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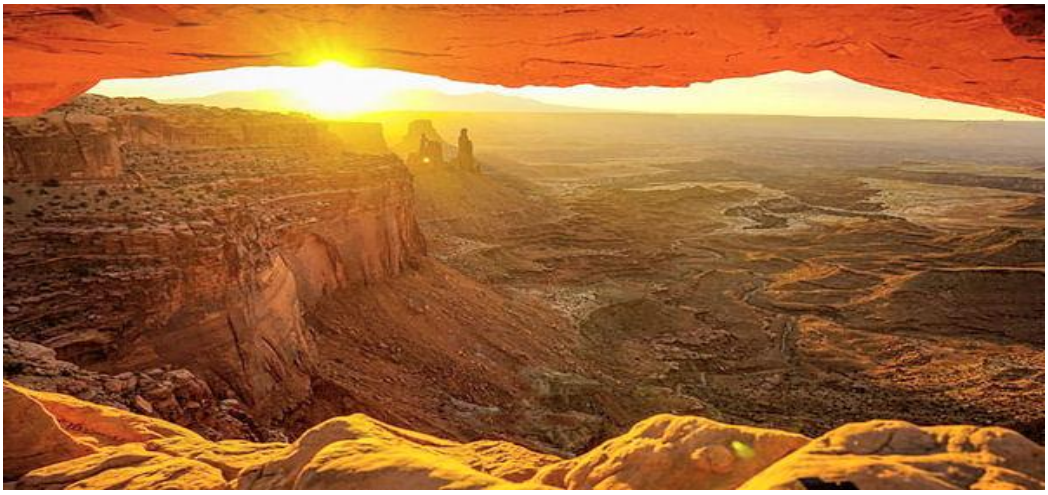
# ARTIFICIAL INTELLIGENCE LARGE LANGUAGE MODEL INTERROGATION



# REPRESENTATIONAL MEASUREMENT FAILURE IN HEALTH TECHNOLGY ASSESSMENT

# UNITED KINGDOM: THE BIRTH OF HEALTH TECHNOLOGY ASSESSMENT AS NUMERICAL STORYTELLING

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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 HTA presents a world of measurement failure.

The objective of this study is to interrogate the epistemic foundations of the United Kingdom's health technology assessment framework using the 24-item representational measurement diagnostic. Rather than examining individual agencies or guidance documents in isolation, the assessment treats the UK HTA system as a unified knowledge base encompassing England, Wales, Scotland, and Northern Ireland. The analysis evaluates whether the numerical constructs that define UK assessment practice, utilities, QALYs, reference-case models, thresholds, and preference-based instruments satisfy the axioms required for scientific measurement. The purpose is not to critique implementation details, but to determine whether the framework itself is capable of generating evaluable, falsifiable therapy impact claims consistent with the standards of normal science.

The findings are unequivocal. The UK HTA knowledge base exhibits systematic rejection of the axioms of representational measurement while strongly reinforcing propositions that permit arithmetic without measurement. Core requirements, unidimensionality, scale-type coherence, measurement preceding arithmetic, and the inadmissibility of composite constructs, are weakly endorsed or actively inverted. At the same time, false propositions central to cost-utility analysis, including the ratio status of QALYs, the legitimacy of utility aggregation, and the evidentiary status of reference-case simulation outputs, are strongly reinforced. The resulting logit profile reflects not marginal misunderstanding but structural commitment to a belief system in which numerical storytelling substitutes for measurement, and closure replaces falsification.

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 UNITED KINGDOM KNOWLEDGE BASE

The United Kingdom health technology assessment knowledge base can be characterized as a highly coherent and internally stable system organized around the valuation of health state descriptions rather than the measurement of therapy impact. Its defining feature is the treatment of preferences over descriptive health states as quantitative entities capable of supporting arithmetic operations. This foundational choice determines the structure, outputs, and limits of the entire system.

At the center of this knowledge base lies the concept of the utility value. Health states, typically defined through multiattribute descriptive systems, are assigned numerical values derived from population preference studies. These values are treated as if they represent magnitude differences in health, despite lacking demonstrated equal intervals, invariance across populations, or a meaningful zero point. The knowledge base does not require these properties to be established prior to use. Instead, valuation itself is treated as sufficient evidence of quantification.

This permissive stance enables the construction of the quality-adjusted life year. Time, a manifest ratio attribute, is multiplied by preference weights that are ordinal in origin. The resulting product is treated as a ratio measure, aggregated across individuals, and compared across disease areas. Within the UK framework, this arithmetic is not conditional upon measurement admissibility; it is presumed valid by convention. The distinction between ordering, scoring, and measuring is rarely acknowledged.

Reference-case simulation models serve as the primary evidentiary vehicle. These models integrate utilities, transition probabilities, assumptions about disease progression, and long-term extrapolation to produce estimates of cost per QALY. The knowledge base treats these outputs as decision-relevant evidence even though they are not empirically testable in real time. Robustness is defined in terms of scenario stability rather than falsifiability. Sensitivity analysis substitutes for empirical refutation.

Unidimensionality is not enforced as a requirement. Health is implicitly treated as a single latent continuum even though it is operationalized through multiattribute instruments that explicitly combine heterogeneous domains. This internal contradiction is resolved not through measurement testing but through institutional acceptance. Once an instrument is designated acceptable, its outputs are treated as commensurable across contexts regardless of structural differences.

Latent attributes are invoked rhetorically but never formally constructed. Concepts such as health-related quality of life, wellbeing, or burden are treated as if they possess measurable magnitude without being subjected to a measurement model capable of producing invariant units. Rasch measurement, which alone provides a logit ratio scale for latent trait possession, is absent as a governing requirement. Its exclusion protects the dominant instrument families from invalidation.

What most clearly defines the UK HTA knowledge base is its prioritization of closure over learning. Decisions are designed to be final, not provisional. Once a model satisfies methodological guidance and falls within an acceptable threshold range, the assessment concludes. There is no expectation that claims will be falsified, reproduced, or revised over time. Evidence is consumed rather than tested.

As a result, the UK system functions as a mature administrative apparatus rather than a scientific evaluative framework. It produces consistency, comparability, and decisional efficiency, but does so by bypassing the conditions required for measurement. The knowledge base is therefore internally disciplined yet externally indefensible: coherent within its own conventions, but incompatible with the axioms that define quantitative science.

This structure explains both the durability and the global influence of the UK model. It offers a complete decision technology that operates without requiring demonstrable measurement, and it has been widely adopted for precisely that reason.

## 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: UNITED KINGDOM

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 UNITED KINGDOM

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

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

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

## UNITED KINGDOM: THE ADMINISTRATIVE PERFECTION OF ARITHMETIC WITHOUT MEASUREMENT

If you want a single jurisdiction that demonstrates the HTA memeplex in its most disciplined, institutionalized form, it is the United Kingdom. Not because the UK is uniquely careless, but because it is uniquely confident. It has converted a set of mathematically inadmissible constructs—utilities, QALYs, and reference-case simulations—into an administrative machine for decision closure. The canonical profile above shows the UK system does not merely tolerate the inversion of representational measurement; it operationalizes it as governance. That is why this table matters. It is not a list of technical quibbles. It is a map of what the system must believe in order to function.

Start with the gatekeeper proposition: measurement precedes arithmetic. In a measurement-literate system this would be non-negotiable. Here it is crushed to $p = 0.10$ with a canonical logit of $-2.20$. The companion proposition—meeting the axioms of representational measurement is required for arithmetic—sits at the same floor. These two results alone are enough to convict the entire UK HTA architecture. They tell you that the system does not treat measurement as a prerequisite for calculation. It treats calculation as a method for manufacturing decision outputs, with meaning assumed after the fact.

This is why the UK can simultaneously endorse, at or near the ceiling, every false proposition required to sustain cost-utility analysis. The claim that EQ-5D preference algorithms create interval measures sits at $p = 0.95$ (+2.50). That is the system announcing, in effect, that an algorithm can confer measurement properties that the empirical attribute does not possess. It is also the system declaring that preference elicitation and scoring rules can substitute for the existence of equal units and invariance. Once that belief is installed, the rest is automatic. The QALY becomes a "ratio measure" at $p = 0.95$ (+2.50). QALYs can be aggregated at $p = 0.95$ (+2.50). Reference-case simulations generate falsifiable claims at $p = 0.95$ (+2.50). Every one of these is a load-bearing falsehood, and the UK system reinforces them not modestly but maximally.

The multiplication rule makes the inversion grotesque rather than merely wrong. Multiplication requires a ratio measure is pushed to $p = 0.10$ ($-2.20$). Yet the defining act of the QALY is multiplication: time multiplied by a preference weight. The UK system therefore rejects the rule and mandates the operation. It cannot do otherwise. If the multiplication rule were enforced, the QALY collapses. Cost-per-QALY collapses. Thresholds collapse. The entire decision apparatus loses its numerical backbone. So the rule must be suppressed, and the table shows exactly that suppression.

Time is treated correctly, with p = 0.95 (+2.50). This matters because it proves the system is capable of recognizing ratio measurement when it is inconvenient to deny it. The UK knows exactly what ratio measurement looks like in the physical world. Its failure is not conceptual incapacity; it is selective exemption. Measurement discipline is applied where it does not threaten the memeplex and suspended where it would dissolve the central constructs.

The next major fault line is unidimensionality. Measures must be unidimensional is weakly endorsed at p = 0.15 (−1.75), while time trade-off preferences are asserted to be unidimensional by endorsing the false statement at p = 0.90 (+2.20). That is the UK's characteristic move: reject unidimensionality as a requirement, then assume unidimensionality when needed. In other words, unidimensionality is not treated as a property to be demonstrated; it is treated as a convenience label applied to preference outputs because the arithmetic requires a single continuum. This is why the QALY can be defended as "one number" even though it is the product of heterogeneous elements and derived from multiattribute descriptions.

The table's treatment of negative values exposes the same exemption with even less subtlety. Ratio measures can have negative values is endorsed as false at p = 0.90 (+2.20), meaning the UK knowledge base strongly reinforces the claim that ratio measures can indeed take negative values. This is the signature accommodation of the EQ-5D value set world: "worse than dead" is accepted, negative utilities are normalized, and yet the system continues to describe the output as if it were on a ratio scale. The contradiction is not repaired; it is institutionalized. Once that is done, the system can go on calling the QALY a ratio measure without ever confronting what a true zero means.

Quality of life, as the UK system uses it, is a further demonstration of the same categorical failure. The table does not include a separate "quality of life" item because your canonical 24 are already sufficient, but the logic is embedded in the endorsement of the QALY as dimensionally homogeneous at p = 0.85 (+1.75). Dimensional homogeneity is the condition for meaningful aggregation and ratio formation. Endorsing it for the QALY is endorsing a fiction: that time and ordinal preference weights are commensurable in a way that supports multiplication, that the product is a single attribute, and that the result can be added across people. This is exactly the kind of claim a measurement gatekeeper would block immediately. The UK system instead blesses it, because it needs a single scalar for administrative closure.

Now the decisive block: Rasch. If the UK system had any serious concept of latent trait possession, it would be driven toward Rasch. Not as an optional method, but as a compulsory condition for claiming measurement of subjective attributes. Your table shows the opposite. Every Rasch proposition collapses to the absolute floor, p = 0.05 (−2.50), including the central claim that there are only two admissible measurement classes (linear ratio for manifest attributes and Rasch logit ratio for latent traits), the claim that transforming subjective responses to interval measurement is only possible with Rasch rules, the claim that the Rasch logit ratio scale is the only basis for assessing therapy impact for latent traits, and the claim that Rasch rules are identical to the axioms of representational measurement. These values do not mean "Rasch is less popular." They mean Rasch is epistemically disallowed. It cannot be permitted to become sovereign because sovereignty would invalidate the scoring-and-mapping pipeline on which the UK HTA system depends.

The possession item reinforces the point. The outcome of interest for latent traits is the possession of that trait sits at p = 0.25 (−1.10). That is weak endorsement: the concept exists only faintly, at the boundary. And that is exactly what you would expect in a system that wants the rhetoric of patient-centeredness but cannot tolerate the measurement consequences. If possession became central, the next question would be: "Measured how?" and the answer would be: "Only on a Rasch logit ratio scale." The system therefore keeps possession conceptually thin and methodologically non-binding.

Finally, consider falsifiability. The UK system can gesture toward scientific norms—non-falsifiable claims should be rejected sits at p = 0.70 (+0.85)—but it simultaneously endorses the opposite institutional practice at the ceiling: reference case simulations generate falsifiable claims sits at p = 0.95 (+2.50). This is not confusion; it is redefinition. "Falsifiable" is quietly transformed to mean "showing sensitivity to assumptions," not "capable of empirical refutation by invariant measurement under a protocol." Once falsification is reduced to model behavior, the system can claim scientific legitimacy while remaining insulated from scientific risk. It can close cases, defend thresholds, and ration access using outputs that can never be falsified in the strong Popperian sense.

That is why the UK is so important in the global memeplex. It demonstrates that the HTA belief system is not merely a set of bad habits. It is an administrative technology designed to produce decisions under limited data, to enforce closure, and to avoid the permanent instability that true normal science would impose. A measurement-first system never closes the case permanently because claims remain provisional and subject to refutation over the product's life. The UK system is built to avoid that burden. It begins with arithmetic, mandates reference-case modeling, and treats the outputs as if they were measurement-grade facts. It is an elegant bureaucratic solution to an epistemic problem, achieved by deleting the gatekeeper.

So the UK profile is not merely "another instance" of false measurement. It is the most disciplined instance of it, because it is embedded in the rules of assessment. The canonical logits make this explicit. The system pushes measurement axioms to the floor while pushing QALY and reference-case propositions to the ceiling. That is the signature of a mature memeplex: it rewards the propositions that reproduce it and suppresses the propositions that would invalidate it. Under representational measurement theory, the UK's central numerical objects are not merely contestable; they are inadmissible. Yet they persist because they solve an administrative problem—closure—while demanding almost nothing from measurement literacy.

If the UK were to adopt a real measurement framework, the change would be immediate and destructive to the present architecture. The QALY would be reclassified as a composite scoring artifact rather than a ratio measure. Mapping and preference algorithms would be treated as non-measurement transformations. Reference-case simulation outputs would be treated as conditional projections rather than falsifiable claims. Manifest claims would be restricted to linear ratio measures. Latent claims would require Rasch logit ratio measurement demonstrating invariance and unidimensionality. And, most importantly, measurement would be restored as the non-negotiable precondition for arithmetic. Until that reversal occurs, the UK system will remain the world's most polished example of arithmetic without measurement, defended not by science but by administrative necessity.

## THE BIRTH OF A GLOBAL MEMEPLEX OF NUMERICAL STORYTELLING.

It is not an exaggeration to say that the modern health technology assessment memeplex began in the United Kingdom. What later became a global architecture of cost-utility analysis, QALYs, thresholds, and reference-case modelling can be traced to a single foundational decision: to treat descriptions of health states as if they could be assigned quantitative value. That decision—made in the late 1970s and early 1980s—set in motion a belief system that continues to dominate HTA worldwide.

The critical move was deceptively simple. Rather than measure therapy impact through observable clinical or behavioral outcomes, the UK framework chose to elicit preferences for hypothetical health states and to express those preferences numerically. These numbers were then treated as if they represented quantities of health. From that point forward, health was no longer something measured; it was something scored, valued, and averaged. The distinction between ordering and measuring disappeared almost entirely from the discourse.

Once this step was taken, the rest followed mechanically. If health states could be assigned numbers, those numbers could be combined with time. If time was a ratio measure—and it is—then multiplying time by a preference weight produced a new numerical object. That object was called the quality-adjusted life year. The decisive error lay not in the arithmetic itself, but in the assumption that the preference weights possessed the properties required to support that arithmetic. They did not, and could not, because they were derived from ordinal judgments over multiattribute descriptions.

Yet this was never confronted. The UK system did not ask whether health state values had equal intervals, whether they were invariant across populations, or whether they possessed a true zero. Instead, it treated valuation as measurement by fiat. Preference elicitation replaced empirical structure. Scoring replaced measuring. What mattered was not whether the numbers were measures, but whether they could be used to produce a single index capable of closing decisions.

That closure function is central. From its inception, the UK approach was not designed to support falsifiable claims in the sense required by normal science. It was designed to support administrative decision making under conditions of limited data. If each therapy could be summarized as a cost per QALY, then pricing and access decisions could be standardized. A threshold could be declared. A recommendation could be issued. The case could be closed.

This is where numerical storytelling enters. The reference-case model did not emerge as a scientific necessity; it emerged as an administrative convenience. By embedding assumptions within a standardized modelling framework, the system could generate apparently rigorous outputs without requiring empirical confirmation of the underlying constructs. Sensitivity analysis replaced falsification. Plausibility replaced measurement. Stability across scenarios substituted for truth.

The success of this framework explains its extraordinary diffusion. Other jurisdictions did not independently rediscover the QALY. They imported it. They adopted UK-style health state valuation, reference-case modelling, and thresholds because these tools offered something

extremely attractive: decisions without open-ended scientific contestation. Once a model was run and a threshold satisfied, no further challenge was required. Measurement questions became irrelevant because the system no longer depended on measurement to function.

This is how a memeplex forms. A set of mutually reinforcing beliefs—utilities are quantitative, QALYs are ratio measures, models generate evidence, thresholds define value—replicates not because it is true, but because it is useful to institutions. Each component protects the others. Questioning any single element threatens the entire structure, so foundational critique is quietly excluded.

Over time, this belief system acquired the language of science without its constraints. Journals published increasingly sophisticated models. Agencies refined methodological guidance. Training programs taught technique without theory. Yet the original error remained untouched: health state descriptions are not quantities, and preferences over them cannot generate measures. The axioms of representational measurement were neither applied nor debated; they were simply absent.

The result is a global HTA enterprise built on a categorical inversion. Arithmetic precedes measurement. Outputs are treated as evidence before the properties of the inputs are examined. Composite indices replace single-attribute claims. And long-horizon simulations substitute for evaluable propositions.

That this system has persisted for forty years is not evidence of its validity. It is evidence of its administrative efficiency. The UK did not merely create a method; it created a template for avoiding the burdens of normal science. Once adopted, that template became self-reinforcing. The global HTA community learned to tell numerical stories that looked scientific, behaved mathematically, and delivered closure—while never requiring the one thing that science demands before numbers can speak: measurement.

This is where it all began. And this is why undoing it requires more than methodological adjustment. It requires rejecting the original decision to value descriptions rather than measure attributes, and replacing numerical storytelling with claims that meet the standards of fundamental measurement.

# 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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