Expanding Horizons: Developing and Implementing AI Models for Delirium Prediction in Critical Care

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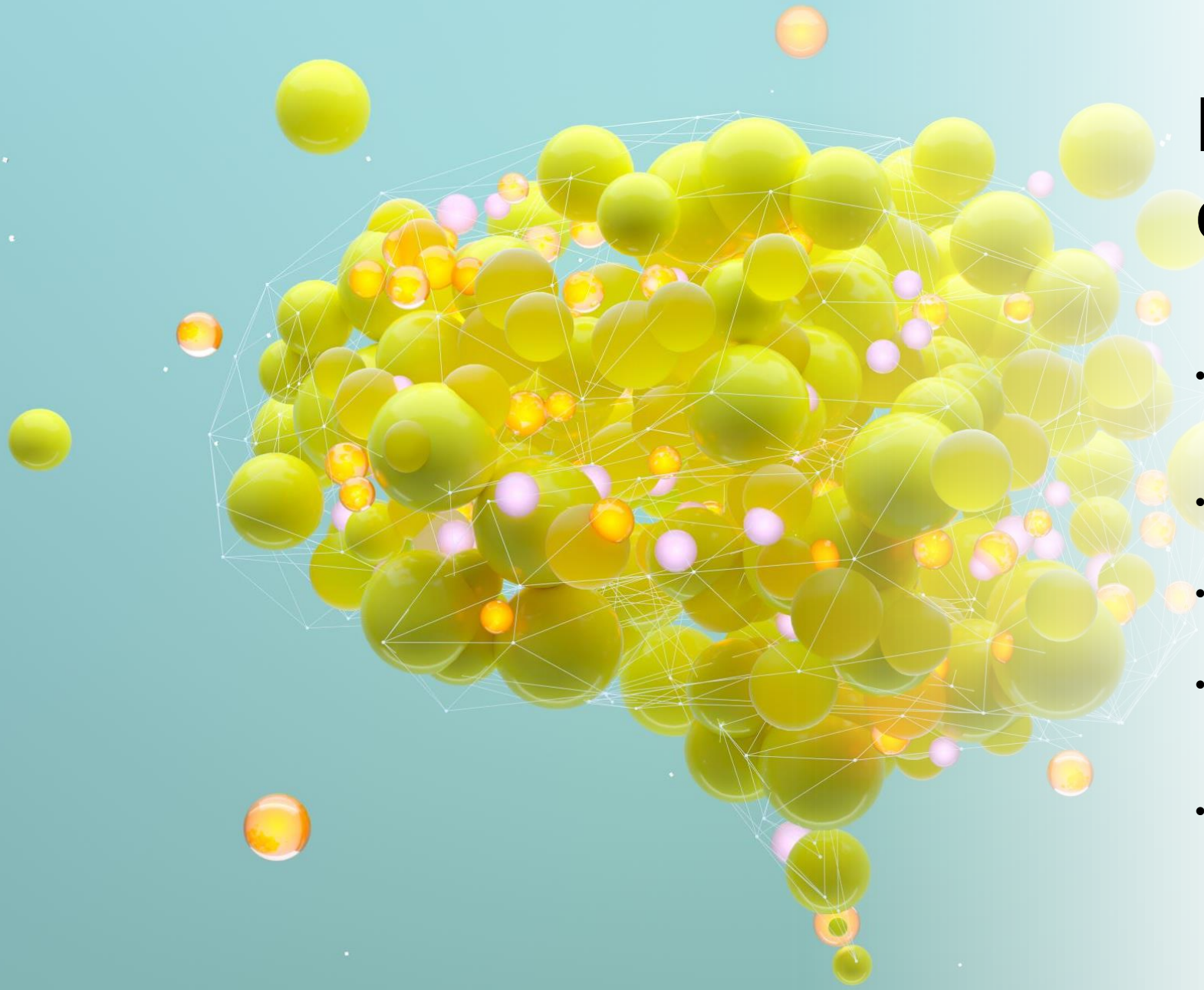
Disclosures

None



Learning objectives

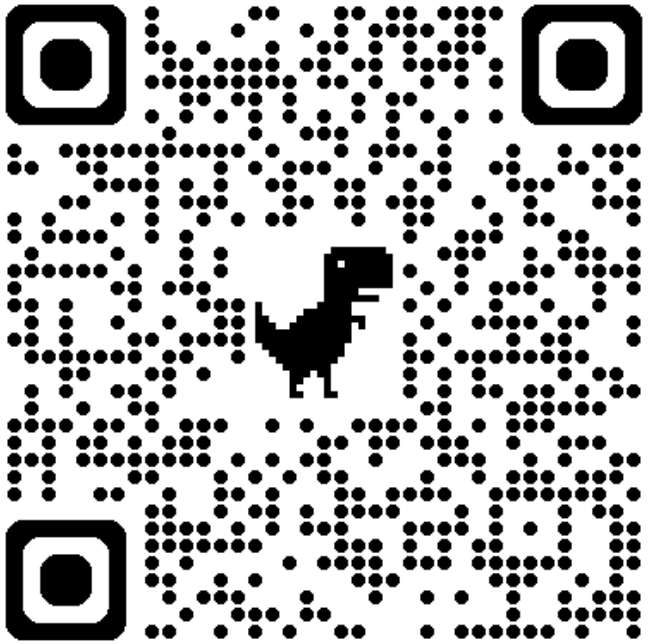
- Understand the principles behind AI model development for delirium prediction.
- Identify challenges like transparency, fairness, and bias in AI.
- Explore the lifecycle of an AI algorithm and its clinical implementation.
- Envision the future of AI in delirium care, including multimodal approaches.
- Apply insights to improve AI development and integration in healthcare.

Imagine an ICU where delirium risk is detected early, interventions are timely and personalized, and outcomes improve for every delirious patient. This future is possible and relies on tools that seamlessly integrate into clinical workflows.

I'll walk you through how we approached building a delirium prediction model that aligns with this vision, prioritizing usability and interpretation.

Model Building

- Delirium prediction to use as a screening tool
- 16546 patients
- Continuous prediction using sliding observation windows



JOURNAL ARTICLE

Delirium prediction in the ICU: designing a screening tool for preventive interventions

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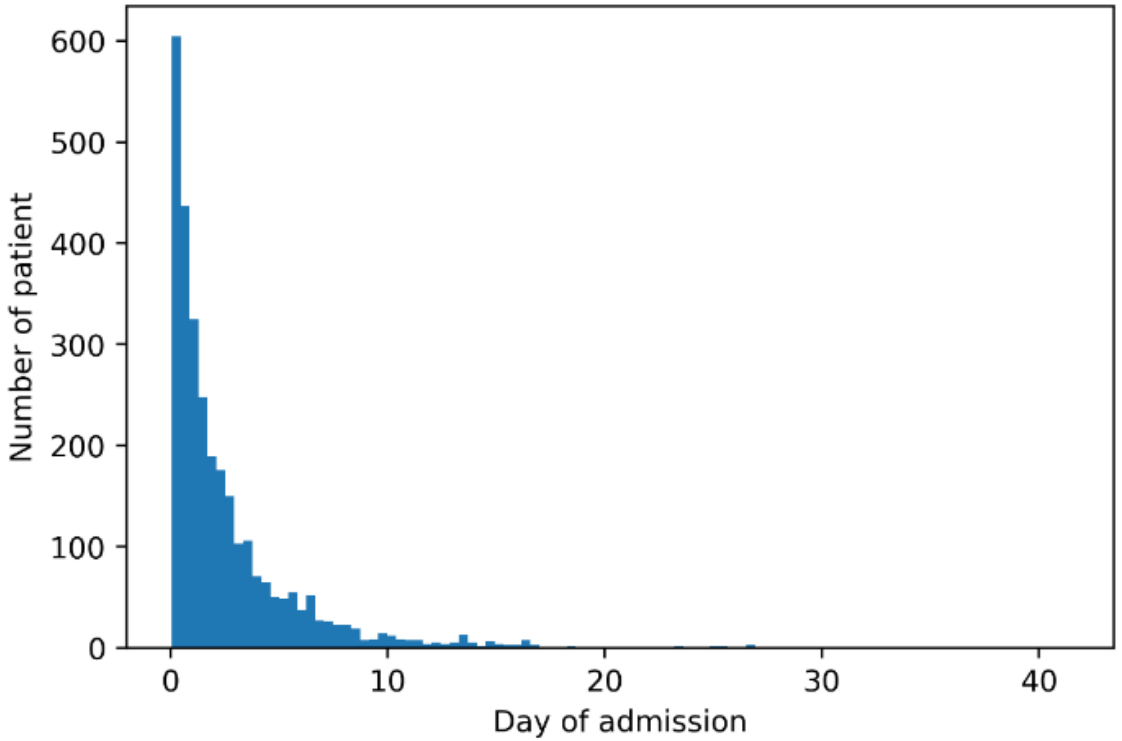
Model Building - Outcome

- Typically diagnosed using CAM-ICU
- We analyzed *timing* and *frequency* to plan prediction



Model Building - Features

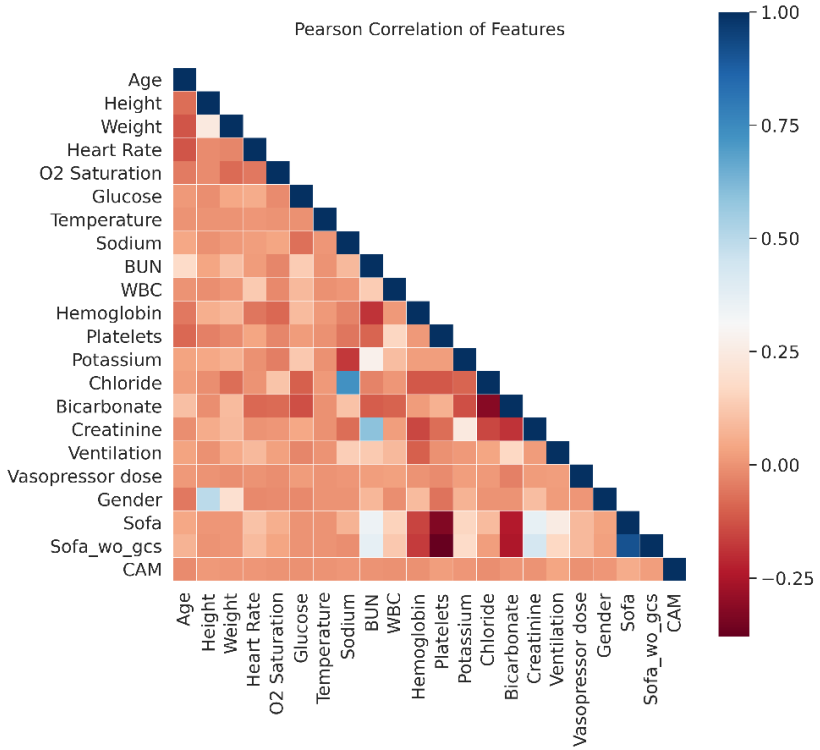


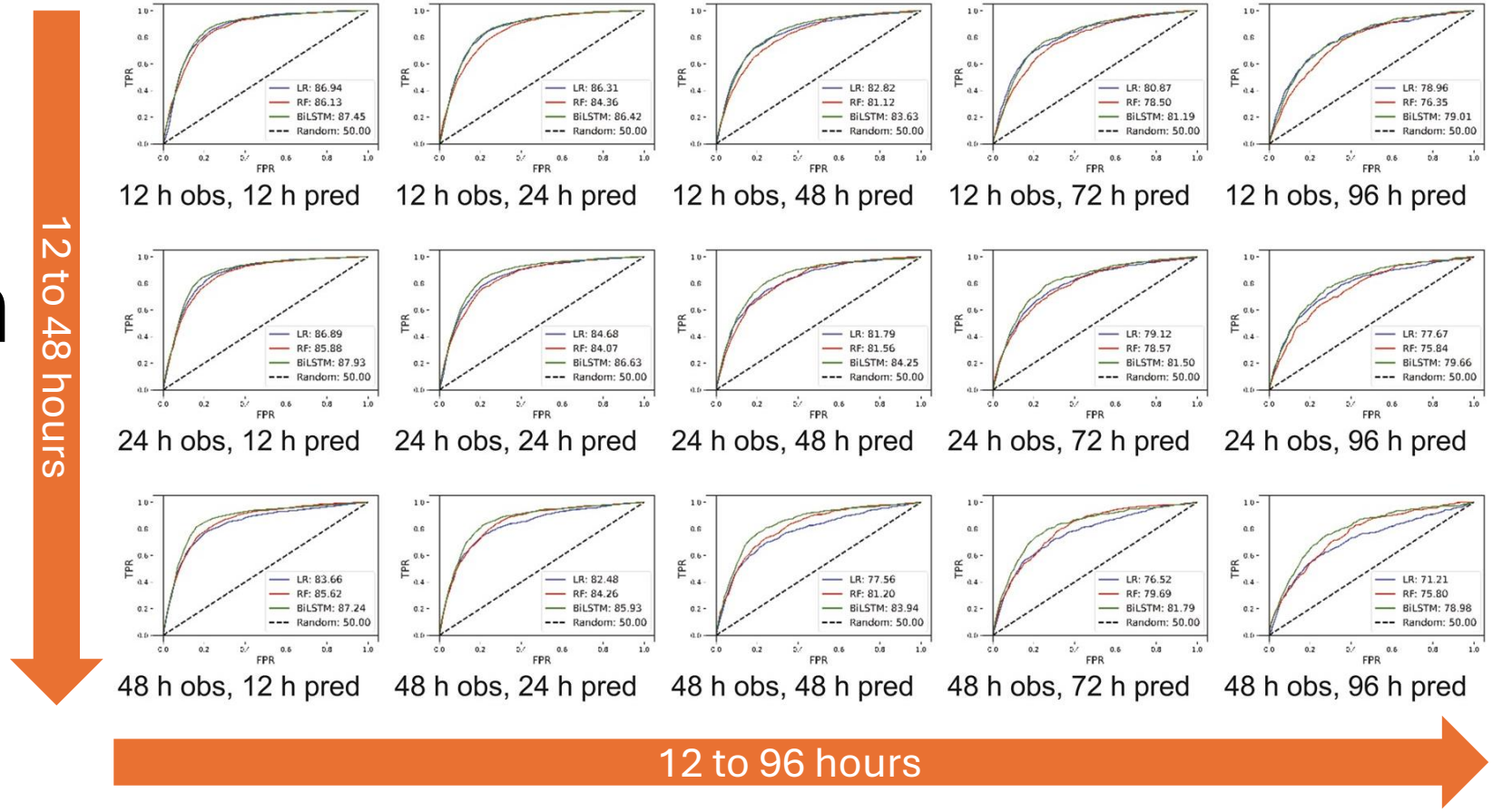
Table 1.
Variables included in the prediction models

Demographic data
Age, gender, height, weight
Vital signs
Oxygen saturation (SpO_2), heart rate (HR), temperature
Other measurements
Sofa, sofa without GCS, Ventilation
Laboratory measurements
White blood cell count (WBC), sodium (Na), blood urea nitrogen (BUN), glucose, hemoglobin, platelets, potassium, chloride, bicarbonate, creatinine
Medications as continuous drips
Dopamine, epinephrine, norepinephrine, phenylephrine (all calculated as norepinephrine equivalent)

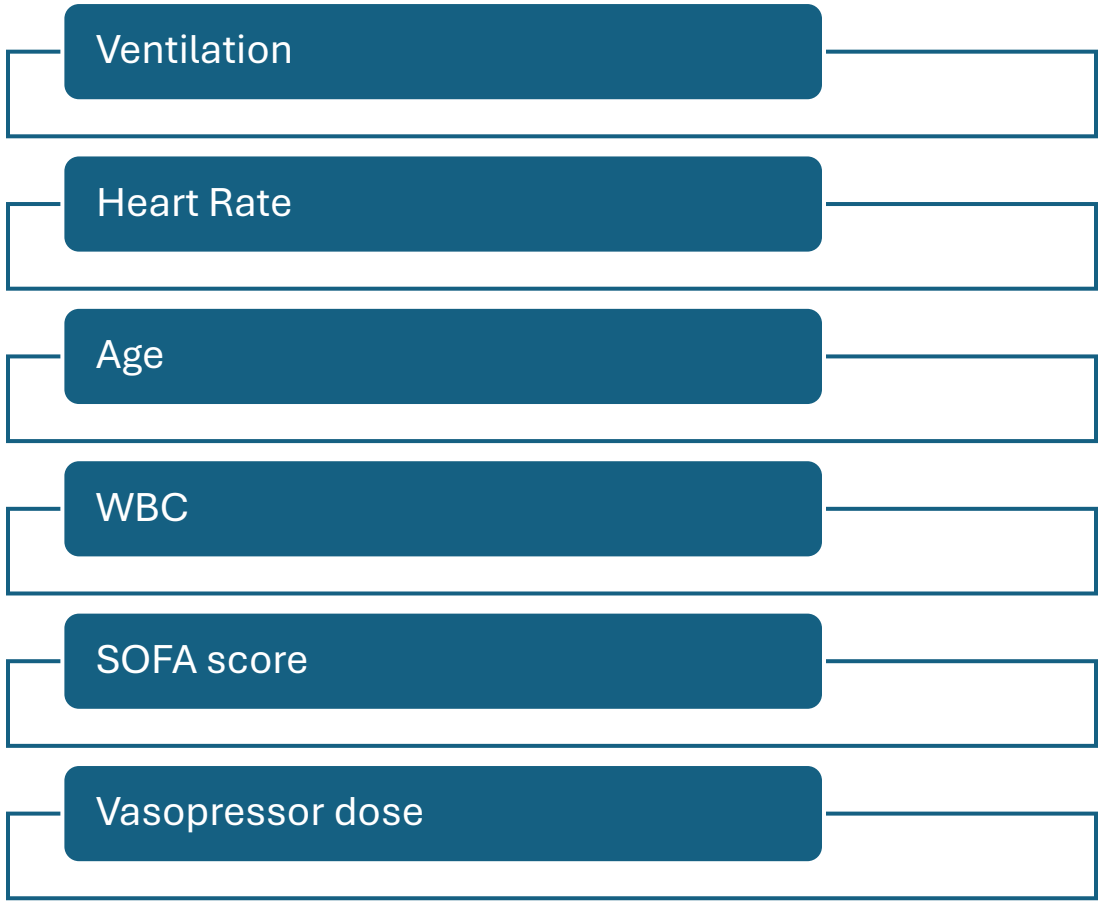
Model Building - Missingness

Variable	eICU (%)	MIMIC-III (%)
Serum Bicarbonate	2.18	14.58
BUN	0.54	9.30
Chloride	0.53	13.65
Serum creatinine	0.61	14.53
Glucose	0.34	5.71
Heart Rate	2.00	0.05
Hemoglobin	0.59	10.21
Oxygen Saturation	2.05	0.13
Platelets	1.65	16.04
Serum Potassium	0.51	13.49
Total norepinephrine dose	0.00	0.00
Serum Sodium	0.51	13.57
SOFA	0.00	0.00
SOFA without GCS	0.00	0.00
Temperature	0.09	4.08
Ventilation	0.00	0.00
WBC	0.65	15.52

Model Building – Observation and Prediction Windows



Model Building - Optimization



	Not optimized	Optimized
Precision	0.38	0.27
Recall	0.86	0.94

Model Building – Challenges Ahead

- Fairness Metrics
- Transparency
- Explainability → Causality
- Real time performance
- Deal with discrepancies

Implementation: Research to Practice

- Standards, best practices, and operational tools
- Quality assurance
- Transparency and accountability
- Risk management for AI models in health care

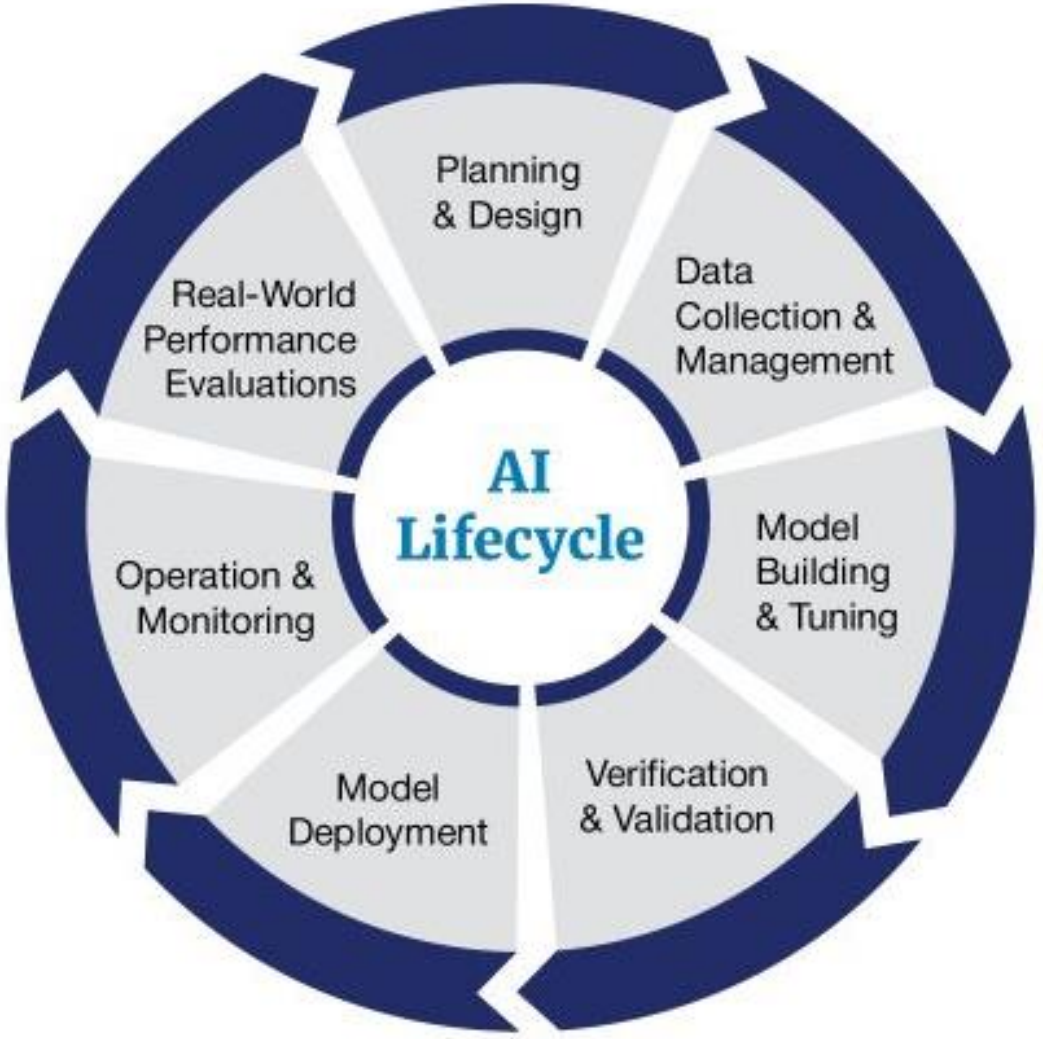
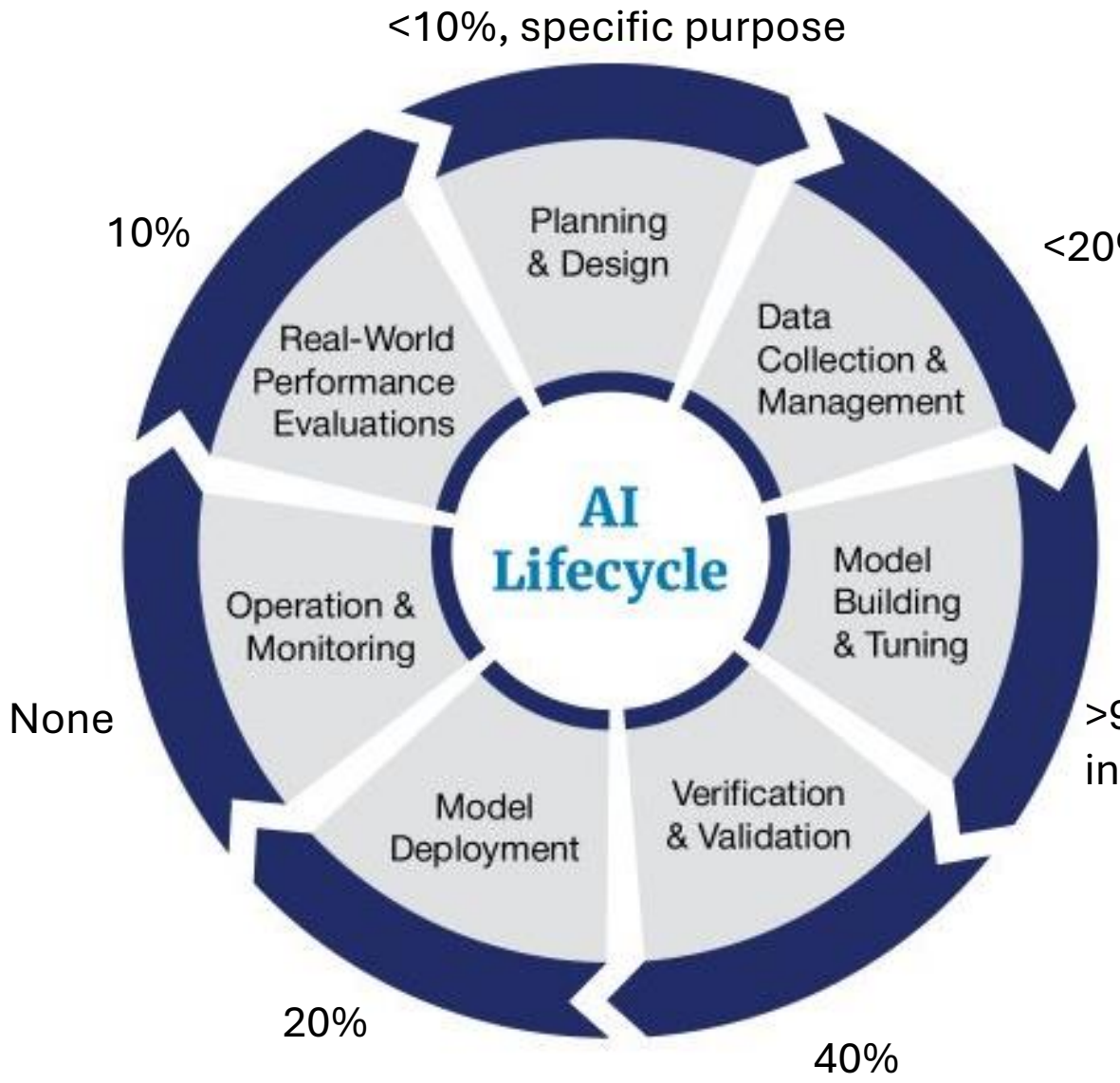


Image Source: FDA

Reporting of delirium prediction algorithms



Future of AI models for Delirium

Model evolution

Different models for different outcomes

Personalized Care

Proactive and Preventive

Multimodal AI

Structured Data, Computer Vision, Knowledge base

Tie data to context

Trust building and Integration

Data visualization tools

Action items integrating with A2F bundle

Clinician training

“The best way to predict the future is to create it.” – Peter Drucker

“Together, we can shape the future of delirium care through innovation, collaboration, and action.”

What do we do next?

Think about your role

Standardize AI building and implementation

Advocacy for AI integration, data sharing

Multidisciplinary teams and settings to address challenges

Questions?

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