Detecting Contradictions Across Clinical, Economic, and HTA Documents Using AI

MSR196

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KEY MESSAGE

AI-supported contradiction detection identified 74 potential inconsistencies across HTA evidence packages, with 78.4% confirmed as true contradictions by expert review. Of these, 32.8% were high-impact issues that could affect evidence credibility and HTA decision-making, demonstrating the value of AI as a quality assurance layer alongside expert review.

BACKGROUND

Healthcare decision-making relies on consistency across clinical evidence, economic evidence in HTA submissions. However, contradictions in assumptions, definitions, or conclusions across documents often go undetected until late stages.

HTA submissions integrate clinical, epidemiologic, and economic evidence that must remain aligned with the decision problem, comparator framework, and uncertainty characterization expected by HTA bodies such as NICE. [1]

Because evidence is often distributed across clinical study reports, model documentation, submission dossiers, and technical appendices, contradictions may remain hidden during manual review, particularly when conceptually related statements are separated across long documents or expressed using different terminology.[2,3]

OBJECTIVES

1. Evaluate an AI-supported approach to systematically identify internal and cross-document inconsistencies within HTA evidence packages
2. Assess the relevance and severity of AI-flagged contradictions through expert review using a three-level severity framework

METHODS

AI-Based Document Analysis Framework

- An AI-based document analysis framework was applied to linked sets of clinical study reports, economic model documentation, and HTA submissions for selected case studies.
- Documents were parsed to extract key claims, assumptions, definitions, and quantitative statements.
- Logical and semantic consistency checks were performed across documents to flag potential contradictions, including mismatched population definitions, inconsistent time horizons, conflicting clinical assumptions, and divergent interpretations of uncertainty.
- Extracted evidence elements were mapped to predefined HTA review domains, including population, intervention, comparator, outcomes, time horizon, subgroup definition, modeling assumptions, and uncertainty handling,
- Identified issues were reviewed by senior HTA experts for relevance and severity.

METHODS (CONTINUED)

Structured Review Pipeline

1. Document Segmentation
2. Entity & Concept Extraction
3. Statement Normalization
4. Pairwise Cross-Document Comparison
5. Deduplication & Categorization
6. Expert Review & Severity Classification

Three-Level Severity Categorization

HIGH
Potential impact on evidence credibility or HTA decisions

MODERATE
Affects interpretation but unlikely to alter conclusions

LOW
Editorial or clarificatory inconsistencies

RESULTS

74
Total Contradictions Flagged

78.4%
Confirmed True Inconsistencies (58/74)

32.8%
High-Impact Issues (19/58)

Distribution of Confirmed Contradictions by Category

n = 58 confirmed contradictions

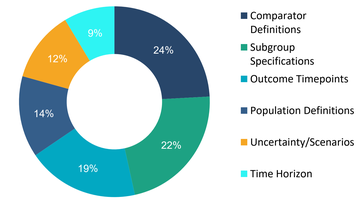


Fig 1: Distribution of confirmed contradictions by category

RESULTS (CONTINUED)

Severity Distribution of Confirmed Contradictions

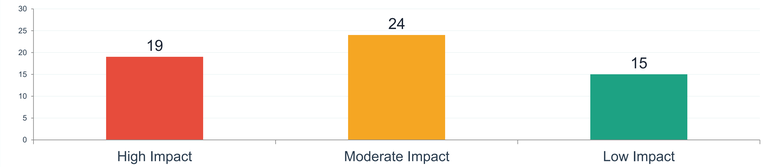


Fig 2: Severity distribution of confirmed contradictions

KEY FINDINGS

Highest concentration of contradictions: between economic model documentation and HTA submission narratives

False-positive rate: 21.6% (16/74) : most arose from statements acceptable once broader contextual framing was considered

DISCUSSION

Expert reviewers judged that approximately two-thirds of confirmed contradictions would have been difficult to detect through standard manual review alone. Human review was retained as the final adjudication step due to contextual nuance in long-form technical text.

CONCLUSIONS

The findings support the use of AI-enabled contradiction screening as a practical quality assurance layer during HTA submission development, particularly before final dossier consolidation.

By improving traceability of assumptions and exposing misalignments between clinical and economic evidence, this approach may help sponsors:

- Address potential reviewer concerns earlier
- Produce more coherent, transparent, and decision-ready submissions
- Reduce downstream HTA risk and improve evidence credibility

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