

Elevating Transparency in Data standardization: Applying XAI in SDTM, ADaM, and TLF Generation

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PRECISION
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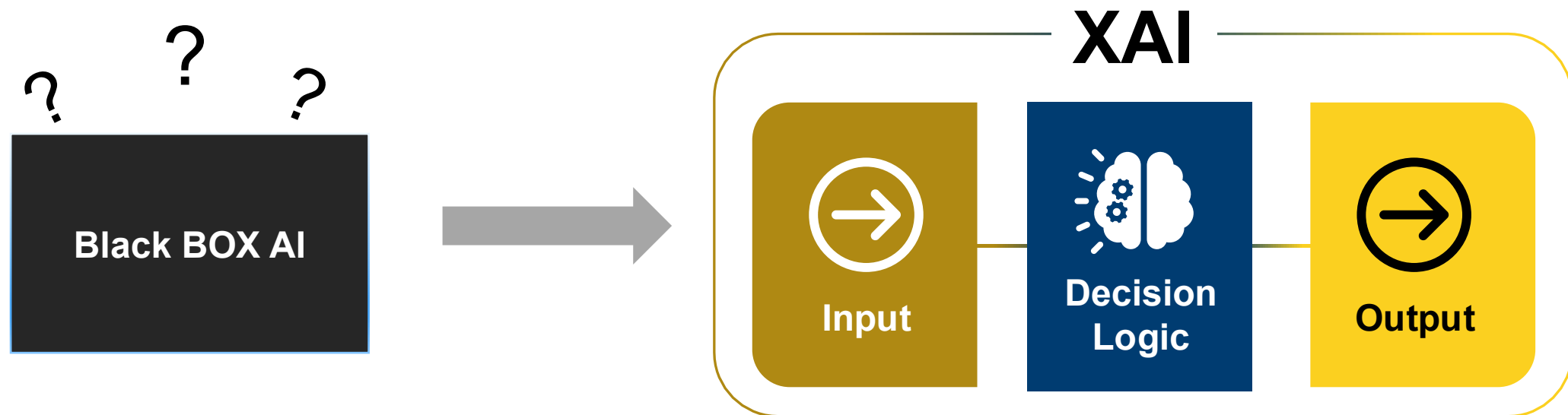
Transparency is not optional in healthcare - **it's the foundation of trust.**

Agenda

1. Introduction to Explainable AI (XAI) in Clinical Trials
2. Importance in Clinical Trials
3. Embedding XAI in Clinical Programming Workflows
4. SHAP Insights for SDTM LB Domain Mapping
5. SHAP Beeswarm Plot for SDTM Domain Mapping
6. XAI in ADAM Derivation
7. XAI for Transparent TLF Validation
8. Explainable AI in Clinical Programming: Impact, Compliance, and Future Directions

Introduction to Explainable AI (XAI) in Clinical Trials

Definition of XAI: AI systems designed to provide transparent and interpretable explanations of their decisions.



Importance in Clinical Trials

- Trust and Accountability
- Debugging Models
- Regulatory Compliance
- Bias Detection



Embedding XAI in Clinical Programming Workflows

- **SDTM Mapping with Explainability**

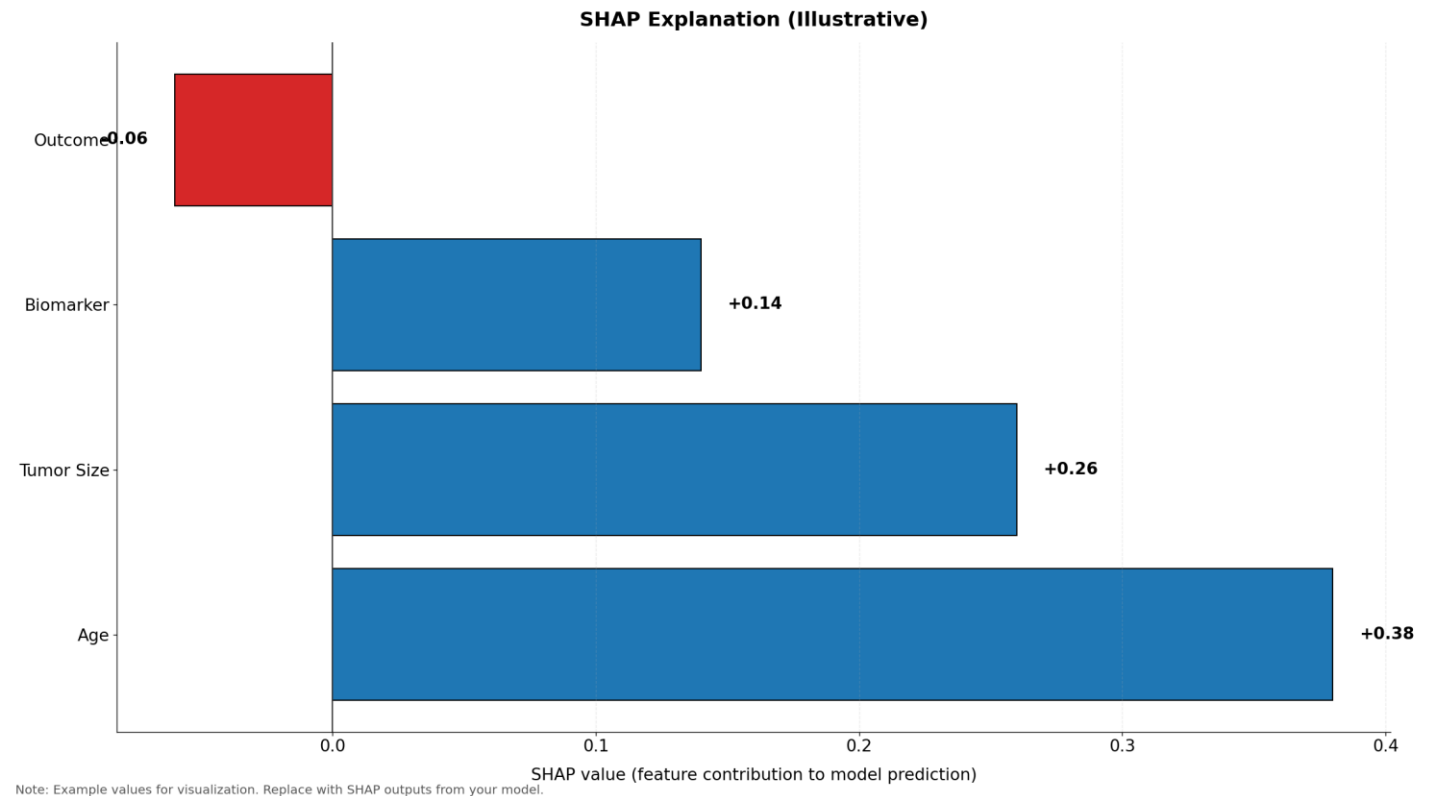
- AI suggest domain mappings
- SHAP values justify decisions

- **ADaM Derivation**

- AI proposes derived variables
- SHAP validates clinical logic

- **Transparent TLF Validation**

- AI cross-validates TLF outputs
- SHAP explains discrepancies

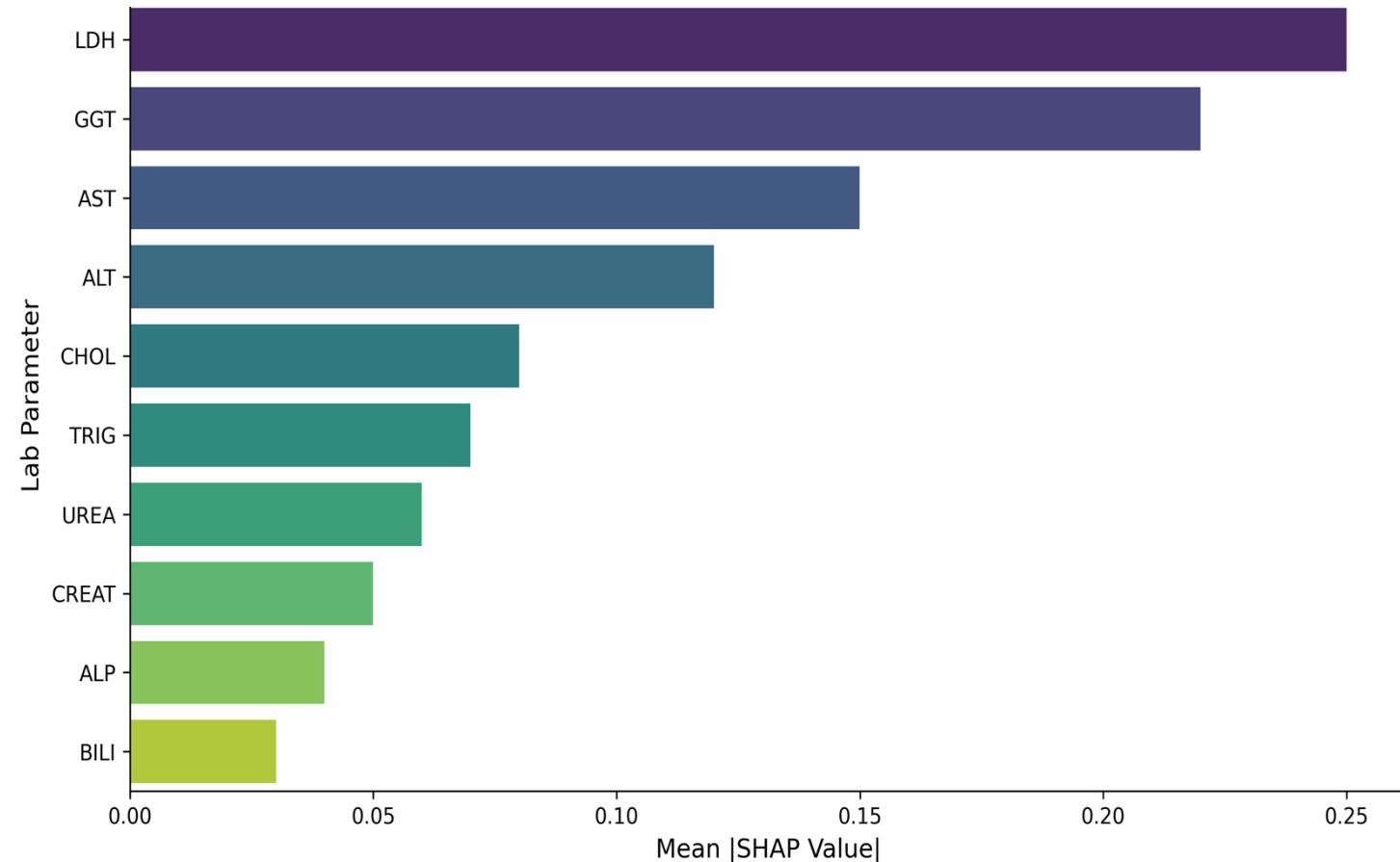


SHAP Insights for SDTM LB Domain Mapping

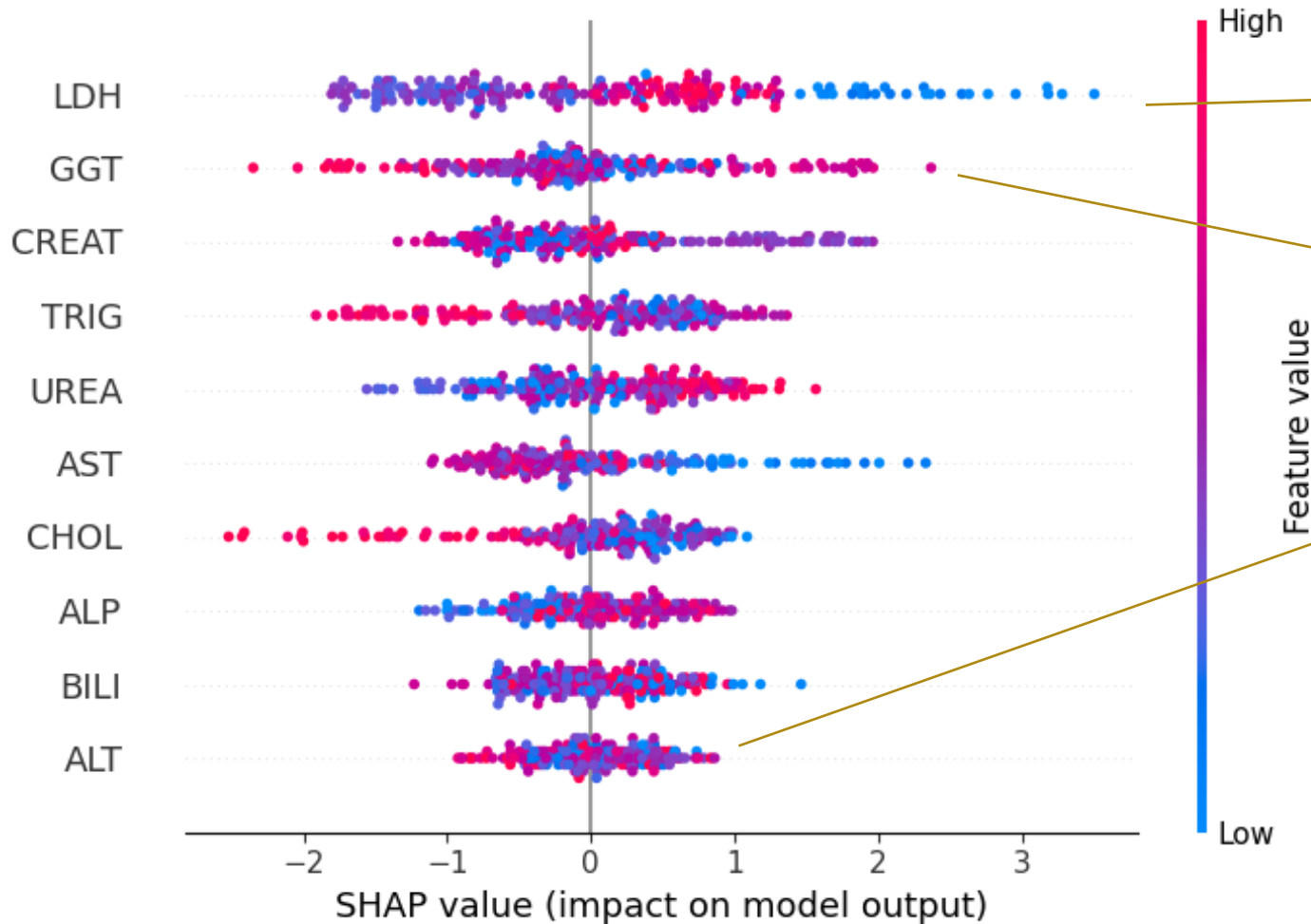
SHAP Feature Importance for SDTM Domain Mapping (LB)

Top influencers:

- LDH (0.25) and GGT (0.22) dominate LB mapping. Elevates LDH and GGT
- AST (0.15) and ALT (0.12) follow, though ALT's impact is modest.
- **Moderate impact:** CHOL, TRIG, UREA, CREAT.
- **Minimal impact:** ALP and BILI.



SHAP Beeswarm Plot for SDTM Domain Mapping



High LDH (pink) → strongly positive SHAP values → **increases LB classification likelihood**. This aligns with clinical expectations since LDH elevation often indicates tissue damage.

High GGT (pink) → positive SHAP values → strong positive influence on LB classification. Matches liver-related clinical markers.

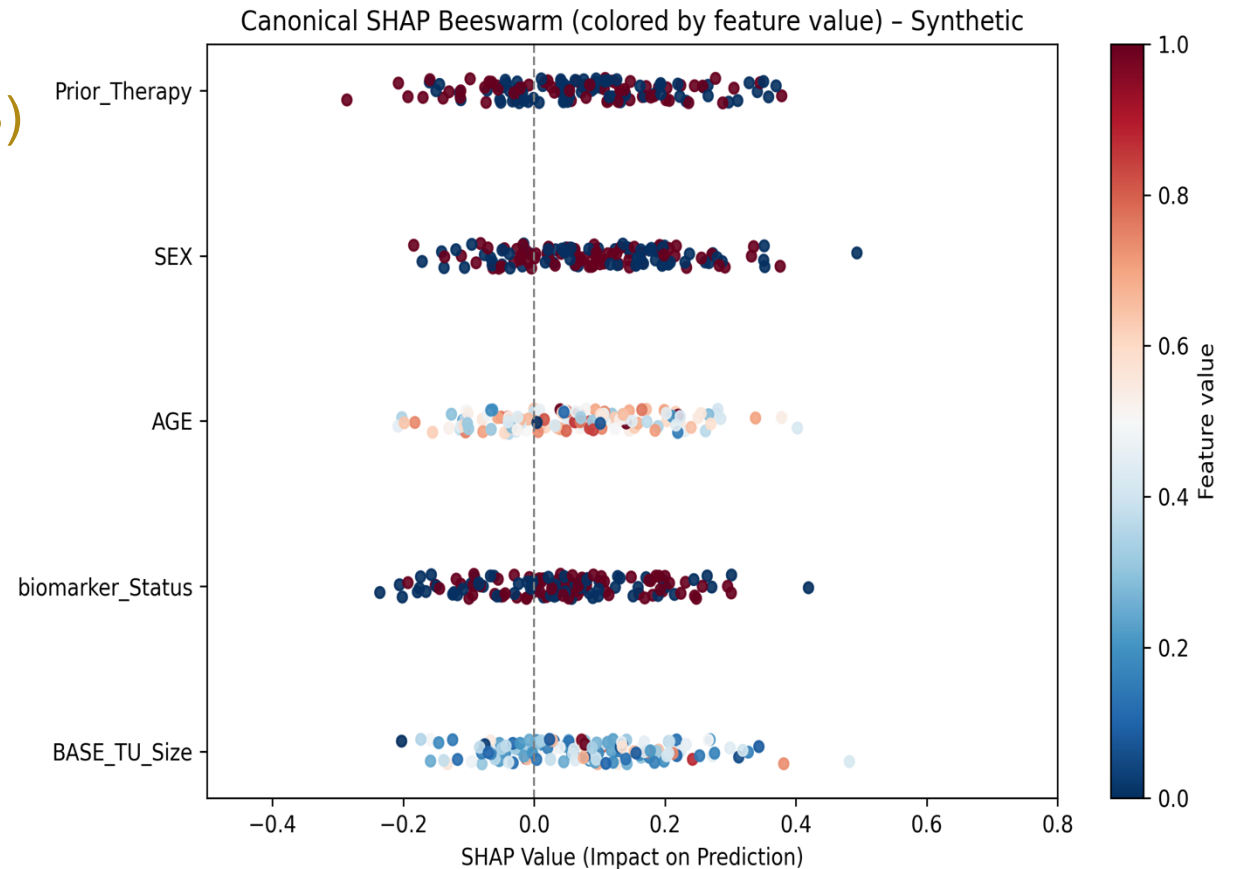
ALT Clustered near zero SHAP → minimal impact on LB classification. High ALT does not strongly push LB likelihood in this model.

Parameter	Model Influence	Clinical Expectation	Alignment
LDH	Strong positive	High LDH → liver/tissue damage	✓
GGT	Strong positive	High GGT → liver dysfunction	✓
AST	Low values positive	High AST → liver injury	✗
ALT	Minimal	High ALT → liver injury	✗
CHOL, TRIG	Weak	Indirect liver marker	✓ (weak)
UREA, CREAT	Weak	Kidney markers	✓ (weak)
ALP, BILI	Minimal	Liver markers	✓ (weak)

XAI in ADAM Derivation

SHAP Insights for Efficacy Endpoints (e.g., PFS)

- Creates analysis-ready datasets for endpoints (PFS, OS)
- Adds transparency to complex derivations
- Key Drivers:
 - Tumor size ↓ PFS
 - Positive biomarker ↑ survival
 - Older age ↓ survival
- SHAP validates AI logic with clinical principles



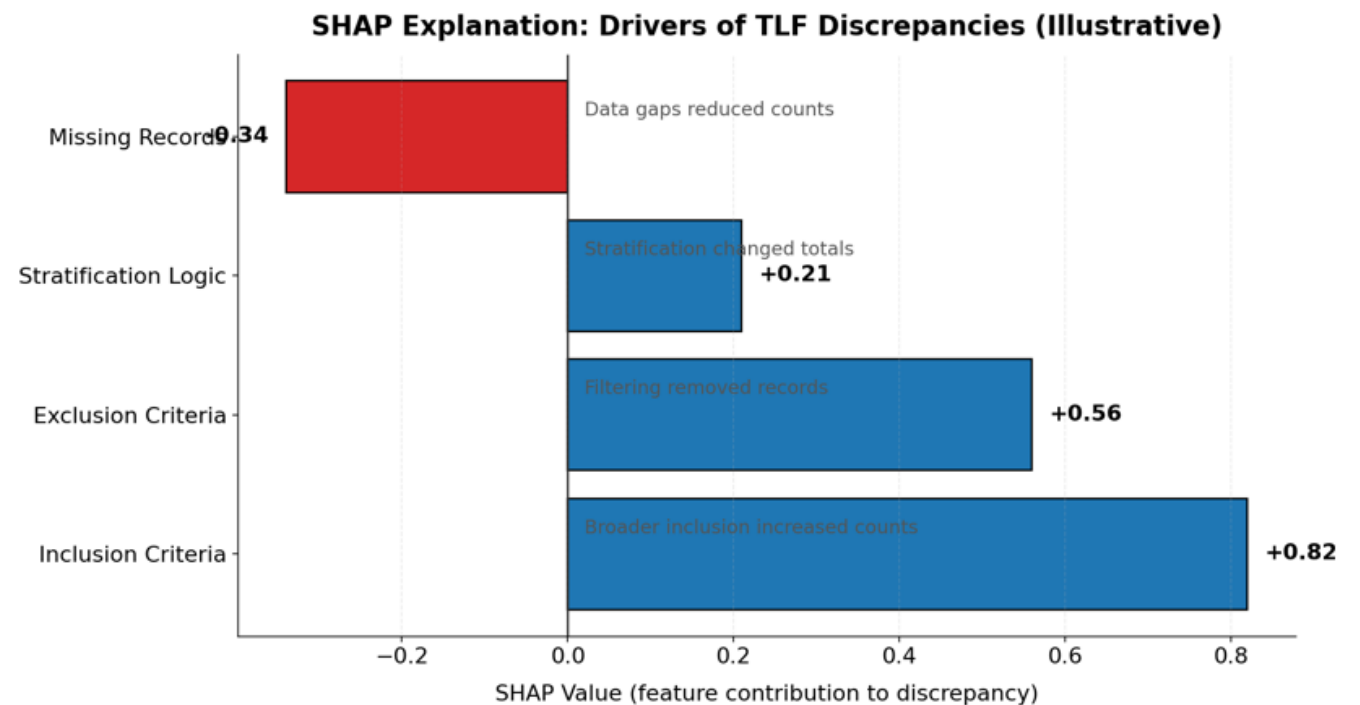
Each dot represents a patient, SHAP value shows feature impact on PFS prediction. Color indicates feature value.

XAI for Transparent TLF Validation

SHAP Insights for Detecting Output Discrepancies

Why TLF Validation Matters:

- Align outputs with ADaM datasets.
- Detect discrepancies early.
- Reduces compliance risk.
- Protects clinical decisions based on AE/efficacy summaries



SHAP explains *why* discrepancies occur — enabling faster root-cause analysis, auditability, and confidence

sdm_shap_dashboard

Validation_dashboard

localhost:8501

Chat

Limit 200MB per file • XPT

Browse files

dm.xpt
7.5KB

Upload cm.xpt

Drag and drop file here
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Browse files

cm.xpt
70.1KB

Upload lb.xpt

Drag and drop file here
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Browse files

Select Model

Random Forest

Select Target for Prediction

AESER

Deploy

SDTM SHAP Explainability Dashboard with Clinical Narratives

Please upload all required SDTM .xpt files to continue.

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Why XAI Matters for Clinical Decision-Making

- **Ensuring Accurate and Trustworthy Outputs**
 - Builds trust in safety and efficacy data.
- **Better Risk-Benefit Decisions**
 - Transparent AI reduces errors.
- **SHAP Explanations**
 - Identify factors behind discrepancies.
- **Enhancing Transparency and Trust**
 - Promotes confidence among clinicians and regulators.





Compliance and Auditability

- **Regulatory Framework Alignment**
 - Aligns with FDA, ICH E6(R3) and GxP guidelines.
- **Audit Trail Strengthening**
 - SHAP strengthens audit trails.
- **Supporting 21 CFR Part 11**
- **Preparing for Future Regulations**
 - Prepares for future AI transparency standards.

What's Next for XAI in Clinical Programming?

- **Automation with Large Language Models**

- Generate SAS code and docs from natural language.

- **Real-Time Feedback**

- AI systems learn from user overrides.

- **Interactive Dashboards for Interpretability**

- SHAP visualizations for live validation.

- **Cross-Therapeutic Scalability**

- Expand to rare diseases and device trials.



An abstract graphic on the left side of the slide features three distinct, overlapping, fan-like shapes in blue, magenta, and yellow, each composed of numerous thin, curved lines radiating from a point on the left. The background is dark blue with a pattern of small, colorful dots and a faint, repeating binary code (0s and 1s) in various colors.

Key Takeaways

- **Transparent Clinical Workflows**

- XAI enables auditable, standards-compliant processes.

- **Trust through Interpretability**

- SHAP-based insights builds trust in AI outputs.

- **Operational Efficiency Gains**

- Cuts programming time **by up to 38%**.

- **Strategic Compliance Enabler**

- Positions for future regulatory requirements.



Questions and Discussion

Thank you

