats multiplication as a technical operation rather than a representational one. The logical necessity of a true zero is displaced by the methodological convenience of ratio outputs.

In direct contrast, propositions that protect QALY arithmetic are endorsed with exceptional strength. The claim that the QALY is a ratio measure is endorsed at $p = 0.90$ ($+2.20$). The proposition that QALYs can be aggregated receives the same endorsement. These values indicate doctrinal commitment rather than inference. The QALY is treated as a ratio quantity not because

its properties have been demonstrated, but because its role in economic evaluation requires that it be so.

The acceptance of negative values on purported ratio scales reaches the same ceiling. The proposition that ratio measures can have negative values is endorsed at p = 0.90 (+2.20). This position directly contradicts the definition of ratio measurement, yet it is embraced without hesitation. States worse than dead are treated as routine features of analysis. The contradiction does not generate epistemic tension because the axioms that would render it incoherent are not operative within the system.

Preference-based instruments occupy a central role in this academic knowledge base. The proposition that EQ-5D algorithms create interval measures is endorsed at p = 0.85 (+1.75). This reflects the widespread assumption that valuation transforms ordinal descriptions into quantitative magnitudes. No transformation model is specified. No invariance is demonstrated. Preference itself is treated as metric.

Similarly, the belief that summed subjective instrument responses generate ratio measures is endorsed at p = 0.90 (+2.20). This confirms that Canadian academic HTA does not distinguish scoring from measurement. Numerical aggregation is equated with quantification. The act of producing a number substitutes for the demonstration of units.

Against this backdrop, Rasch-related propositions collapse entirely. The proposition that transforming subjective responses into interval measurement is only possible with Rasch rules falls to p = 0.05 (−2.50). The claim that the Rasch logit ratio scale is the only defensible basis for latent-trait measurement collapses to the same floor. The equivalence between Rasch axioms and representational measurement theory likewise registers at absolute absence. These results do not reflect disagreement with Rasch measurement. They reflect non-possession. Rasch theory does not function as a conceptual reference point within Canadian academic HTA. It is not engaged, contested, or rejected. It is simply not part of the methodological grammar taught, cited, or enforced.

The proposition that latent traits are defined by possession rather than valuation also collapses to p = 0.05 (−2.50). This finding reveals a fundamental conceptual displacement. Academic HTA does not conceptualize outcomes as attributes possessed by patients. Instead, outcomes are understood as values assigned to descriptions by populations. Measurement is replaced by social preference. This displacement explains the strong endorsement of simulation modeling as evidentiary output. The proposition that reference-case simulations generate falsifiable claims is endorsed at p = 0.90 (+2.20). Modeled projections are treated as empirical claims despite the absence of observable referents. Hypothetical futures become evidence. Falsifiability is redefined as internal sensitivity analysis rather than empirical testability. Although the proposition that non-falsifiable claims should be rejected registers slightly higher at p = 0.30 (−0.95), this value does not indicate meaningful constraint. It reflects rhetorical acknowledgment rather than operational enforcement. In practice, non-falsifiable claims dominate academic HTA output.

The epistemic structure revealed here is not accidental. Academic research centers occupy a dual role. They generate methodological frameworks and train the analysts who populate HTA

agencies. As such, they serve as the principal mechanism by which epistemic norms are reproduced. Their commitment to numerical modeling is therefore stronger, not weaker, than that of policy institutions. This explains why the canonical profile for academic centers exhibits even more extreme endorsement of false measurement propositions than national HTA agencies. Universities do not merely apply the framework; they legitimize it. They supply the theoretical language through which numerical storytelling is defended as science.

The invariance of this profile with those observed in other jurisdictions is therefore unsurprising. The academic HTA community is internationally networked. Journals, conferences, graduate curricula, and methodological textbooks circulate globally. What appears as national practice is in fact a shared epistemic memeplex.

The absence of measurement theory within this memeplex has profound consequences. Without scale-type constraints, no value claim can be empirically evaluated. Without unidimensionality, no attribute is being measured. Without invariance, no comparison is stable. Without a true zero, multiplication is meaningless. As a result, Canadian academic HTA does not generate testable claims. It generates narratives expressed in numerical form. These narratives acquire authority through institutional endorsement rather than through empirical corroboration.

This condition explains the resilience of HTA methods in the face of critique. Challenges grounded in representational measurement theory cannot gain traction because the knowledge base lacks the conceptual resources to recognize them as relevant. What cannot be represented within the epistemic grammar cannot be debated.

The canonical diagnostic therefore reveals that reform cannot occur through methodological refinement alone. Improved modeling, better data, or more sophisticated valuation techniques cannot supply what is missing. Measurement is not an optional enhancement. It is the precondition for quantitative science. Until Canadian academic HTA research centers recognize representational measurement theory as a governing authority, the outputs they produce will remain numerically elaborate but empirically undefined. The crisis exposed by this analysis is not one of execution or expertise. It is a crisis of knowledge itself.

DO CANADIAN ACADEMIC RESEARCH CENTERS HAVE AN EPISTEMIC RESPONSIBILITY FOR CHANGE?

The preceding analysis raises an unavoidable question. If the Canadian academic health technology assessment knowledge base systematically excludes the axioms required for quantitative measurement, where does responsibility for change reside? This question cannot be answered by appealing to individual intentions, competence, or good faith. Epistemic responsibility does not arise from error. It arises from position. Academic research centers occupy a privileged role within the HTA ecosystem precisely because they define what counts as legitimate knowledge.

Universities do not merely participate in HTA practice. They construct its intellectual boundaries. Through graduate curricula, doctoral supervision, methodological publications, and peer review, academic centers determine which concepts are taught, which methods are normalized, and which

questions are rendered unaskable. Over time, these decisions shape the cognitive framework within which analysts reason. When entire generations are trained without exposure to representational measurement theory, the absence of such theory ceases to appear as a gap. It becomes invisible.

The canonical diagnostic demonstrates that this invisibility is not accidental. Measurement theory does not function as a governing authority within Canadian academic HTA because it is not part of the disciplinary grammar. It is not invoked to evaluate claims, it is not used to adjudicate disputes, and it is not required for methodological legitimacy. In such an environment, analysts can be technically skilled, statistically sophisticated, and intellectually serious while remaining unable to recognize the conditions that make quantitative inference possible.

This distinction is critical. The problem is not ignorance in the ordinary sense. Ignorance implies that relevant knowledge exists within the discipline but has been imperfectly acquired. What the diagnostic reveals instead is non-possession. The axioms of measurement are not absent because they are misunderstood; they are absent because they are not recognized as necessary. When a discipline does not possess a concept, it cannot demand its application.

Academic research centers therefore occupy a unique epistemic position. They are the only institutions capable of altering what the field recognizes as foundational. HTA agencies operate within frameworks supplied to them. Manufacturers comply with methodological requirements they did not design. Consultants implement accepted conventions. Only universities define the content of training, the criteria for scholarly acceptance, and the conceptual thresholds that determine methodological legitimacy.

With this authority comes responsibility. Epistemic responsibility does not imply culpability or fault. It refers to stewardship of knowledge. Institutions that confer scientific credentials and define methodological standards assume responsibility for ensuring that those standards are coherent with the basic conditions of science itself. When numerical reasoning is taught without reference to measurement axioms, the resulting practices may be internally consistent yet externally indefensible.

The reluctance to confront this issue is understandable. Challenging foundational assumptions threatens institutional continuity. It complicates teaching, destabilizes curricula, and raises uncomfortable questions about decades of published research. Yet epistemic responsibility cannot be deferred indefinitely. When a discipline's central outputs cannot, even in principle, be empirically evaluated, silence becomes a form of endorsement.

Importantly, acknowledging epistemic responsibility does not require immediate consensus on solutions. It requires only recognition of the problem. No reform is possible while the absence of measurement theory remains unspoken. Without that recognition, methodological refinement merely reinforces incoherence. More sophisticated models cannot compensate for the absence of quantity. Improved data cannot rescue arithmetic that lacks representational meaning.

The canonical diagnostic makes this condition explicit. It demonstrates that the problem confronting Canadian academic HTA is not methodological immaturity but epistemic closure. The field has stabilized around numerical practices that no longer require justification. In such a

system, critique appears external, philosophical, or irrelevant, not because it is incorrect, but because the system lacks the conceptual resources to absorb it.

If change is to occur, it must therefore begin where those resources are created. Universities must reclaim their role not simply as producers of technique, but as custodians of scientific coherence. This does not imply abandoning applied relevance or policy engagement. It implies restoring the logical order in which measurement precedes arithmetic and empirical claims precede modeling.

The question, then, is not whether Canadian academic research centers are responsible for the current state of HTA. Responsibility in that sense is diffuse and historical. The relevant question is whether institutions that define knowledge standards can continue to exclude the axioms that make those standards intelligible. Epistemic responsibility arises at the moment that exclusion is recognized.

The analysis presented in this paper establishes that recognition is now unavoidable. The absence of measurement theory is no longer an abstract concern. It is a structural condition with observable consequences. Whether Canadian academic HTA research centers choose to confront that condition will determine not only the future credibility of HTA, but whether the field can continue to claim membership within quantitative science at all.

3. THE TRANSITION TO MEASUREMENT IN HEALTH TECHNOLOGY ASSESSMENT

THE IMPERATIVE OF CHANGE

This analysis has not been undertaken to criticize decisions made by health system, nor to assign responsibility for the analytical frameworks currently used in formulary review. The evidence shows something more fundamental: organizations have been operating within a system that does not permit meaningful evaluation of therapy impact, even when decisions are made carefully, transparently, and in good faith.

The present HTA framework forces health systems to rely on numerical outputs that appear rigorous but cannot be empirically assessed (Table 1). Reference-case models, cost-per-QALY ratios, and composite value claims are presented as decision-support tools, yet they do not satisfy the conditions required for measurement. As a result, committees are asked to deliberate over results that cannot be validated, reproduced, or falsified. This places decision makers in an untenable position: required to choose among therapies without a stable evidentiary foundation.

This is not a failure of expertise, diligence, or clinical judgment. It is a structural failure. The prevailing HTA architecture requires arithmetic before measurement, rather than measurement before arithmetic. Health systems inherit this structure rather than design it. Manufacturers respond to it. Consultants reproduce it. Journals reinforce it. Universities promote it. Over time it has come to appear normal, even inevitable.

Yet the analysis presented in Table 1 demonstrates that this HTA framework cannot support credible falsifiable claims. Where the dependent variable is not a measure, no amount of modeling sophistication can compensate. Uncertainty analysis cannot rescue non-measurement. Transparency cannot repair category error. Consensus cannot convert assumption into evidence.

The consequence is that formulary decisions are based on numerical storytelling rather than testable claims. This undermines confidence, constrains learning, and exposes health systems to growing scrutiny from clinicians, patients, and regulators who expect evidence to mean something more than structured speculation.

The imperative of change therefore does not arise from theory alone. It arises from governance responsibility. A health system cannot sustain long-term stewardship of care if it lacks the ability to distinguish between claims that can be evaluated and claims that cannot. Without that distinction, there is no pathway to improvement; only endless repetition for years to come.

This transition is not about rejecting evidence. It is about restoring evidence to its proper meaning. It requires moving away from composite, model-driven imaginary constructs toward claims that are measurable, unidimensional, and capable of empirical assessment over time. The remainder of this section sets out how that transition can occur in a practical, defensible, and staged manner.

MEANINGFUL THERAPY IMPACT CLAIMS

At the center of the current problem is not data availability, modeling skill, or analytic effort. It is the nature of the claims being advanced. Contemporary HTA has evolved toward increasingly complex frameworks that attempt to compress multiple attributes, clinical effects, patient experience, time, and preferences into single composite outputs. These constructs are then treated as if they were measures. They are not (Table 1).

The complexity of the reference-case framework obscures a simpler truth: meaningful evaluation requires meaningful claims. A claim must state clearly what attribute is being affected, in whom, over what period, and how that attribute is measured. When these conditions are met, evaluation becomes possible. When they are not complexity substitutes for clarity. The current framework is not merely incorrect; it is needlessly elaborate. Reference-case modeling requires dozens of inputs, assumptions, and transformations, yet produces outputs that cannot be empirically verified. Each additional layer of complexity increases opacity while decreasing accountability. Committees are left comparing models rather than assessing outcomes.

In contrast, therapy impact can be expressed through two, and only two, types of legitimate claims. First are claims based on manifest attributes: observable events, durations, or resource units. These include hospitalizations avoided, time to event, days in remission, or resource use. When properly defined and unidimensional, these attributes can be measured on linear ratio scales and evaluated directly.

Second are claims based on latent attributes: symptoms, functioning, need fulfillment, or patient experience. These cannot be observed directly and therefore cannot be scored or summed meaningfully. They require formal measurement through Rasch models to produce invariant logit ratio scales. These two forms of claims are sufficient. They are also far more transparent. Each can be supported by a protocol. Each can be revisited. Each can be reproduced. Most importantly, each can fail. But they cannot be combined. This is the critical distinction. A meaningful claim is one that can be wrong.

Composite constructs such as QALYs do not fail in this sense. They persist regardless of outcome because they are insulated by assumptions. They are recalculated, not refuted. That is why they cannot support learning. The evolution of objective knowledge regarding therapy impact in disease areas is an entirely foreign concept. By re-centering formulary review on single-attribute, measurable claims, health systems regain control of evaluation. Decisions become grounded in observable change rather than modeled narratives. Evidence becomes something that accumulates, rather than something that is re-generated anew for every submission.

THE PATH TO MEANINGFUL MEASUREMENT

Transitioning to meaningful measurement does not require abandoning current processes overnight. It requires reordering them. The essential change is not procedural but conceptual: measurement must become the gatekeeper for arithmetic, not its byproduct.

The first step is formal recognition that not all numerical outputs constitute evidence. Health systems must explicitly distinguish between descriptive analyses and evaluable claims. Numbers that do not meet measurement requirements may inform discussion but cannot anchor decisions.

The second step is restructuring submissions around explicit claims rather than models. Each submission should identify a limited number of therapy impact claims, each defined by attribute, population, timeframe, and comparator. Claims must be unidimensional by design.

Third, each claim must be classified as manifest or latent. This classification determines the admissible measurement standard and prevents inappropriate mixing of scale types.

Fourth, measurement validity must be assessed before any arithmetic is permitted. For manifest claims, this requires confirmation of ratio properties. For latent claims, this requires Rasch-based measurement with demonstrated invariance.

Fifth, claims must be supported by prospective or reproducible protocols. Evidence must be capable of reassessment, not locked within long-horizon simulations designed to frustrate falsification.

Sixth, committees must be supported through targeted training in representational measurement principles, including Rasch fundamentals. Without this capacity, enforcement cannot occur consistently.

Finally, evaluation must be iterative. Claims are not accepted permanently. They are monitored, reproduced, refined, or rejected as evidence accumulates.

These steps do not reduce analytical rigor. They restore it.

TRANSITION REQUIRES TRAINING

A transition to meaningful measurement cannot be achieved through policy alone. It requires a parallel investment in training, because representational measurement theory is not intuitive and has never been part of standard professional education in health technology assessment, pharmacoeconomics, or formulary decision making. For more than forty years, practitioners have been taught to work within frameworks that assume measurement rather than demonstrate it. Reversing that inheritance requires structured learning, not informal exposure.

At the center of this transition is the need to understand why measurement must precede arithmetic. Representational measurement theory establishes the criteria under which numbers can legitimately represent empirical attributes. These criteria are not optional. They determine whether addition, multiplication, aggregation, and comparison are meaningful or merely symbolic. Without this foundation, committees are left evaluating numerical outputs without any principled way to distinguish evidence from numerical storytelling.

Training must therefore begin with scale types and their permissible operations. Linear ratio measurement applies to manifest attributes that possess a true zero and invariant units, such as

time, counts, and resource use. Latent attributes, by contrast, cannot be observed directly and cannot be measured through summation or weighting. They require formal construction through a measurement model capable of producing invariant units. This distinction is the conceptual fulcrum of reform, because it determines which claims are admissible and which are not.

For latent trait claims, Rasch measurement provides the only established framework capable of meeting these requirements. Developed in the mid–twentieth century alongside the foundations of modern measurement theory, the Rasch model was explicitly designed to convert subjective observations into linear logit ratio measures. It enforces unidimensionality, tests item invariance, and produces measures that support meaningful comparison across persons, instruments, and time. These properties are not approximations; they are defining conditions of measurement.

Importantly, Rasch assessment is no longer technically burdensome. Dedicated software platforms developed and refined over more than four decades make Rasch analysis accessible, transparent, and auditable. These programs do not merely generate statistics; they explain why items function or fail, how scales behave, and whether a latent attribute has been successfully measured. Measurement becomes demonstrable rather than assumed.

Maimon Research has developed a two-part training program specifically to support this transition. The first component provides foundational instruction in representational measurement theory, including the historical origins of scale theory, the distinction between manifest and latent attributes, and the criteria that define admissible claims. The second component focuses on application, detailing claim types, protocol design, and the practical use of Rasch methods to support latent trait evaluation.

Together, these programs equip health systems, committees, and analysts with the competence required to enforce measurement standards consistently. Training does not replace judgment; it enables it. Without such preparation, the transition to meaningful measurement cannot be sustained. With it, formulary decision making can finally rest on claims that are not merely numerical, but measurable.

A NEW START IN MEASUREMENT FOR HEALTH TECHNOLOGY ASSESSMENT

For readers who are looking for an introduction to measurement that meets the required standards, Maimon Research has just released two distance education programs. These are:

- Program 1: Numerical Storytelling – Systematic Measurement Failure in HTA.
- Program 2: A New Start in Measurement for HTA, with recommendations for protocol-supported claims for specific objective measures as well as latent constructs and manifested traits.

Each program consists of five modules (approx. 5,500 words each), with extensive questions and answers. Each program is priced at US$65.00. Invitations to participate in these programs will be distributed in the first instance to 8,700 HTA professionals in 40 countries.

More detail on program content and access, including registration and on-line payment, is provided with this link: https://maimonresearch.com/distance-education-programs/

DESIGNED FOR CLOSURE

For those who remain unconvinced that there is any need to abandon a long-standing and widely accepted HTA framework, it is necessary to confront a more fundamental question: why was this system developed and promoted globally in the first place?

The most plausible explanation is administrative rather than scientific. Policy makers were searching for an assessment framework that could be applied under conditions of limited empirical data while still producing a determinate conclusion. Reference-case modeling offered precisely this convenience. By constructing a simulation populated with assumptions, surrogate endpoints, preference weights, and extrapolated time horizons, it became possible to generate a numerical result that could be interpreted as decisive. Once an acceptable cost-effectiveness ratio emerged, the assessment could be declared complete and the pricing decision closed. This structure solved a political and administrative problem. It allowed authorities to claim that decisions were evidence-based without requiring the sustained empirical burden demanded by normal science. There was no requirement to formulate provisional claims and subject them to ongoing falsification. There was no obligation to revisit conclusions as new data emerged. Closure could be achieved at launch, rather than knowledge evolving over the product life cycle.

By contrast, a framework grounded in representational measurement would have imposed a very different obligation. Claims would necessarily be provisional. Measurement would precede arithmetic. Each therapy impact claim would require a defined attribute, a valid scale, a protocol, and the possibility of replication or refutation. Evidence would accumulate rather than conclude. Decisions would remain open to challenge as real-world data emerged. From an administrative standpoint, this was an unreasonable burden. It offered no finality.

The reference-case model avoided this problem entirely. By shifting attention away from whether quantities were measurable and toward whether assumptions were plausible, the framework replaced falsification with acceptability. Debate became internal to the model rather than external to reality. Sensitivity analysis substituted for empirical risk. Arithmetic proceeded without prior demonstration that the objects being manipulated possessed the properties required for arithmetic to be meaningful.

Crucially, this system required no understanding of representational measurement theory. Committees did not need to ask whether utilities were interval or ratio measures, whether latent traits had been measured or merely scored, or whether composite constructs could legitimately be multiplied or aggregated. These questions were never posed because the framework did not require

them to be posed. The absence of measurement standards was not an oversight; it was functionally essential.

Once institutionalized, the framework became self-reinforcing. Training programs taught modeling rather than measurement. Guidelines codified practice rather than axioms. Journals reviewed technique rather than admissibility. Over time, arithmetic without measurement became normalized as "good practice," while challenges grounded in measurement theory were dismissed as theoretical distractions. The result was a global HTA architecture capable of producing numbers, but incapable of producing falsifiable knowledge. Claims could be compared, ranked, and monetized, but not tested in the scientific sense. What evolved was not objective knowledge, but institutional consensus.

This history matters because it explains why the present transition is resisted. Moving to a real measurement framework with single, unidimensional claims does not merely refine existing methods; it dismantles the very mechanism by which closure has been achieved for forty years. It replaces decisiveness with accountability, finality with learning, and numerical plausibility with empirical discipline. Yet that is precisely the transition now required. A system that avoids measurement in order to secure closure cannot support scientific evaluation, cumulative knowledge, or long-term stewardship of healthcare resources. The choice is therefore unavoidable: continue with a framework designed to end debate, or adopt one designed to discover the truth.

Anything else is not assessment at all, but the ritualized manipulation of numbers detached from measurement, falsification, and scientific accountability.

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