AI for Prediction, Early Warning, & Risk Assessment: Concepts of Utilization for Healthcare & Public Health Emergency Operations

Presented by:

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“The Unknowns”

“As we know, there are known knowns. There are things we know we know. We also know there are known unknowns. That is to say we know there are some things we don’t know. But there are also unknown unknowns, the ones we don’t know we don’t know.”

SecDef Donald Rumsfeld: DoD News Briefing 12 Feb 2002.

How can AI shift the “unknowns” to ”knowns” and how will that impact our operations moving forward?

HCA Healthcare

HCA Healthcare is one the nation's leading providers of healthcare services, comprised of **182** hospitals and approximately **2,400** ambulatory sites of care in **20** states and the United Kingdom

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HCA Healthcare®

Network	Patients
182 hospitals	**35.7M** patient encounters
127 freestanding emergency rooms	**8.5M** emergency room visits
125 surgery centers	**2.1M** admissions
257 urgent care clinics	**217k** deliveries

HEALTHTRUST Performance Group

Enterprise Preparedness & Emergency Operations (EPEO)

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Vice President & Chief

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HCA's Legacy: Putting Patients First

"The great hospitals will **always put the patient and the patient's familyfirst**, and the really great institutions will provide care with warmth, compassion, and dignity for the individual."

Dr. Thomas Frist, Sr.

Emergency Operations Mission

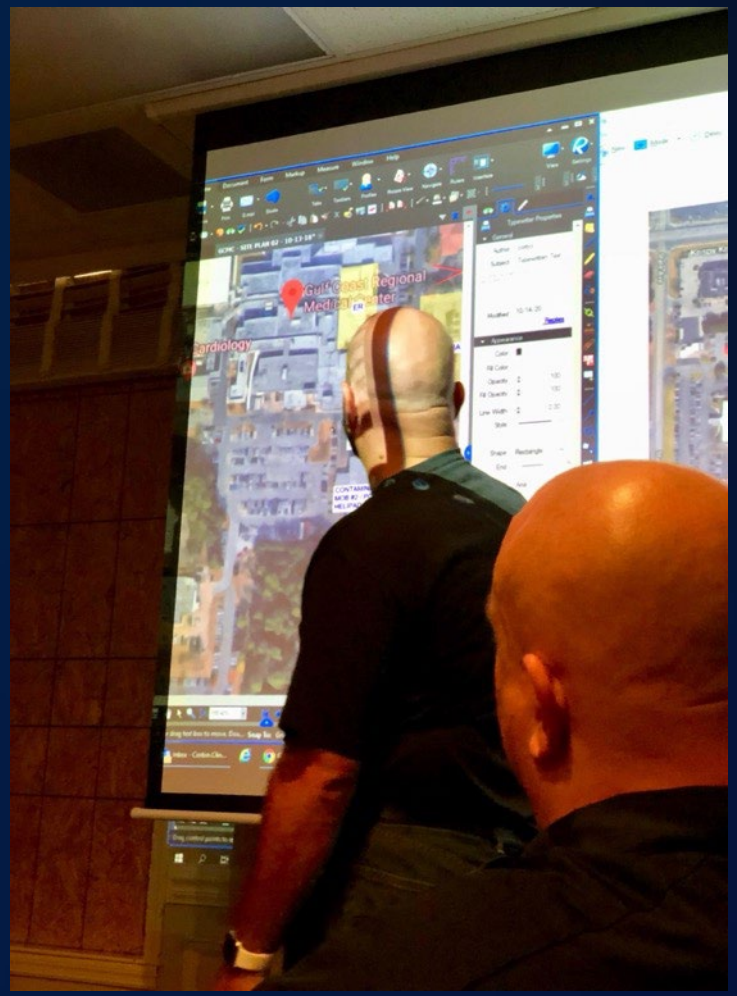
"Ensure safe, uninterrupted quality patient care,

Prevent damage and protect our patients, colleagues, communities, and facilities both natural and manmade events

Maintain continuity of healthcare and business operations, and

Uphold a positive HCA Healthcare mission"

Healthcare & Public Health Emergency Operations



A legacy approach to situational awareness & response coordination

- Increase number and frequency of complex events
- Legacy systems rely on manual input and correlation of dispirit systems
- Resource intensive systems to produce fragmented and incomplete reports and analysis
- Slow communication and broken pathways of information
- Not proactive, limited data-driven automation

Need for AI in Healthcare & Public Health Emergency Operations

Enhanced Situational Awareness

- Customized presentation of information
- Near / Real-time intel and information presented in an organize way to provide the most accurate and up-to-date situation report
- Disaster syndemic surveillance with correlation of incident and event factors

Comprehensive COP through Aligned Data

- Alignment of multiple data sets from a variety of information sources
- Clear and concise information sharing among dispirit systems
- Alignment of "mission sets" or essential elements of information (EEIs)

Informed & Automated Decision Support

- Incorporation of historical data, real-time data, and misc. sources of information to inform a more comprehensive basis for decision-making
- Modeling and programming to run systems based on factors and sensor information received.
- Enhanced accuracy, efficiency, and effective system management

Governance and Considerations

Governance & Oversight

- Data Privacy and Security
- Algorithm Fairness and Management of Bias
- Accountability
- Ethical Use Monitoring and Compliance
- Interoperability and Collaboration
- Product and Program Development

Ethics & Integrity

- Preventing Misuse of AI
- Public Trust and Confidence
- Transparency and Accountability
- Privacy and Data Protection

Security & Safety

- Protection of Sensitive Data / Business Intel
- Patient Privacy
- Preventing Disruption
- Prevention of Manipulation and Misinformation

Introduction:
Concepts for Use of AI in Healthcare & Public Health Emergency Operations

Prediction

- Utilization of advanced algorithms and data analysis to predict the occurrences of disasters and health crises, allowing for proactive measures and resource allocation to mitigate impact.
- Near/real-time predictions of impending local, regional, and global disasters based on historical data, trends, indicators, and sensors.

Early Warning

- Employed to provide timely early warning in emergency situations, leveraging real-time data and predictive models to alert stakeholders and the public to potential hazards, enabling rapid response and evacuation if necessary.

Risk Assessment

- Assessing vulnerabilities and potential impacts of disasters, facilitating evidenced-based decision-making and the optimization of resource allocation to reduce risk and enhance emergency operations

Advancing Practice through Key AI Technologies

Disaster Prediction

- Improved Accuracy through Machine Learning and Deep Learning Models
- Real-time Data Analysis from various sources
- Adaptive Modeling to refine predictions based on incoming data to ensure current reporting
- Multi-Hazard Approach to Disaster Syndemics

Early Warning Systems

- Real-time Data Analysis to detect emerging threats and hazards
- Predictive Analytics to forecast hazards
- Continuous Learning to improve accuracy
- Automated Alert Systems automatically generated to alert stakeholders and the public
- Customized Alerts tailed to stakeholder needs

Risk Assessment

- Resource Optimization by identifying high(er)-risk threats or hazards and recommending the allocations of resource at the scale and to the location of appropriate need
- Adaptive Decision Support offering real-time insights and recommendations to mitigate/manage the risk presented

Enabling Components

AI in healthcare and public health emergency operations relies on several enabling components that work together to support its implementation and effectiveness

Data Sources & Integration

- Access to diverse and high-quality data sources to ensure real-time accuracy and comprehensive display of information

Advanced Algorithms and Modeling

- Cutting-edge AI technologies, including machine learning, natural language processing, and predictive modeling systems

Computational Power & Infrastructure

- High-performance computing infrastructure to ensure that AI can deliver timely predictions and assessments

Implementation Challenges

Data and Information

- Data Quality and Availability
- Data Privacy and Security
- Data Integration and Interoperability

Technological

- Infrastructure and Resource Requirements
- Human Expertise and Workforce Development
- Ethical and Bias Concerns

Operational

- Change Management
- Regulatory and Legal Framework
- Scalability and Sustainability

Case Studies:

Natural Disasters

- Improves forecasting, storm tracking, and accuracy of warnings
- Early detection of disease outbreak
- Early risk assessment for wildfire mitigation
- Early warning for seismic events
- Enhanced forecasting of flood intrusion / inundation

Man-Made Disasters

(Intentional & Unintentional)

- Cyber incidents / CI utility failure
- Active shooter response events
- Hazardous chemical or biological incident
- Fire / evacuation assistance

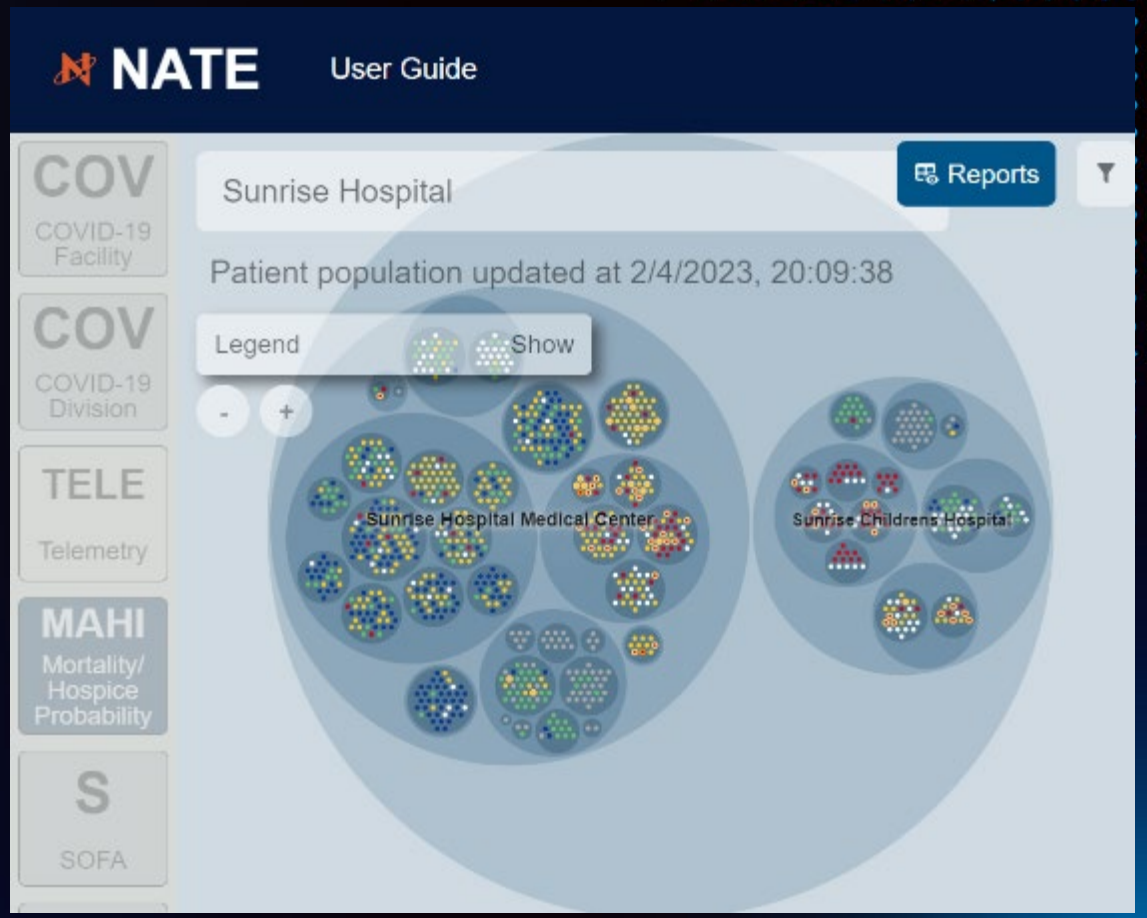
HCA Healthcare | Current Use Case Study

Using ReaTime Data to Enhance Response Operations

NATE |*NextGen Analytics for Treatment & Efficiency*

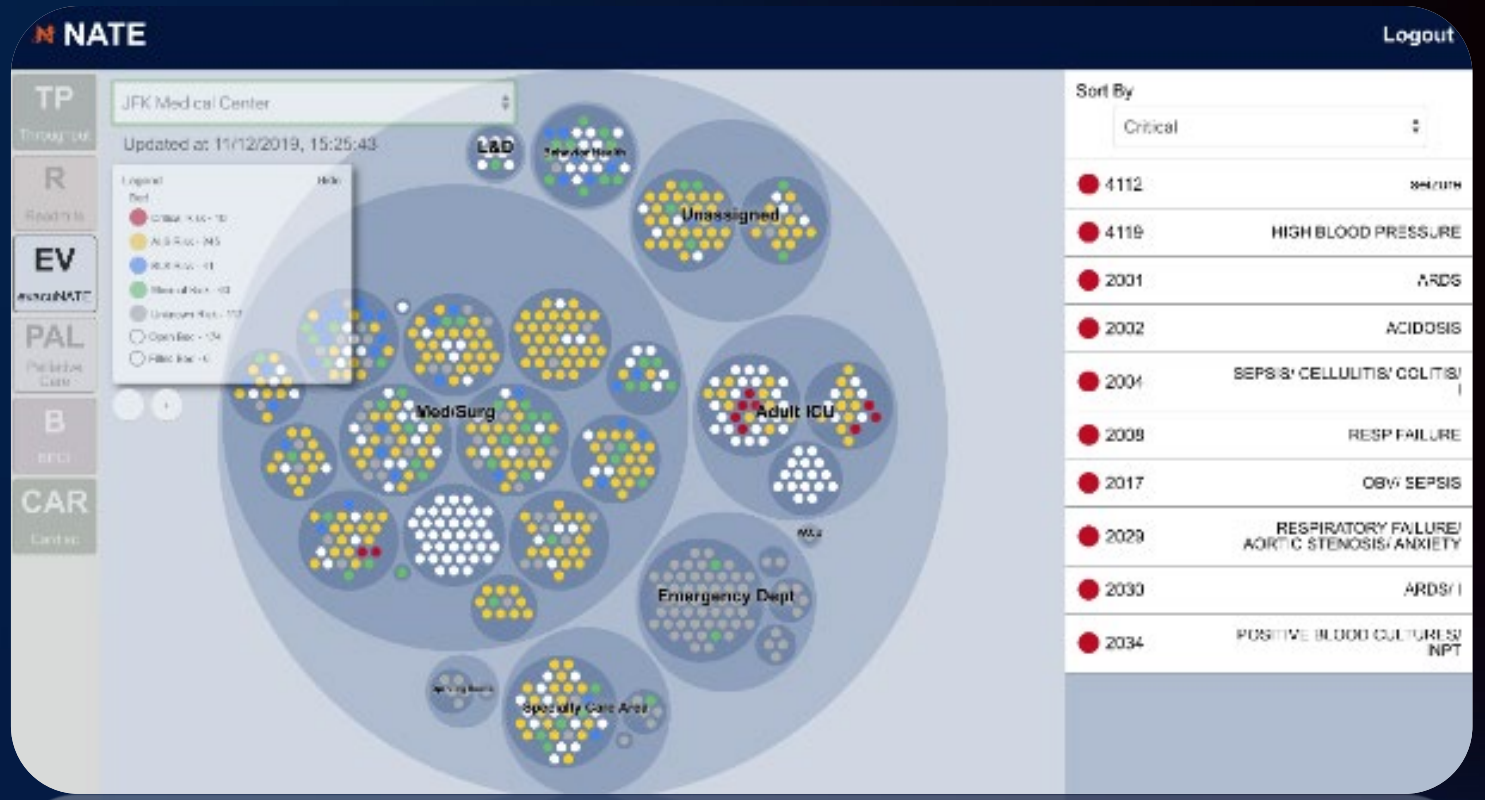
What is NATE?

- **Next-gen Analytics for Treatment and Efficiency**
  - Flexible, holistic visualization of a hospital or Division
  - Integrates real-time facts and predictive analytics
    - Enables clinicians and facility operators a clearer understanding of what's happening in the facility now and what's likely to happen in the future



- **NATE Modules Relevant to Emergency Operations**
  - evacuNATE, coroNATE, C-ARDS (COVID ARDS), SOFA, Throughput

evacuNATE: Real-time Evacuation Planning



- Uses near real-time facility and clinical data
- Triages patients based on clinical criteria
- Estimates evacuation resources by patient
- Displays local and neighboring facility capacity

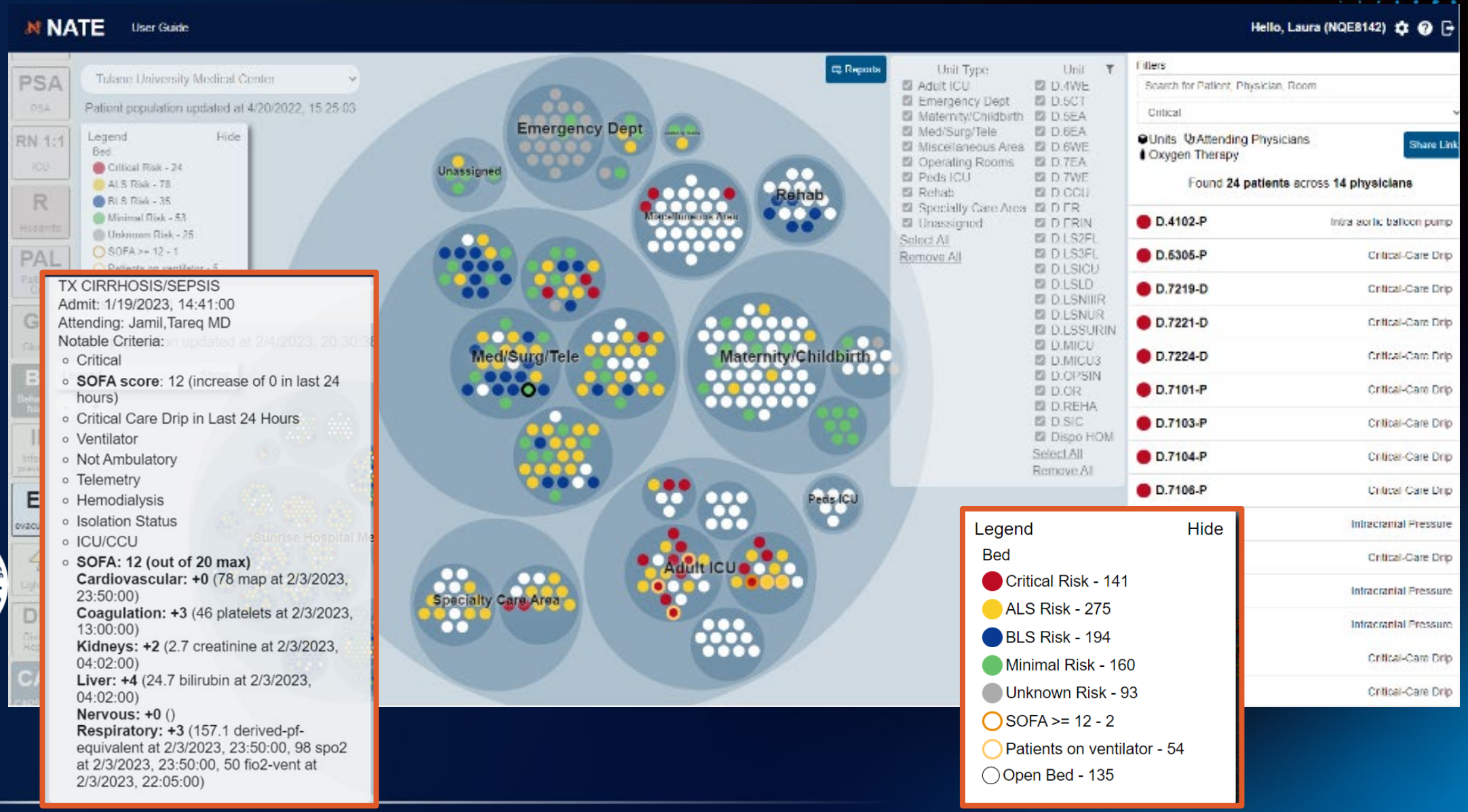
Evacuation Resource Categories

Color	Risk Assessment	Evacuation Needs
RED	CRITICAL	**Critical Care Ambulance or Air Transport:** Air transport, AMT, HEMS, Specialty Interfacility Intensive Care Team required (i.e. neonatal), etc.
YELLOW	ALS	**Advanced life-support Ambulance:** Medication Management, Continuous Telemetry Monitoring, etc.
BLUE	BLS OR NONAMBULATORY	**Basic life-support Ambulance:** Stretcher-bound, Suicidal/Homicidal Patient, Oxygen dependent, etc.
GREEN	MINIMAL	**Ambulance care may not be required or can be readily cohorted for mass transport:** Patient is ambulatory and can be eligible for medical bus or other appropriate mass transport, wheelchair van, etc.

Qualifying Conditions:

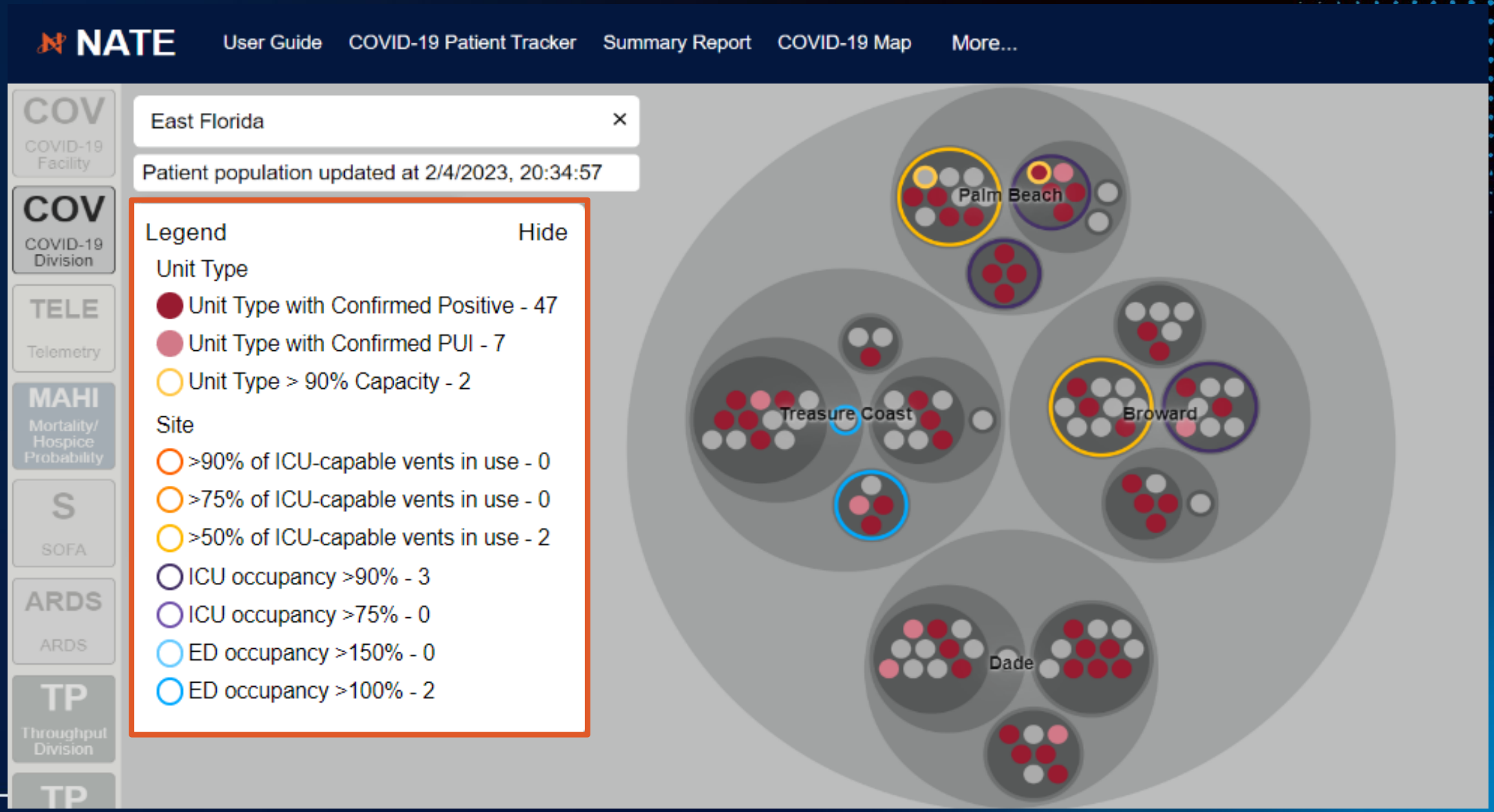
CRITICAL	ALS	BLS
ICU/CCU	Surgery in last 24hrs	On Dialysis
NICU	PACU phase 1	Violence risk
Ventilator	Anesthesia in last 12hrs	Isolation
Intra-aortic balloon pump	Telemetry	PACU phase 2
Intracranial pressure	Not ambulatory	Involuntary hold
Ventricular assist device	Bariatric	1:1 monitoring *
Critical care drip	ALS drip	Suicide Assessment *
Cath lab *	C-Section *	
	Interventional radiology *	

EvacuNATE Overview



Scarce Resource Decision Support

COVID Regional Visualization in HICC Relevance



It was my pleasure to present to you today!

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