# Machine Learning in Healthcare Training Course: Prediction, Imaging and Clinical Validation

4 – 15 April 2027
Muscat

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## Programme Summary

Machine learning in healthcare is the subject of this two-week training course for healthcare directors, informatics heads and medical leaders at strategic level, ending in a model assurance file for one clinical model. Hospitals and health systems are offered models that predict risk, read scans and summarise notes, yet leaders often judge them by vendor claims rather than evidence. The programme explains how each model family works, how it is evaluated and validated, and how it is monitored once in use, applying every step to cases from several sectors. Mars Training Centre UK delivers this programme on machine learning in healthcare to mixed-organisation cohorts.

## The Business Case

A clinical model that performs well in a demonstration can fail on a different patient group, a new scanner or a changed referral pattern. Leaders who commission or approve such models carry the safety, quality and cost consequences without needing to write code. A shared evaluation method gives medical directors, informatics teams and quality leaders one language for questioning evidence, setting limits and reviewing performance after go-live.

- Patient Safety Events: Fall as validation, threshold setting and escalation rules are agreed before a model is used.
- Unequal Performance: Falls as subgroup testing shows where a model serves some patients poorly.
- Wasted Spend: Falls as commissioning questions screen out models without sound evidence.

## Principles and Evidence Base

- TRIPOD+AI: This reporting guidance for clinical prediction models using regression or machine learning structures the evidence review in Session 7.
- Receiver operating characteristic analysis: Its trade-off between true and false positives guides the metric and threshold work in Session 3.
- Bias-variance trade-off: This statistical principle underpins model selection in Sessions 2 and 3.
- Model lifecycle approach: Its stages from framing to retirement organise Sessions 1, 8 and 9.

## Intended Participants

- Healthcare directors who decide which clinical models enter care pathways.
- Digital health and informatics heads who commission, integrate and monitor models.
- Medical directors who carry clinical accountability for decisions that models inform.
- Quality and patient safety leaders who audit model performance and incidents.
- Procurement and contract leads who assess vendor evidence for clinical models.

Typical settings include hospital groups, health insurers, diagnostics providers and public health bodies.

## Learning Outcomes

1. Participants will be able to construct a problem framing for a clinical use case that states the decision, data and risk.
2. Participants will be able to evaluate prediction, imaging and language models against suitable metrics and thresholds.
3. Participants will be able to diagnose weaknesses in training data, annotation and dataset shift.
4. Participants will be able to assess bias and fairness through subgroup performance and explainability methods.
5. Participants will be able to justify a validation plan and reporting approach to a clinical governance committee.
6. Participants will be able to design monitoring, escalation and retirement rules for a deployed model.

## Programme Structure

## Day 1: Machine Learning in Healthcare Foundations

What can models do in care, and how are they built from data to prediction?

- Care Pathway Use Case Map
- Learning Paradigm Overview
- Clinical Data Readiness Checklist
- Model Lifecycle Diagram
- Problem Framing Canvas

## Day 2: Prediction Models for Risk and Triage

How do supervised models estimate patient risk, and what makes an estimate usable?

- Risk Score Model Anatomy
- Regression and Tree Model Comparison
- Feature Selection Review
- Triage Prediction Case
- Calibration Curve Reading

## Day 3: Model Selection and Evaluation Metrics

Which model and which metric fit the clinical question?

- Sensitivity and Specificity Trade-off
- Discrimination Metric Review
- Threshold Setting Sheet
- Cross-Validation Plan
- Baseline Comparison Table

## Day 4: Medical Imaging Models

How do image models read scans, and where can they go wrong?

- Convolutional Model Overview
- Annotation Quality Audit
- Classification and Segmentation Contrast
- Scanner Shift Check
- Reader Study Design

## Day 5: Language Models for Clinical Text

How do language models handle notes and reports, and what can they get wrong?

- Note Extraction Use Cases
- Language Model Capability Map
- Hallucination Risk Register
- Retrieval Pattern Review
- De-Identification Check

## Day 6: Bias, Fairness and Explainability

Which patients might a model serve poorly, and how is that shown?

- Subgroup Performance Table
- Fairness Metric Comparison
- Explainability Method Review
- Clinician Trust Assessment
- Mitigation Options Log

## Day 7: Clinical Validation and Reporting

What evidence shows that a model works for the patients it will serve?

- Internal and External Validation Design
- TRIPOD+AI Reporting Checklist
- Prospective Evaluation Protocol
- Evidence Level Grid
- Validation Report Outline

## Day 8: Deployment, Monitoring and Safety

How is a model run safely once it is in use?

- Workflow Integration Map
- Drift Monitoring Dashboard
- Safety Case Template
- Override and Escalation Rules
- Retirement Criteria Sheet

## Day 9: Commissioning and Oversight

How do leaders buy, govern and review clinical models?

- Vendor Evidence Question Set
- Model Register Design
- Oversight Committee Charter
- Data Protection Impact Review
- Value Tracking Sheet

## Day 10: Applying the Tools to One Clinical Model

Do the framing, evaluation and safety tools produce one assured model?

- Applying the Session 1 Problem Framing Canvas
- Using the Session 3 Threshold Setting Sheet
- Running the Session 6 Subgroup Performance Table
- Checking the Session 8 Safety Case Template
- Completing the Model Assurance File

## Methodology

The programme uses case analysis supported by structured exercises. Participants work in mixed clinical and management teams on anonymised model summaries, performance tables, scan examples and note extracts drawn from hospital, diagnostics and insurance settings. Teams question the evidence for each model, challenge each other's conclusions and receive written facilitator feedback after every exercise set. Each session closes with a decision on whether the evidence supports use.

- Suggested activity: Choosing a decision threshold for a deterioration alert and defending it.
- Suggested activity: Reading a performance table to find a subgroup the model misses.
- Suggested activity: Drafting escalation rules for a drifting imaging model.

## Capstone Output

Each participant completes a model assurance file for one clinical model. It holds a problem framing, an evaluation summary, a subgroup performance table, a validation plan, a safety case and monitoring rules. The file is used at work to brief the clinical governance committee, to question vendors and to set the review cycle for the model after go-live.

## Frequently Asked Questions

### Is machine learning in healthcare suitable for leaders who do not code?

Yes. Machine learning in healthcare is taught at strategic level through case material, tables and checklists, so programming is not required, though familiarity with clinical decision making and basic statistics is assumed.

### Which models and guidance does machine learning in healthcare draw on?

Machine learning in healthcare draws on TRIPOD+AI reporting guidance, receiver operating characteristic analysis, the bias-variance trade-off and a model lifecycle approach, each applied in named sessions.

### How is the file from machine learning in healthcare used at work?

You use the model assurance file to brief a clinical governance committee, to question vendors about evidence and to set the review cycle for a model in use.

### How does machine learning in healthcare differ from a health data analytics programme?

Machine learning in healthcare concentrates on prediction, imaging and language models and the evidence needed to use them safely, while health data analytics concerns reporting and descriptive analysis of records.