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REPRESENTATIONAL MEASUREMENT FAILURE IN HEALTH TECHNOLGY ASSESSMENT

SPAIN: PROGRAM CONTENT AND THE ABSENCE OF REPRESENTATIONAL MEASUREMENT IN HTA EDUCATION

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ABSTRACT

Background: *Health technology assessment (HTA) depends upon quantitative claims whose scientific legitimacy requires measurement to precede arithmetic. The properties of the measurement scale must support the operations and interpretations imposed upon numerical values. Previous assessments have identified measurement and curriculum inversion across major HTA environments. This study extends program-content interrogation to Spain, a mature academic and institutional HTA environment with extensive expertise in health economics, economic evaluation and decision modelling.*

Methods: *Publicly available Spanish HTA and health-economics program content was assessed using a fixed 37-topic framework. Seventeen topics represented the requirements of representational measurement, including measurement preceding arithmetic, scales of measurement, ratio properties, admissible transformations, dimensional homogeneity, manifest and latent attributes, linear ratio measurement and Rasch measurement. Twenty topics represented contemporary HTA and health economics, including utilities, QALYs/AVACs, cost-effectiveness and cost-utility analysis, ICERs, decision modelling, simulation, uncertainty analysis and reimbursement applications. The unit of analysis was the pooled Spanish program-content knowledge base rather than individual institutions or investigators.*

Results: *None of the 17 representational-measurement topics was substantively identified, while all 20 contemporary HTA topics were represented: 0/17 versus 20/20. This demonstrates program-content inversion rather than lack of analytical sophistication. The QALY illustrates the consequence. In QALY = T × U, a preference value U = 0.5 is treated as though it provides the proportional adjustment required to convert 12 months into six quality-adjusted months. Yet a numerical value originating in Preference Space does not thereby become a lawful proportion in Time Space. Numerical identity is not measurement identity; even a lawful preference ratio would remain a preference ratio rather than become a time ratio.*

Conclusions: *Spanish HTA comprehensively represents the downstream analytical apparatus of contemporary HTA while apparently omitting its logically prior measurement gatekeeper. The problem cannot be resolved by adding measurement as another curriculum topic. Reconstruction requires representational measurement to become the organizing foundation: defined attributes, separate manifest and latent measurement pathways, admissible arithmetic, dimensional requirements, and empirically evaluable, replicable and falsifiable therapy-impact claims. The Spanish result therefore calls for curriculum replacement rather than supplementation: the analytical apparatus is present; the measurement gatekeeper is not*.

INTRODUCTION

Health technology assessment (HTA) depends upon quantitative claims. These claims are scientifically defensible only when measurement precedes arithmetic and the properties of the measurement scale permit the mathematical operations performed. Proportional and multiplicative claims require appropriate measurement structures; arithmetic must respect admissible

transformations and dimensional homogeneity; and manifest and latent attributes require different approaches to measurement. The question is whether the Spanish HTA community is aware of standards imposed by the axioms of representational measurement and the role of ratio measures as an integral part of the scales of measurement [1] [2] .

Previous interrogations of HTA knowledge bases in Australia, Canada, New Zealand and the United States have identified a consistent pattern of measurement inversion. The principles required for lawful measurement receive little or no substantive recognition, while utilities, QALYs, cost-effectiveness analysis and simulation modelling are strongly represented. Curriculum inversion reproduces the same failure educationally: students are introduced to the analytical methods of contemporary HTA without first being provided with the measurement principles required to determine whether the arithmetic underlying those methods is admissible.

The present investigation extends these program-content assessments to the Spanish HTA and health-economics knowledge base. Spain provides an important European setting because of the breadth of its university-based health-economics, outcomes-research and health-policy environment together with an established national and regional infrastructure for health technology assessment. Spanish academic and HTA activities encompass health economics, economic evaluation, cost-effectiveness and cost-utility analysis, pharmacoeconomics, health-state preferences, QALYs, patient-reported outcomes, decision modelling, uncertainty analysis, budget impact, reimbursement and resource-allocation decision making. Spain therefore provides a substantial academic and institutional environment in which to examine the scientific foundations underlying contemporary quantitative HTA.

The unit of analysis is not an individual Spanish university, research center, HTA organization or investigator. It is the publicly available program content through which the collective Spanish HTA and health-economics knowledge base is expressed and reproduced. This includes teaching and training, program and course descriptions, research priorities, methodological statements, projects, publications and other publicly available descriptions of what relevant Spanish programs research, apply and teach. The purpose is therefore to characterize the pooled Spanish program-content knowledge base rather than to infer what individual faculty members or researchers may know or address outside that publicly presented framework.

Two contrasting bodies of content are assessed using the fixed 37-topic framework. The first comprises 17 topics representing the requirements of representational measurement, including measurement preceding arithmetic, attribute definition, scales of measurement, admissible transformations, ratio measurement, dimensional homogeneity, the distinction between manifest and latent attributes, linear ratio measurement, Rasch measurement, person-item conjoint measurement, specific objectivity, invariance and attribute possession. The second comprises 20 topics representing contemporary health economics and HTA, including health economics, HTA, economic evaluation, utilities and health-state preferences, QALYs, cost-effectiveness and cost-utility analysis, ICERs, patient-reported outcomes, decision analysis, decision trees, Markov models, simulation, uncertainty analysis, value-of-information analysis, budget impact, resource allocation, value assessment and reimbursement decision making.

The question is deliberately narrow: does the Spanish HTA and health-economics program-content knowledge base establish representational measurement as the foundation for quantitative claims before introducing or applying the arithmetic of contemporary HTA? If the requirements of representational measurement are absent while conventional HTA methods are extensively represented, the result is program-content inversion: an educational, research and methodological environment in which arithmetic and modelling proceed without first establishing that the quantities involved possess the measurement properties required to support the operations performed.

Spain is particularly informative because the question cannot reasonably be attributed to an immature HTA or health-economics environment. The country has an established academic health-economics community and a substantial infrastructure concerned with technology assessment, economic evaluation and healthcare decision making. The relevant question is therefore not whether Spain possesses expertise in contemporary HTA. It plainly does. The question is whether the logically prior scientific principles governing lawful quantitative measurement have been incorporated into the Spanish program-content knowledge base as the gatekeeper for the methods subsequently taught and applied.

This distinction is fundamental. Representational measurement is not another methodology that can simply be added to contemporary HTA. It establishes the scientific rules governing whether numerical representations possess the properties required for the quantitative interpretations placed upon them. Once those rules are applied, every numerical construct must satisfy the appropriate measurement requirements before downstream arithmetic can acquire empirical meaning. The Spanish review therefore assesses whether lawful measurement provides the scientific foundation for its HTA and health-economics program content or whether the legacy framework of contemporary HTA occupies that position without it.

The result provides a particularly stark test. Across the pooled Spanish program-content knowledge base, substantive representation was identified for all 20 contemporary HTA and health-economics topics but for none of the 17 representational-measurement topics. The resulting 0/17 versus 20/20 contrast is not evidence of a lack of methodological sophistication. It demonstrates the opposite problem: a highly developed downstream analytical framework accompanied by an apparent absence of the logically prior measurement framework required to determine whether its central quantitative constructs and operations possess empirical legitimacy.

Spain therefore reproduces the program-content inversion already identified in other HTA environments. The significance is not simply that representational measurement is missing from a list of subjects. It is that the missing content comprises the scientific knowledge required to determine whether utilities, QALYs, incremental QALYs, cost-per-QALY ICERs and related quantitative claims can legitimately be interpreted as measures. The breadth and sophistication of Spanish HTA consequently make the finding more, rather than less, consequential**.** The analytical apparatus is present. The measurement gatekeeper is not.

FOUNDATIONS OF QUANTITATIVE ANALYSIS

Before examining Spanish program content, it is important to identify the scientific principles against which that content is assessed. These are not matters of methodological preference or alternative schools of economic evaluation. They are the requirements of representational measurement that determine whether quantitative claims and the arithmetic operations supporting them are admissible.

Two principles are fundamental. First, measurement must precede arithmetic. Numerical operations cannot create measurement where measurement does not exist. A numerical value must first represent a defined attribute through a measurement structure possessing the properties required for the quantitative claim being made. Second, the arithmetic performed must be admissible for the measurement scale concerned. Operations involving multiplication, division and proportional comparisons require the appropriate ratio measurement properties, while quantitative relationships must also respect admissible transformations and dimensional homogeneity. For claims of therapy impact in HTA, this establishes two measurement pathways: appropriate linear ratio measurement for manifest attributes and Rasch measurement for latent attributes.

These requirements establish the boundary between the manipulation of numbers and lawful quantitative measurement. Contemporary Spanish HTA and health economics, by contrast, are extensively organized around economic evaluation, health-state preferences, utilities, QALYs, cost-effectiveness and cost-utility analysis, ICERs, patient-reported outcomes, decision analysis, simulation modelling, uncertainty analysis and budget-impact assessment. Over approximately four decades, these methods have become embedded within Spain's university, research and health technology assessment environments and incorporated into the analytical framework used to inform reimbursement, healthcare policy and resource-allocation decisions.

The existence of this sophisticated analytical infrastructure is not in question. Nor is the technical competence of Spanish researchers and analysts who apply it. Institutional acceptance, methodological sophistication and longevity, however, do not determine measurement status**.** The logically prior scientific question remains whether the quantities entering these analyses possess the measurement properties required for the arithmetic and quantitative interpretations imposed upon them. A calculation can be computationally correct while the resulting claim remains scientifically inadmissible because its inputs do not possess the required measurement properties.

The Spanish program-content review therefore asks a straightforward question: does the publicly available Spanish HTA and health-economics knowledge base recognize representational measurement as the foundation and gatekeeper for quantitative claims, or does it proceed directly to the methods and arithmetic of contemporary HTA without first establishing their measurement admissibility? This is the criterion governing the analysis that follows. The issue is not whether Spain has developed a sophisticated HTA framework. It plainly has. The issue is whether that framework begins where any quantitative science must begin: with the identification of the attribute, establishment of a lawful measure and demonstration that the proposed arithmetic is permitted by the properties of that measure.

MEASUREMENT BEFORE ARITHMETIC

Before students are introduced to health technology assessment, health economics, cost-effectiveness analysis or decision modelling, they should understand the scientific conditions that determine whether quantitative claims are possible. The governing principle is straightforward: measurement must precede arithmetic. Numbers cannot be manipulated legitimately merely because they have been assigned to observations. The properties of the measurement scale determine which arithmetic operations and quantitative interpretations are admissible.

Representational measurement provides this foundation. The target attribute must first be identified and defined, its measurement properties established, and the appropriate scale constructed. Only then can arithmetic proceed. Proportional and multiplicative claims require appropriate ratio measurement properties, admissible transformations must be respected, and dimensional homogeneity must be maintained. Reversing this sequence allows arithmetic to precede measurement and produces numerical constructions that cannot be interpreted as lawful quantitative measures.

For HTA claims of therapy impact, the distinction between manifest and latent attributes is fundamental. Manifest attributes are directly observable. Examples include survival time, hospital days, emergency department visits, treatment administrations and walking distance. Where a defined unit, equal intervals and a non-arbitrary zero are established, these attributes can support linear ratio measurement and the arithmetic permitted by that measurement structure.

Latent attributes, such as pain, fatigue, physical function or need fulfilment, cannot be observed directly. Assigning numbers to questionnaire responses or adding item scores does not establish measurement. A measurement model is required to construct a unidimensional continuum and demonstrate invariant measurement. For this purpose, Rasch measurement provides person-item conjoint measurement, specific objectivity and a logit continuum upon which possession of the latent attribute can be assessed, with multiplicative comparisons represented through the corresponding odds.

The educational requirement can therefore be stated simply. Claims concerning manifest attributes require appropriate linear ratio measurement; claims concerning latent attributes require Rasch measurement. Students should understand these requirements before being introduced to utilities, QALYs, cost-effectiveness ratios or simulation models. Numerical constructions do not acquire measurement properties merely through arithmetic, statistical analysis, institutional acceptance or incorporation into increasingly sophisticated models.

This sequence provides the criterion for assessing the Spanish HTA and health-economics program-content knowledge base. The question is not how sophisticated Spanish teaching, research, economic evaluation or modelling may be, nor how firmly established contemporary HTA methods have become across Spain's universities, research centers and health technology assessment environment. Spain plainly possesses substantial expertise in these areas. The question is whether students and researchers are first provided with the measurement principles required to determine whether the arithmetic they subsequently perform is admissible.

If representational measurement, ratio measurement, admissible transformations, dimensional homogeneity and the distinction between manifest and latent attributes are absent while economic evaluation, utilities, QALYs, ICERs and modelling are extensively represented, the result is program-content inversion. In Spain, the significance lies not simply in the findings for any individual university, research center or HTA organization but in the pattern demonstrated across the pooled publicly available program-content knowledge base. The issue therefore concerns not a single course, institution or investigator, but the scientific foundations upon which Spanish HTA and health-economics teaching and research have been constructed. A sophisticated analytical apparatus cannot compensate for the absence of the measurement framework required to determine whether its central quantitative claims are scientifically admissible.

THE CRITICAL ROLE OF RATIO SCALES

The Spanish program-content assessment rests upon a fundamental requirement of representational measurement: arithmetic operations and their empirical interpretations are determined by the properties of the measurement scale. Numerical values cannot legitimately be multiplied, divided or otherwise manipulated merely because numbers have been assigned. Measurement must first be established, the properties of the scale demonstrated, and the proposed arithmetic shown to be admissible for the scale concerned.

The distinction between nominal, ordinal, interval and ratio scales is therefore critical. Nominal scales classify; ordinal scales establish order; interval scales provide equal intervals but lack a non-arbitrary zero. Ratio scales possess both equal units and a non-arbitrary zero and therefore support meaningful ratios and proportional comparisons. Their admissible transformations preserve these relationships. Ratio status cannot simply be assumed from the numerical appearance of a scale; the required measurement structure must first be demonstrated.

This requirement has immediate consequences for Spanish HTA and health economics. QALYs multiply health-state preference values by time; incremental cost-effectiveness ratios divide differences in costs by differences in outcomes; and decision models combine probabilities, utilities, durations, costs and other numerical inputs through sequences of arithmetic operations. These methods are extensively represented across the Spanish academic health-economics and HTA environment. The scientific question, however, precedes their application: do the quantities entering these operations possess the measurement properties required for the arithmetic and interpretations imposed upon them? Where they do not, the arithmetic is inadmissible. Subsequent statistical analysis, probabilistic sensitivity analysis, modelling or simulation cannot correct a measurement failure that occurred before the arithmetic began.

For claims of therapy impact, two measurement pathways are relevant. Manifest attributes require appropriate linear ratio measurement, with the properties necessary to support the proposed quantitative comparisons. Latent attributes require Rasch measurement to construct a unidimensional logit continuum through person-item conjoint measurement, invariance and specific objectivity, with multiplicative comparisons represented through the corresponding odds. This distinction provides the measurement foundation for determining whether subsequent quantitative claims are admissible.

The Spanish assessment therefore applies a straightforward criterion. Does the publicly available pooled Spanish HTA and health-economics program-content knowledge base recognize scales of measurement, ratio measurement, admissible transformations, admissible arithmetic, dimensional homogeneity and the different measurement requirements of manifest and latent attributes before introducing the quantitative methods of contemporary HTA? Or does it proceed directly to economic evaluation, utilities, QALYs, cost-effectiveness and cost-utility analysis, ICERs and decision modelling without first establishing the measurement properties required for their quantitative interpretation?

Ratio measurement is therefore not simply another topic within an HTA curriculum or research program. More broadly, representational measurement establishes the boundary between scientifically admissible quantitative analysis and the manipulation of numbers without demonstrated measurement properties. For Spain, this criterion applies across a substantial and diverse academic and HTA environment encompassing universities, health-economics programs, public-health and medical faculties, outcomes and health-services research, economic evaluation and national and regional health technology assessment activities.

The issue is therefore not whether Spain possesses sophisticated quantitative expertise. It clearly does. Nor is the issue whether Spanish analysts can execute the arithmetic and modelling procedures conventionally required by contemporary HTA. The issue is logically prior: has the measurement foundation required to give those calculations empirical meaning first been established? If it has not, analytical sophistication cannot compensate for its absence. The Spanish program-content assessment asks whether measurement governs the arithmetic of HTA or whether, as the 0/17 versus 20/20 result indicates, arithmetic and modelling have been allowed to precede measurement.

THE KNOWLEDGE BASE: PROGRAM CONTENT AND COVERAGE

The assessment uses the large language model interrogation framework applied in previous studies of measurement, curriculum and program-content inversion. The present analysis differs in one important respect: rather than estimating categorical probabilities of endorsement, it examines whether specified scientific and methodological topics are explicitly represented in the publicly available program content of the Spanish HTA and health-economics knowledge base.

The Spanish knowledge base comprises the publicly accessible teaching, research, training and methodological environment associated with universities, university-affiliated research groups and other identifiable academic programs engaged in health economics, health technology assessment, outcomes research, health services research, pharmacoeconomics, economic evaluation, decision science and health policy. Material considered includes program and course descriptions, research priorities, methodological statements, projects, publications, seminars, training activities and related publicly available evidence. The objective is not to evaluate individual investigators, courses, universities or HTA organizations, but to characterize the methodological framework represented across the pooled Spanish knowledge base as a whole.

Importantly, the assessment is deliberately generous in determining whether a topic is represented. A topic does not have to appear across multiple Spanish institutions to qualify as present.

Substantive publicly available evidence from any relevant part of the pooled knowledge base is sufficient for the topic to be recorded as represented. The procedure therefore gives the Spanish academic HTA and health-economics environment every reasonable opportunity to demonstrate that the specified content forms part of its collective knowledge base.

Two contrasting groups of content are examined. The first represents the requirements of representational measurement. It comprises 17 topics including measurement preceding arithmetic, attribute definition, scales of measurement, the axioms of representational measurement, ratio measurement, admissible transformations, admissible arithmetic, dimensional homogeneity, the distinction between manifest and latent attributes, linear ratio measurement for manifest attributes, Rasch measurement for latent attributes, person-item conjoint measurement, specific objectivity, invariance and attribute possession.

The second represents contemporary HTA and health economics. It comprises 20 topics including health economics, health technology assessment, economic evaluation, cost-effectiveness and cost-utility analysis, pharmacoeconomics, utilities and preference-based outcomes, QALYs, incremental cost-effectiveness ratios, patient-reported outcomes, decision analysis, decision trees, Markov models, simulation, probabilistic sensitivity and uncertainty analysis, value-of-information analysis, budget-impact analysis, resource allocation, value assessment and reimbursement decision making. The Spanish knowledge base provides extensive representation of these activities through its university programs, health-economics and outcomes-research groups, public-health and medical environments, economic-evaluation activities and wider HTA infrastructure.

The interrogation asks a single question: does the Spanish HTA and health-economics program-content knowledge base establish representational measurement as the foundation for quantitative claims before presenting and applying the analytical methods of contemporary HTA**?** The criterion is the presence or absence of substantive publicly available program content rather than a probability of endorsement. Absence therefore means that substantive evidence of the specified topic was not identified within the publicly available pooled knowledge base examined; it does not imply that no individual Spanish researcher possesses knowledge of that topic or has addressed it outside the material assessed.

This distinction is important. Earlier knowledge-base interrogations assessed the relative strength with which propositions associated with measurement inversion and curriculum inversion were represented. Program-content interrogation provides a more direct test. If representational measurement is absent while the methods of contemporary HTA are extensively represented, the result is program-content inversion. Arithmetic, modelling and simulation are taught, researched and applied without representational measurement being established as the logically prior framework determining whether the quantities involved possess the properties required for the operations and interpretations imposed upon them.

The Spanish assessment therefore focuses on a narrow issue: whether the scientific requirements governing measurement are represented in the pooled program-content knowledge base through which contemporary HTA and health economics are taught, researched and transmitted. The purpose is to determine whether lawful measurement provides the scientific foundation for

quantitative analysis in Spain or whether the methods of the legacy HTA framework are represented without the prior measurement standards required to establish their quantitative legitimacy.

The breadth and sophistication of the Spanish environment make this a demanding test. Spain possesses extensive expertise in economic evaluation, health economics, outcomes research, modelling and health technology assessment. The issue is therefore not whether contemporary quantitative methods are represented. They clearly are. The critical question is whether the measurement framework that should determine their admissibility is represented first. The resulting 0/17 for representational measurement and 20/20 for contemporary HTA and health economics provides the answer: the downstream analytical framework is comprehensively represented while the logically prior measurement framework is apparently absent.

ASSESSMENT FRAMEWORK

For this assessment, the Spanish program-content knowledge base was defined as the publicly available material describing relevant teaching and training in health economics, HTA, outcomes research, pharmacoeconomics, economic evaluation and related fields. Sources included program and curriculum descriptions, courses and modules, syllabi where available, learning objectives, seminars, workshops, teaching resources and associated educational material. The purpose was to establish what students and trainees are expected to encounter across the pooled Spanish HTA and health-economics educational environment, not what individual faculty members may know or address in their independent research.

The relationship between the two components is the critical issue. Contemporary HTA methods cannot be taught independently of the measurement requirements governing their quantitative interpretation. If students are taught that measurement precedes arithmetic, that proportional and multiplicative claims require appropriate ratio measurement properties, that arithmetic must respect admissible transformations and dimensional homogeneity, and that manifest and latent attributes require different measurement strategies, they possess the scientific criteria required to judge whether subsequent HTA methods are admissible. Where these foundations are absent, utilities, QALYs, cost-effectiveness ratios and simulation models can be introduced without confronting the measurement properties required to give their arithmetic empirical meaning.

Program-content inversion is therefore identified where contemporary HTA and health-economics methods are comprehensively represented (20/20 topics) while the logically prior requirements of representational measurement are absent (0/17 topics). This is more than an imbalance in program content. It reverses the scientific sequence: arithmetic and modelling are introduced without first establishing the measurement conditions governing their admissibility.

Program-content inversion places contemporary Spanish HTA in direct conflict with the standards required of normal quantitative science. Scientific status does not follow from generating numbers, employing sophisticated statistical methods or constructing increasingly complex models. Quantitative science requires lawful measurement, admissible arithmetic, empirical evaluation, replication and the possibility of falsification. If the foundational requirements of representational measurement are absent while utilities, QALYs, ICERs and simulation models are extensively

represented without first establishing that their quantitative interpretation is admissible, HTA is operating outside those requirements. The **0/17 versus 20/20** result therefore identifies more than an educational deficiency. It signals a separation between the Spanish HTA program-content framework and the measurement standards required for defensible quantitative science.

This finding is particularly significant in Spain because it cannot plausibly be attributed to a lack of quantitative expertise, methodological sophistication or academic resources. Spain has developed a substantial academic and institutional environment encompassing health economics, economic evaluation, pharmacoeconomics, outcomes research, public health, health services research, healthcare policy and health technology assessment. Contemporary methods of cost-effectiveness and cost-utility analysis, QALYs, ICERs, decision modelling, uncertainty analysis and related techniques are extensively represented. The program-content inversion identified here therefore occurs within a mature and technically sophisticated HTA and health-economics environment.

The problem is consequently not insufficient analytical sophistication. It is the apparent absence of the logically prior measurement framework required to determine whether that sophistication is being applied to quantities capable of supporting the operations and interpretations imposed upon them. Indeed, the greater the sophistication of the downstream analytical apparatus, the more striking the absence of the measurement gatekeeper becomes. Additional modelling cannot compensate for a failure to establish the measurement legitimacy of the quantities entering the model.

The two frameworks are consequently incompatible as foundations for quantitative analysis. Representational measurement requires arithmetic to be constrained by measurement. Once that principle is accepted, every subsequent quantitative construct and method must satisfy the relevant measurement requirements. Numerical constructions cannot be exempted simply because they are established components of contemporary Spanish HTA, incorporated into university teaching, applied within health technology assessment, or supported by decades of methodological convention. Institutional acceptance cannot substitute for measurement demonstration.

Conversely, where representational measurement is absent from the organizing framework, there is no corresponding measurement constraint preventing utilities, QALYs, incremental QALYs, cost-per-QALY ICERs and associated modelling structures from being taught, researched and applied without first demonstrating that the quantities upon which they depend possess the required measurement properties. The Spanish **0/17 versus 20/20** result captures this incompatibility in its clearest form: the downstream analytical framework is comprehensively represented, while the measurement framework required to determine its quantitative legitimacy is apparently absent.

ASSESSMENT RESULTS: PROGRAM CONTENT REVIEW

Spain

Knowledge Base

Spanish Health Technology Assessment, Health Economics and Outcomes Research Program-Content Knowledge Base

Purpose

This review evaluates publicly available program content associated with health technology assessment (HTA), health economics, economic evaluation, outcomes research, health services research, pharmacoeconomics and related quantitative health research in Spain against the fixed 37-topic framework. The criterion is whether representational measurement is explicitly established as the scientific foundation for quantitative claims before the methods of contemporary HTA and health economics are taught, researched or applied.

The pooled Spanish knowledge base includes publicly available university teaching and training, health-economics and economic-evaluation programs, outcomes and health-services research, public-health and medical programs, methodological guidance, and activities associated with the wider Spanish HTA environment. Publicly available material demonstrates extensive engagement with health economics, HTA, pharmacoeconomics, economic evaluation, patient-reported outcomes, health-state preferences, QALYs, cost-effectiveness and cost-utility analysis, decision modelling, uncertainty analysis, budget-impact analysis, reimbursement and resource-allocation decision making.

The objective is not to evaluate individual investigators, courses, universities or HTA organizations. The unit of analysis is the pooled publicly available Spanish program-content knowledge base through which contemporary HTA and health economics are taught, researched, applied and reproduced.

Topic results are presented in Table 1 for representational measurement.

TABLE 1: REPRESENTATIONAL MEASUREMENT

Topic	Explicitly recognized	Spanish program evidence
Representational measurement	No evidence identified	—
Scales of measurement as constraints on arithmetic	No evidence identified	—
Measurement precedes arithmetic	No evidence identified	—
Axioms of representational measurement	No evidence identified	—
Ratio measurement as prerequisite for proportional and multiplicative claims	No evidence identified	—
Non-arbitrary zero and equal units	No evidence identified	—

Admissible transformations	No evidence identified	—
Admissible arithmetic by scale type	No evidence identified	—
Dimensional homogeneity	No evidence identified	—
Manifest and latent attributes as distinct measurement classes	No evidence identified	—
Linear ratio measurement for manifest attributes	No evidence identified	—
Possession of latent attributes	No evidence identified	—
Rasch measurement as requirement for latent attributes	No evidence identified	—
Person-item conjoint measurement	No evidence identified	—
Specific objectivity and invariance	No evidence identified	—
Rasch logit measurement and multiplicative representation through odds	No evidence identified	—
Two measurement pathways for therapy-impact claims	No evidence identified	—

Result: 0/17 representational-measurement topics explicitly recognized as foundations of the publicly available Spanish HTA and health-economics program-content knowledge base reviewed.

Across the pooled publicly available Spanish program content examined, no substantive evidence was identified that representational measurement has been incorporated as the scientific framework governing HTA and health-economics education and research. In particular, no substantive program content was identified establishing measurement before arithmetic, admissible transformations, dimensional homogeneity, linear ratio measurement for manifest attributes or Rasch measurement for latent attributes as the prior requirements governing quantitative therapy-impact claims.

This finding should not be interpreted as demonstrating that no individual Spanish researcher is familiar with these concepts. The assessment concerns their explicit representation within the publicly available pooled program-content knowledge base. A topic was allowed to qualify as represented if substantive evidence was identified anywhere within that pooled environment. Despite this deliberately permissive criterion, none of the 17 representational-measurement topics qualified.

Topic results for contemporary HTA and health economics are presented in Table 2.

TABLE 2: CONTEMPORARY HEALTH ECONOMICS AND HTA FRAMEWORK

Topic	Explicitly represented	Spanish program evidence
Health economics	Yes	University teaching, postgraduate health-economics programs and research activities
Health technology assessment	Yes	Spanish academic and national/regional HTA activities
Economic evaluation	Yes	University programs, HTA training and methodological materials
Cost-effectiveness analysis	Yes	Economic-evaluation teaching, research and HTA methods
Cost-utility analysis	Yes	Health-economic evaluation and HTA program content
Pharmacoeconomics	Yes	University and postgraduate pharmaceutical and health-economics programs
Utilities and preference-based outcomes	Yes	Health-outcomes, preference and economic-evaluation content
Quality-adjusted life-years (QALYs/AVACs)	Yes	Economic-evaluation and HTA teaching, including QALY/AVAC applications
Incremental cost-effectiveness ratios (ICERs)	Yes	Cost-effectiveness and cost-utility evaluation
Measurement and valuation of health outcomes / patient-reported outcomes	Yes	Outcomes research, quality-of-life and health-status assessment
Decision analysis	Yes	Health-economic evaluation and decision-science content
Decision-tree modelling	Yes	Economic-evaluation and modelling instruction
Markov modelling	Yes	Health-economic decision modelling
Simulation and microsimulation modelling	Yes	Advanced economic and decision-modelling content
Probabilistic sensitivity and uncertainty analysis	Yes	Economic evaluation, uncertainty analysis and decision modelling
Value-of-information analysis	Yes	Decision uncertainty and health-economic modelling content
Budget-impact analysis	Yes	HTA, pharmacoeconomics and economic-evaluation content

Healthcare priority setting and resource allocation	Yes	Health economics, public health, health policy and HTA
Value-for-money / value assessment	Yes	Economic evaluation and technology-assessment activities
Policy, reimbursement and decision use of economic evaluation	Yes	HTA, reimbursement and healthcare decision-making content

Result: 20/20 contemporary health-economics and HTA topics represented in the publicly available Spanish program-content knowledge base reviewed.

The contrast between the two assessments is therefore complete:

Representational measurement: 0/17

Contemporary health economics and HTA: 20/20

The result cannot reasonably be interpreted as evidence of an unsophisticated Spanish HTA or health-economics environment. The opposite is apparent. Spain demonstrates extensive representation of the downstream analytical apparatus of contemporary HTA: economic evaluation, utilities, QALYs, ICERs, decision models, simulation, uncertainty analysis, budget impact and the use of economic evidence in healthcare decision making.

What is apparently absent is the logically prior measurement framework required to determine whether the quantities entering these procedures possess the properties necessary for the arithmetic and quantitative interpretations imposed upon them. The Spanish knowledge base therefore demonstrates **program-content inversion** in its clearest form: comprehensive representation of contemporary HTA methods accompanied by no identified substantive representation of the 17 topics establishing representational measurement as their scientific gatekeeper.

The contrast is particularly important for the QALY. Spanish program content explicitly represents QALYs/AVACs and their use in economic evaluation, yet no corresponding program content was identified establishing the ratio-measurement, dimensional, attribute-specific and admissible-arithmetic requirements necessary to determine whether the QALY can exist as a lawful measure. Students can therefore encounter the construction and application of the QALY without first encountering the measurement principles required to interrogate its legitimacy.

The 0/17 versus 20/20 result is consequently not simply a count of topics. It identifies the ordering of the Spanish HTA knowledge base. The methods and arithmetic of contemporary HTA are comprehensively represented; the measurement framework that should determine whether those methods are quantitatively admissible is apparently absent. Arithmetic and modelling are present. The measurement gatekeeper is not.

ASSESSMENT OF THE SPANISH RESULT

The Spanish program-content review identifies a complete inversion in the scientific ordering of health technology assessment education and research. Across the 37 topics examined, none of the 17 topics defining representational measurement was explicitly recognized as the scientific foundation for quantitative claims, while all 20 topics associated with contemporary health economics and HTA were represented. The resulting profile of 0/17 for representational measurement and 20/20 for contemporary HTA is not a minor curriculum imbalance. It indicates that the methods of contemporary HTA are taught, researched and applied without prior establishment of the measurement conditions required to support their quantitative claims.

The absence begins at the most fundamental level. No substantive evidence was identified that representational measurement itself is introduced as the framework governing quantitative inquiry. There is no explicit recognition that measurement must precede arithmetic, that scale type constrains admissible mathematical operations, or that the axioms of representational measurement must be satisfied before numerical assignments can be treated as measures. These omissions remove the scientific criteria by which the legitimacy of every subsequent analytical construct should be assessed.

The failure to recognize scales of measurement as constraints upon arithmetic is particularly important. Nominal, ordinal, interval and ratio scales possess different mathematical properties and support different quantitative interpretations. Meaningful proportional comparisons require appropriate ratio structure, while differences require the relevant interval properties. Ordinal numbers establish order but do not thereby establish equal differences or proportional relationships. Yet the Spanish program-content knowledge base provides no substantive evidence that students are first required to determine whether the numbers entering an HTA analysis possess the scale properties necessary for the claims made with them.

This omission has immediate consequences for utilities, QALYs and incremental cost-effectiveness ratios [3]. Spanish program content explicitly represents health-state preferences, utilities, QALYs/AVACs, cost-utility analysis and ICERs. The familiar construction: QALY = T × U requires the health-state preference value U to perform a very specific quantitative function. If U = 0.5 and T = 12 months, the procedure produces six “quality-adjusted” months. But the arithmetic raises the logically prior measurement question: what has been measured as one-half?

The conventional health-state preference score provides no satisfactory answer. A composite preference value bounded between zero and one does not thereby possess equal units, a non-arbitrary zero or invariant ratios. Consequently, U = 0.5 does not establish that one-half of a defined attribute has been measured. The absence of ratio measurement from Spanish program content therefore removes the very framework required to identify this problem.

The failure is deeper still. Duration is represented within Time Space. If T1 = 6 months and T0 = 12 months, then: T1 / T0 = 0.5

is a lawful proportional comparison between two commensurable ratio measures of time. The health-state preference value originates in an entirely different Preference Space. Assigning the

same numeral, 0.5, to a preference value does not transform that number into the time proportion required by:Tadjusted / T = 0.5. The numerical values may be identical; their measurement meanings are not. Numerical identity is not measurement identity.

This distinction eliminates an important potential defense of the QALY. Even if a lawful ratio measure of a defined preference attribute could be constructed, a preference ratio would remain a preference ratio. It would not become a time ratio merely because both relationships happened to be represented by the number 0.5. Preference and duration are not commensurable attributes. The QALY therefore requires a numerical value originating in Preference Space to perform a proportional measurement function in Time Space for which it has no lawful measurement basis.

Dimensional homogeneity reinforces rather than rescues the construction. If the QALY is claimed to retain the dimension of time, then [QALY] = [T] × [U] requires U to function as a dimensionless factor. But being dimensionless is not sufficient. A dimensionless number is not necessarily a dimensionless proportional measure, and a dimensionless proportional measure of one attribute does not automatically become a lawful proportional adjustment to another. The distinction is fundamental: dimensionless number ≠ dimensionless proportional measure ≠ lawful proportional adjustment to time.

The Spanish knowledge base provides no substantive representation of dimensional homogeneity as a governing principle for HTA arithmetic. This omission allows the QALY construction to be introduced as an accepted quantitative procedure without students first being required to establish the dimensional and measurement status of the multiplier upon which the construction depends.

No substantive evidence was identified for non-arbitrary zero, equal units, admissible transformations or admissible arithmetic by scale type. These are not abstract theoretical refinements. They determine whether a numerical representation remains meaningful under permissible transformation and whether comparisons, differences and ratios preserve empirical interpretation. Without them, computational correctness can easily be mistaken for measurement legitimacy.

The review also identifies no explicit distinction between manifest and latent attributes as separate measurement classes. This distinction should precede instrument selection and analytical design. Manifest attributes such as survival time, hospital days, emergency department visits, treatment administrations and walking distance can, where the required properties are established, be represented through lawful linear ratio measures. Latent attributes such as pain, fatigue, physical function and need fulfilment cannot be observed directly and require a measurement model capable of constructing an invariant unidimensional continuum.

The absence of this distinction allows fundamentally different kinds of observations to enter a common numerical environment without first establishing their measurement status. Counts, durations, questionnaire scores, preference values and modelled outcomes can all appear as numbers. That numerical appearance does not make them equivalent as measures. Before therapy impact can be quantified, the attribute must be defined and the measurement system appropriate to that attribute established.

The Spanish knowledge base provides no substantive recognition of linear ratio measurement for manifest attributes as the foundation for therapy-impact claims. This is significant because manifest attributes provide some of the most straightforward opportunities for empirically evaluable claims. Survival duration, hospital days, treatment administrations and other directly observable quantities can support transparent protocols, replication and falsification when their measurement requirements are satisfied.

The omission is equally consequential for latent attributes. No substantive program-content evidence was identified for possession of latent attributes, Rasch measurement as the required measurement pathway, person-item conjoint measurement, specific objectivity or invariance. Assigning integers to questionnaire response categories, summing those responses or statistically transforming the resulting scores does not itself establish measurement.

Rasch measurement provides a fundamentally different framework. It requires a defined unidimensional latent attribute, conjoint calibration of persons and items, evaluation of invariance and specific objectivity, and construction of an additive logit continuum. Differences in possession can be represented on that continuum, while multiplicative comparisons can be expressed through the corresponding odds. Its absence from the Spanish program-content knowledge base means that the distinction between obtaining questionnaire scores and constructing measures of latent attributes is not represented as a foundational requirement.

The absence of the final representational-measurement topic brings the pattern together. The Spanish program-content knowledge base does not identify the two required measurement pathways for therapy-impact assessment: linear ratio measurement for manifest attributes and Rasch measurement for latent attributes. Instead, it comprehensively represents the conventional methods of contemporary HTA.

All 20 contemporary HTA and health-economics topics are represented. Health economics, HTA, economic evaluation, cost-effectiveness analysis, cost-utility analysis and pharmacoeconomics are present. Utilities, preference-based outcomes, QALYs/AVACs and ICERs form part of the accepted quantitative vocabulary. Health outcomes and patient-reported outcomes are represented, but without the logically prior measurement framework required to distinguish assigning or valuing numerical outcomes from constructing lawful measures.

Decision analysis, decision-tree modelling, Markov modelling, simulation, uncertainty analysis, probabilistic sensitivity analysis and value-of-information concepts are also represented. These methods can be technically sophisticated, but their sophistication is downstream. Their scientific interpretation depends upon the measurement properties of the quantities entering them. A simulation cannot repair a failure of measurement. More elaborate computation cannot manufacture a non-arbitrary zero, create invariant ratios or transform a preference-space number into a time-space proportion.

Budget-impact analysis, priority setting, resource allocation, value assessment and the policy and reimbursement use of economic evaluation complete the contemporary framework. The Spanish knowledge base therefore demonstrates a mature decision-facing analytical environment. What is

apparently missing is the scientific framework required to determine whether the quantitative claims produced by that environment possess lawful measurement foundations.

The contrast between 0/17 and 20/20 therefore defines program-content inversion. The Spanish knowledge base is comprehensive where contemporary HTA methods are concerned and apparently silent where the logically prior scientific foundations of measurement are concerned. Arithmetic, modelling and decision frameworks are introduced without first establishing the properties of the quantities entering those operations. The sequence required of quantitative science has been reversed.

The problem cannot be resolved by adding a lecture or module on measurement theory to the existing curriculum. Representational measurement is not topic number 38. It is the gatekeeper that determines whether the other quantitative topics are scientifically admissible. Once measurement preceding arithmetic, attribute definition, scale properties, admissible transformations, dimensional homogeneity and the manifest-latent distinction are introduced, utilities, QALYs, ICERs and reference-case models can no longer simply be accepted as established starting points. They become objects of measurement scrutiny.

This is why the two frameworks cannot simply be treated as complementary. A curriculum cannot teach that proportional claims require lawful measurement and simultaneously present $U = 0.5$ as reducing twelve months to six "quality-adjusted" months without establishing what has been measured as one-half. It cannot teach dimensional homogeneity while treating a dimensionless preference number as though dimensionless alone established proportional meaning. It cannot teach attribute-specific measurement while allowing a number originating in Preference Space to perform the quantitative role of a proportion in Time Space. And it cannot teach lawful latent measurement while assuming that summed questionnaire scores or preference algorithms become measures merely through numerical transformation.

The contradiction is structural. The contemporary HTA framework has been able to survive educationally because the measurement principles capable of interrogating its central constructs have apparently not been established as its gatekeeper. The absence of representational measurement is therefore not simply a missing component of an otherwise complete Spanish HTA curriculum. It is the condition under which the inherited analytical framework can continue to be reproduced without confronting the measurement legitimacy of its foundational quantities.

The implications for Spanish university education are consequently unavoidable. Spain clearly possesses substantial quantitative expertise in health economics, economic evaluation, modelling, outcomes research and HTA. But technical proficiency in established methods is not equivalent to education in quantitative science. Scientific education requires students first to understand the conditions under which quantitative claims are possible and only then to learn the arithmetic and modelling appropriate to lawful measures.

The path forward is therefore reconstruction rather than supplementation. The curriculum should begin with the definition of attributes, the distinction between manifest and latent attributes, scales of measurement, admissible transformations, dimensional homogeneity and the requirement that quantitative claims be constrained by measurement. Manifest therapy-impact claims should be

developed through appropriate linear ratio measurement. Latent therapy-impact claims should be developed through Rasch measurement, including unidimensionality, person-item conjoint measurement, specific objectivity, invariance and possession.

Only after lawful measurement has been established should arithmetic, statistical analysis and modelling proceed. Therapy-impact claims can then be framed prospectively through protocols identifying the target population, comparator, attribute, measurement instrument, timeframe, success criterion and falsification rule. The scientific order is restored: define the attribute → establish the measure → determine admissible arithmetic → formulate the therapy-impact claim → subject the claim to empirical evaluation, replication and falsification**.**

The Spanish program-content review therefore reaches an unequivocal conclusion. The publicly available pooled knowledge base comprehensively represents the technical methods of contemporary HTA but does not substantively represent the scientific foundations required to determine their quantitative legitimacy. The 0/17 versus 20/20 result is the clearest possible expression of program-content inversion. Spain has developed a sophisticated HTA and health-economics environment organized around economic evaluation, utilities, QALYs, ICERs and modelling, but the publicly documented program content does not demonstrate an HTA curriculum organized around lawful measurement. The analytical apparatus is present. The measurement gatekeeper is not.

CONCLUSION: THE CHALLENGE OF TRANSFORMATION IN SPAIN

Now that the measurement problem has been exposed, the challenge facing Spanish universities, research centers and the wider HTA and health-economics community is substantial. The issue is no longer whether contemporary HTA might benefit from greater attention to measurement theory. The Spanish program-content findings, together with the earlier demonstrations of measurement and curriculum inversion, identify a foundational problem: the central analytical framework of legacy HTA permits quantitative operations without first establishing the measurement properties required to give those operations empirical meaning. The 0/17 versus 20/20 result demonstrates the educational expression of that inversion. The measurement cat is out of the contemporary HTA litter box. It cannot simply be put back.

There is therefore no scientific basis for defending the status quo by appealing to longevity, institutional acceptance or methodological convention. The relevant question is no longer whether utilities, QALYs, ICERs and economic models have been useful, widely adopted or employed for decades. None of these establishes measurement legitimacy. Measurement must precede arithmetic. Scale properties constrain the quantitative interpretations that can legitimately be made. Proportional claims require appropriate measurement structure. Dimensional homogeneity must be respected. Numerical assignment cannot substitute for measurement. Where these requirements are not satisfied, subsequent modelling, probabilistic sensitivity analysis, simulation or computational sophistication cannot manufacture the missing measurement properties.

The QALY makes the problem particularly transparent. Spanish program content explicitly represents utilities, health-state preferences, QALYs/AVACs and cost-utility analysis. Yet the publicly available knowledge base provides no substantive evidence that students are first taught

the measurement requirements necessary to determine whether the QALY can exist as a measure. If U = 0.5 is used to reduce 12 months to six quality-adjusted months, the prior question is unavoidable: what has been measured as one-half? A numerical preference value of 0.5 does not establish a lawful proportion merely because it lies between zero and one.

Nor can the problem be rescued by treating the preference value as a dimensionless adjustment factor. A lawful ratio of two time measures, such as 6/12 = 0.5, establishes a proportion within Time Space. A numerical value of 0.5 originating in Preference Space does not thereby acquire that measurement meaning. Numerical identity is not measurement identity**.** Even a lawful preference ratio would remain a preference ratio; it could not become a time ratio merely because the two happened to have the same numerical value. The failure therefore occurs before subsequent economic modelling begins.

The challenge is consequently one of transformation: how should Spanish HTA education be reconstructed to meet the requirements of lawful measurement? Spanish universities and research groups have an important responsibility because they educate future practitioners, undertake methodological research and contribute to economic evaluation, outcomes research, health policy and technology assessment. The implications extend beyond universities to the wider Spanish HTA environment because the same measurement standards must govern quantitative claims whether they originate in academic research, industry-sponsored analysis, national or regional technology assessment, or healthcare decision making.

The 0/17 versus 20/20 program-content finding provides an opportunity to reconsider not simply what students are taught, but the scientific order in which they are taught it. The problem is not a lack of technical sophistication. Spain clearly possesses a sophisticated HTA and health-economics environment. The problem is whether that sophistication rests upon a scientifically defensible measurement foundation. The Spanish findings indicate that the downstream analytical apparatus is comprehensively represented while its logically prior measurement gatekeeper is apparently absent.

The starting point for reconstruction is straightforward. Representational measurement must become the foundation of HTA rather than an optional addition to the existing curriculum. Students must first learn to identify and define the target attribute, distinguish manifest from latent attributes, determine the appropriate measurement pathway, establish the properties of the resulting measure, determine which quantitative operations and interpretations are admissible, and formulate therapy-impact claims capable of empirical evaluation, replication and falsification. Only after these requirements have been satisfied should statistical analysis, economic evaluation, modelling or other downstream quantitative procedures be undertaken.

For manifest attributes, the appropriate pathway is linear ratio measurement where the required unit, equal intervals and non-arbitrary zero can be demonstrated. Survival time, hospital days, treatment administrations and other directly observable attributes can provide transparent and empirically evaluable therapy-impact claims when their measurement requirements are satisfied. For latent attributes, including pain, fatigue, physical function and need fulfilment, the appropriate pathway is Rasch measurement: definition of a unidimensional attribute, person-item conjoint

measurement, assessment of invariance and specific objectivity, and construction of an additive logit continuum, with multiplicative comparisons represented through the corresponding odds.

The reconstructed sequence is therefore: define the attribute → determine whether it is manifest or latent → construct the appropriate lawful measure → establish admissible arithmetic → formulate the therapy-impact claim → evaluate, replicate and attempt to falsify it.

This transformation does not abandon HTA. It abandons the legacy framework that allowed arithmetic to precede measurement. It brings HTA within the requirements of normal quantitative science. Spanish universities and research centers therefore face a clear choice: continue reproducing a legacy analytical framework after its measurement failures have been exposed, or begin reconstruction around lawful measurement. What faculty were taught explains the past; it cannot determine what they teach next.

Faculty necessarily have the leading educational role. This does not require an assumption that instructors have knowingly disregarded representational measurement. Most have themselves been educated within contemporary HTA and have inherited a methodological framework transmitted through universities, textbooks, journals, professional organizations, methodological guidelines and established research practice. The Spanish 0/17 finding indicates the extent to which representational measurement is apparently absent from the publicly presented program-content framework examined. That absence can explain how the legacy was transmitted. Once identified, however, it cannot justify transmitting it again.

Transformation must therefore begin by providing faculty with the knowledge and practical tools required to reconsider the scientific foundations of what they teach. This is not accomplished by inserting a single measurement lecture into an otherwise unchanged health-economics curriculum. Measurement is not topic number 38. It is the gatekeeper that determines whether the remaining quantitative methods survive scientific scrutiny. Once measurement becomes the organizing principle, utilities, QALYs, ICERs and modelled claims are no longer accepted simply because they are conventional components of HTA. They must demonstrate their measurement legitimacy.

It is precisely this gap that the Maimon Research nine-unit HTA reconstruction program is intended to address [4]. The program is designed as more than a sequence of educational materials. It provides a structured framework for faculty, researchers and practitioners seeking to understand and implement the transition from legacy HTA to an approach grounded in representational measurement. Approximately 45,000 words of structured instructional material move progressively from measurement preceding arithmetic through attributes, scales of measurement, admissible arithmetic and dimensional homogeneity to the distinction between manifest and latent attributes, linear ratio measurement, Rasch measurement, attribute possession and the construction of empirically evaluable therapy-impact claims.

The nine units can therefore support several levels of transition. They can be used for individual faculty preparation, as a framework for reconsidering existing graduate teaching, or as the foundation for developing a postgraduate HTA course organized explicitly around lawful measurement and normal science. The objective is not to add another specialist topic to an existing

HTA curriculum. It is to provide the intellectual structure through which that curriculum can be reconstructed from measurement forward.

An important feature of the program is that participants are not simply left to work through the material independently. Those enrolled have continuing online Q&A support as they study the units and begin to apply the framework in teaching, research and therapy evaluation. Questions arising from particular attributes, proposed measures, Rasch applications, therapy-impact claims, protocols or curriculum development can therefore be addressed as they arise. This is particularly important for faculty whose previous education did not include representational measurement and who may now be reconsidering assumptions embedded in many years of teaching and research.

The objective is not simply completion of nine units. It is development of the capability to apply the measurement framework independently and to introduce it confidently to students and colleagues. The transition succeeds only when participants can move from understanding measurement principles to using them as the gatekeeper for quantitative claims.

The program can also provide a starting point for broader institutional engagement in Spain. Universities, research centers, academic departments and professional groups wishing to examine the implications of lawful measurement in greater depth can build additional activities around their particular requirements, including seminars, faculty discussions, workshops, small-group sessions, curriculum-development support and presentations addressing specific measurement or therapy-evaluation problems. This provides a pathway from individual faculty preparation to institutional reconstruction.

Access to the nine-unit program involves a fee supporting its maintenance, administration, updating, hosting and continuing participant support. The significance of the program, however, lies not in the mechanism through which access is provided but in the fact that a structured transition framework is available now. Spanish universities do not have to wait for professional organizations, HTA agencies or another generation of methodological debate before beginning reconstruction. Nor does each institution have to recreate the measurement framework independently from first principles.

The nine-unit program is therefore offered as a template for faculty preparation and the development of a post-legacy graduate HTA program. Universities remain free to develop their own educational structures, but the scientific requirements themselves are not optional. Any reconstructed HTA curriculum must begin with attributes and measurement, distinguish the manifest and latent pathways, constrain arithmetic by the properties of the measures constructed, and require therapy-impact claims to be empirically evaluable, replicable and capable of falsification.

The framework already exists. The immediate question for Spanish faculty and graduate programs is therefore no longer whether reconstruction is possible. It is whether they are prepared to begin it.

The Spanish program-content result makes the reason for doing so difficult to avoid. Representational measurement: 0/17. Contemporary HTA and health economics: 20/20. The

analytical apparatus is present. The measurement gatekeeper is not. The task now is not to supplement legacy HTA but to replace its inverted scientific order with one in which measurement precedes arithmetic.

HTA can have a future. Legacy HTA cannot.

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