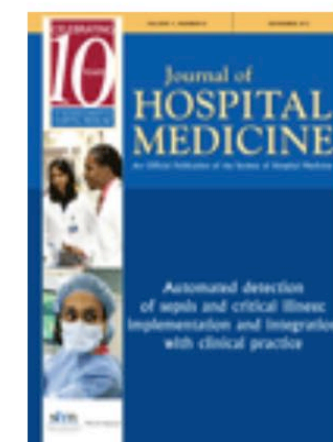ADVANCE ALERT Monitor

Advance Alert Monitor Variables

Designed to predict an ICU transfer or unexpected death in the next 12 hours

Laboratory	Vital signs	Patient & hospital factors	Composite indices
Anion gap	Diastolic BP	Age	LAPS2 – acute
Bicarbonate	Systolic BP	Gender	severity of illness
Glucose	Heart rate	Care directive	COPS2 – chronic
Hematocrit	Oxygen saturation	Length of stay	comorbidity score
Lactate	Respiratory rate	Season	
Blood urea nitrogen	Temperature	Time of day	
Creatinine	Shock index	Admission type	
Sodium	Neurologic status	Hospital facility	
Troponin			
WBC count			

KAISER PERMANENTE.
DIVISION OF RESEARCH

Journal of HOSPITAL MEDICINE

Journal of Hospital Medicine 2017

KAISER PERMANENTE®

ADVANCE
ALERT Monitor

Designing integrated clinical response pathways

Establishing standardized processes and timelines for alert response

Alert
time-zero   1 hour   3 hours   6 hours

Within 1 hour
eHospital chart review
Call to local RRT nurse

Within 3 hours
RRT RN talks to 1° RN
Vitals re-evaluation
Calls 1° MD with SBAR

Within 6 hours
MD evaluation/diagnosis
Communicate plan with team
Consult social services/palliative care

Before hospital discharge
Social services reviews charts to ensure
documentation of decision-maker
Additional services, if appropriate

KAISER PERMANENTE®

ADVANCE
ALERT Monitor

Improving AAM patient-provider communication

Helping patients understand how our tools are designed to enhance clinical practice

KAISER PERMANENTE®

ADVANCE
ALERT Monitor

Interim results of AAM Beta Pilots

Deployment based on 1st/2nd generation EMR-external solution

Matched groups	Alerted Patients in AAM Live Hospitals *(n = 3,097)*	Matched Patients in non-AAM Hospitals *(n = 3,097)*
Inpatient mortality	8.8%	10.8%
30-day mortality	14.2%	16.4%
Decision-maker documented[1]	76 – 95%	40 – 47%

[1]Data from first 3 medical centers on 2nd generation platform between 2016 to 2018

KAISER PERMANENTE®

Roger's Hospital Course – today with AAM

- 6 hours after admission:
  - AAM system alerts
  - RRT RN, bedside RN, and covering MD evaluate Roger
  - Document their assessment with criteria for escalation

- 7 AM the next morning:
  - Oncoming RRT RN conducts proactive AAM follow-up rounds
  - Roger is still confused, with worsened breathing
  - RN requests an arterial blood gas – Roger found to be retaining CO_2

- 8 AM:
  - Based on the AAM score and her assessment, RRT RN calls the ICU team
  - They agree that Roger would benefit from ICU admission

18

Roger's Hospital Course: towards recovery

- In the ICU that day:
  - Roger was sedated, given antibiotics, and placed on BiPAP overnight

- By the next AM:
  - Roger was off BiPAP and sitting with family
  - Imaging showed a psoas abscess
  - IR drained the abscess

- Two days later:
  - Roger recovered and went home

ADVANCE ALERT Monitor

A RRT RN's experience of AAM

Thu-Thuy Bui, KP Santa Clara Medical Center

Nurses and doctors are sometimes too busy to keep track of small changes in patients and AAM can pick these up before an RRT…

I want to be able to see the AAM scores directly so we can improve our own screening practice…

In my experience, about 20% of alerts turn out to be real…

I have so many stories like this of AAM working, where the score helps us to get to patients earlier…

KAISER PERMANENTE®

ADVANCE
ALERT Monitor
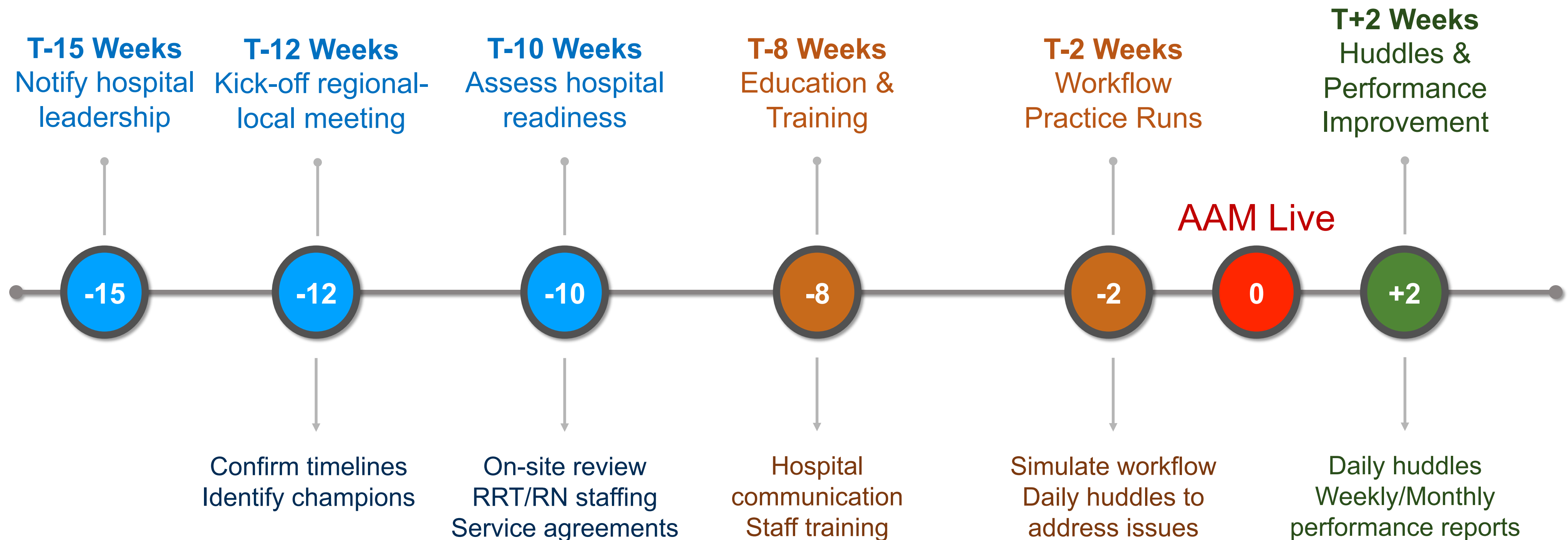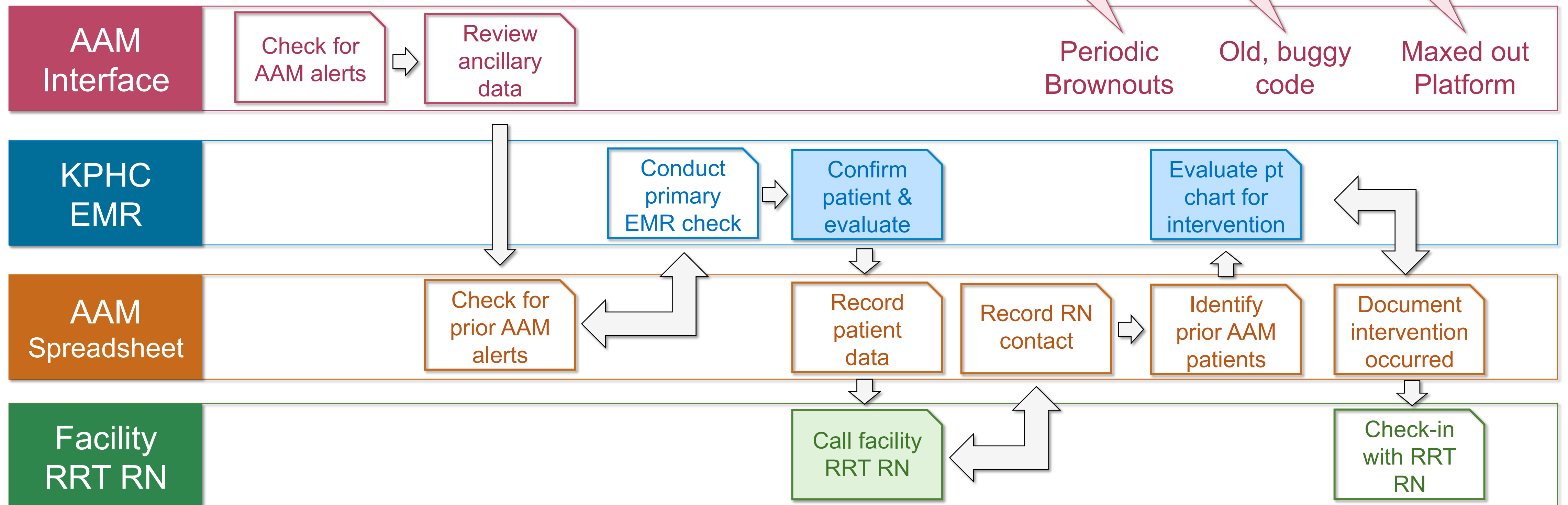
LAPS2, COPS2, and AAM scores

KPNC-wide real-time risk scoring in production

Score	Metric	C-statistic (Live)	KPHC stored values per day
LAPS2	Acute severity of illness	0.84	~64,000
COPS2	Chronic comorbid disease burden	0.73	~400
AAM	Risk of ICU transfer or unexpected death among inpatients	0.76 *(low outcome rate)*	~45,000

KAISER PERMANENTE®

Challenges in model validation

Validation step	Example
Translating curated model parameters to real-time data	Lactate values
Simple transcription errors	SBP rules
Limitations to Epic properties	Ratios (shock index) Neuro scores
Timestamp data differences	All subscore values
Lack of decimal places in risk score output	AAM score alert threshold

KAISER PERMANENTE®

Key Takeaways

- The promise of real-time predictive models is exciting
- Explicit conversations between Data and Delivery Science are needed
- Governance is needed to improve all aspects of model value
- The Epic platform offers advantages for integrated model deployment
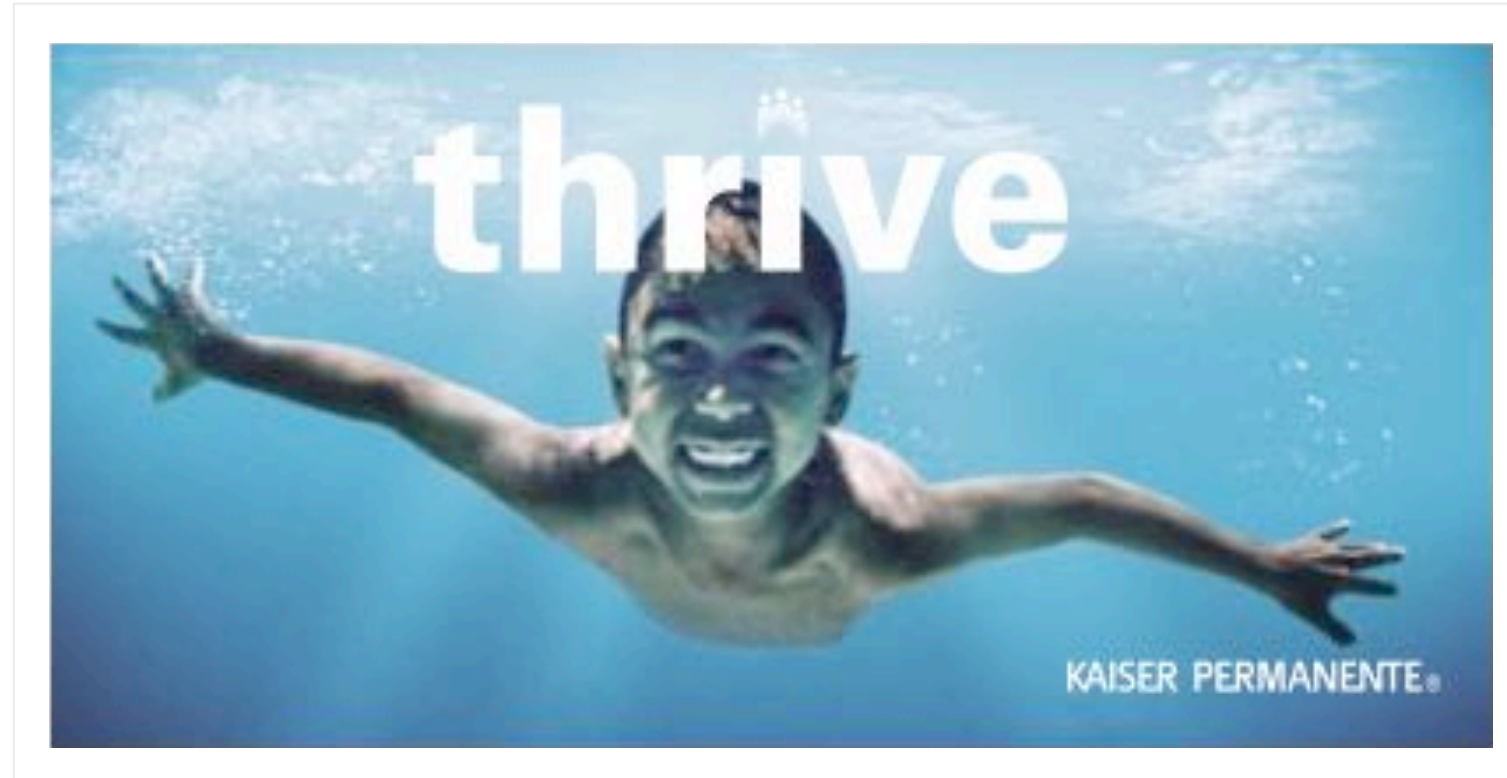- However, there are challenges in the platform

vincent.x.liu@kp.org

ADVANCE ALERT Monitor

thrive

KAISER PERMANENTE.

KAISER PERMANENTE.