Quantitative Framework for Clinical Decision Structuring:
Revisited Conceptual Interpretation of paper published in Feb 2000

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Prefatory Note

The present text is a revised English-language reinterpretation of an article originally published in Russian in February 2000 in *KRC Medical Review*, a medical journal issued in Israel by the author. At the time of its original publication, the article proposed a quantitative framework intended to support clinical decision making under uncertainty by explicitly balancing expected benefit, procedural risk, and baseline patient condition.

Over the subsequent decades, both clinical practice and the philosophy of medical decision making have undergone substantial development. In particular, increased attention has been paid to the epistemic limits of numerical models, the population-based nature of probabilities, and the irreducibly individual character of clinical outcomes. In light of these developments, the present version does not attempt to strengthen or update the original framework through additional data or refined calculations. Instead, it reinterprets the original formulation in accordance with contemporary methodological standards.

The core mathematical expression has been preserved for reasons of conceptual continuity and historical reference. However, its role has been fundamentally redefined. The framework is no longer presented as a predictive or outcome-calculating model, but as a structured heuristic intended to discipline clinical reasoning, clarify trade-offs, and make implicit assumptions explicit. Numerical values should be understood as ordinal and contextual estimates rather than measurable quantities or probabilities.

This republication serves two purposes. First, it provides an archival English-language reference to an early conceptual attempt to formalize clinical decision structuring. Second, it illustrates how such early quantitative approaches can be reframed today without overstating their precision or predictive power. The responsibility for clinical decisions remains with the physician, informed by evidence, experience, and patient values; the framework offered here is intended solely as an aid to reflective judgment under uncertainty.

Abstract

Clinical decision making inevitably unfolds under conditions of uncertainty, incomplete information, and value-based judgment. Over the past decades, multiple formal approaches—ranging from discriminant analysis to decision theory and artificial intelligence—have attempted to systematize medical decisions through probabilistic and utility-based reasoning. However, the practical applicability of such approaches remains constrained by epistemic limits, subjective assessments, and individual patient variability.

In this article, we revisit a quantitative framework originally proposed in 2000, preserving its core formula while substantially revising its interpretation. Rather than presenting a predictive or outcome-calculating model, the framework is reinterpreted as a decision-structuring instrument designed to discipline clinical reasoning by explicitly balancing expected benefit, procedural risk, and baseline patient condition. The framework does not claim numerical precision or predictive validity and should be understood as a heuristic aid rather than a prescriptive algorithm.

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1. Introduction

Clinical practice is characterized by continuous decision making under uncertainty. Physicians are routinely required to choose diagnostic and therapeutic strategies without full knowledge of

outcomes, probabilities, or patient-specific responses. Despite advances in evidence-based medicine, most clinical decisions cannot be reduced to purely algorithmic procedures.

Classical decision analysis introduces concepts such as outcomes, actions, states, probabilities, utilities, and choices. These tools are valuable for structuring problems but depend critically on assumptions that are rarely satisfied in individual patient care: stable probabilities, well-defined utilities, and homogeneous reference classes. As Aristotle already observed, physicians rarely face a clear choice between success and failure; more often, both available options may lead to unsatisfactory outcomes.

The present work revisits an early attempt to formalize clinical reasoning quantitatively, not to strengthen its numerical claims, but to clarify its proper epistemic role within modern clinical decision making.

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2. Limits of Quantitative Decision Models in Medicine

Quantitative models in medicine face several inherent limitations. Probabilities are typically derived from population-level data and may not be directly applicable to individual patients. Utilities and benefits are value-laden and context-dependent. Clinical variables are often ordinal, qualitative, or estimated rather than measured. Outcomes can only be evaluated retrospectively.

Consequently, numerical results in clinical decision frameworks should not be interpreted as predictions. Their legitimate role is to organize reasoning, expose hidden assumptions, and prevent unbalanced reliance on either expected benefit or procedural risk.

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3. Conceptual Reinterpretation of the Kriger Framework

The original framework proposed a numerical expression for evaluating treatment outcomes:

$$\varepsilon = \frac{\Delta\psi - \Sigma}{\omega}$$

In its revised interpretation, this expression does not calculate treatment success. Instead, it provides a structured comparison between the expected benefit of treatment, the aggregate burden of risk and systemic stress, and the baseline resilience of the patient. The formula should be read directionally, not metrically.

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4. Definition of Variables (Reinterpreted)

ω — Baseline Patient Condition
An ordinal clinical assessment reflecting overall physiological and psychosocial resilience. This parameter is not a measurable quantity but a synthesized judgment based on cardiovascular, respiratory, metabolic, and psychosocial functioning.

ψ — Prognostic Outlook Without Treatment
An estimate derived from population-level survival data, interpreted as a contextual reference rather than an individual forecast.

δ — Prognostic Outlook With Treatment
A corresponding reference estimate under treatment conditions, subject to the same limitations.

Δψ = δ − ψ — Expected Therapeutic Gain
Represents the direction and magnitude of expected benefit relative to non-intervention, not a guaranteed outcome.

μ — Diagnostic Risk Burden
Aggregated qualitative assessment of potential harms associated with diagnostic procedures.

ρ — Therapeutic Risk Burden

Aggregated qualitative assessment of risks associated with treatment interventions.

α — Systemic Recovery Stress Indicator

A historical indicator reflecting the patient's prior exposure to medical stressors and recovery dynamics. This term should be understood as contextual memory rather than a causal predictor.

Σ = μ + ρ + α — Aggregate Risk and Stress Load

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5. Interpretation of ε

The resulting value ε must not be interpreted as a probability, utility, or success rate.

Instead, $\varepsilon > 0$ suggests that expected benefit plausibly outweighs cumulative burden; $\varepsilon \approx 0$ indicates marginal or highly uncertain justification; $\varepsilon < 0$ signals that intervention may impose greater harm than benefit under current assumptions. Threshold values should be regarded as heuristic warnings rather than contraindications.

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6. Worked Example (Illustrative Only)

Any numerical example included should be understood as illustrative. Its purpose is not to demonstrate correctness of calculation but to show how explicit balancing of benefit, risk, and baseline condition can alter clinical intuition and reveal hidden trade-offs.

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7. Discussion

This framework does not replace clinical judgment, evidence-based guidelines, or shared decision making. Its primary contribution lies in forcing transparency: every assumed benefit,

risk, and baseline condition must be made explicit, even when estimates are uncertain or subjective.

Importantly, numerical coherence does not imply predictive validity. The framework serves as a cognitive scaffold rather than a decision engine.

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8. Conclusion

The revised interpretation of the Kriger framework positions it not as a quantitative theorem in the strict sense, but as a formalized heuristic for clinical reasoning. By preserving the original structure while rejecting unwarranted claims of precision, the framework remains relevant as a reflective tool for navigating uncertainty in individual patient care.

Limitations and Scope

The framework presented in this article is subject to fundamental limitations that must be explicitly acknowledged. The numerical form of the expression does not imply metric validity. All variables involved are based on clinical judgment, ordinal assessment, and contextual interpretation. They are not directly measurable quantities and do not admit calibration through frequency-based validation.

The framework does not generate individual probabilities, predictions, or guarantees of outcome. Population-level data are used solely as reference points for contextual reasoning and cannot be assumed to transfer directly to individual patients. Additive aggregation of heterogeneous components should be understood as a conceptual device rather than a causal or mechanistic model.

Accordingly, the scope of this framework is limited to reflective clinical reasoning under uncertainty. It is intended to complement, not replace, evidence-based guidelines, clinical

expertise, and shared decision making with patients. Any use of the framework beyond this scope constitutes a category error.

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