Experience of Implementing a Stroke AI Platform in a Large Health Care System

Jacob Bermudez MD PhD, Heather Vannes RN, Richard D. Beegle MD
AdventHealth Orlando Diagnostic Radiology Department

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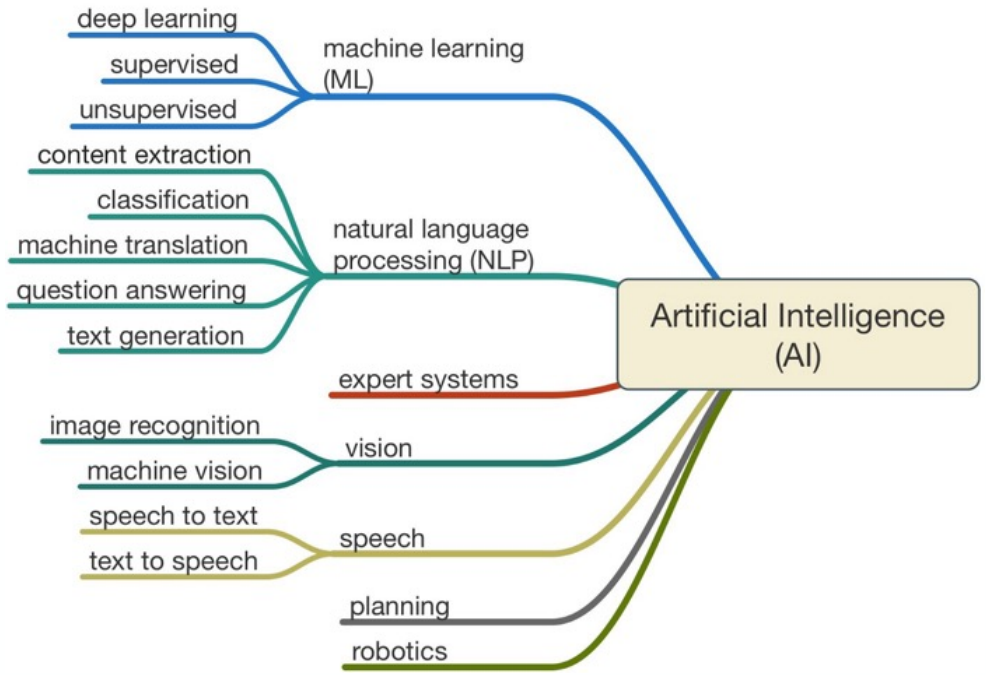
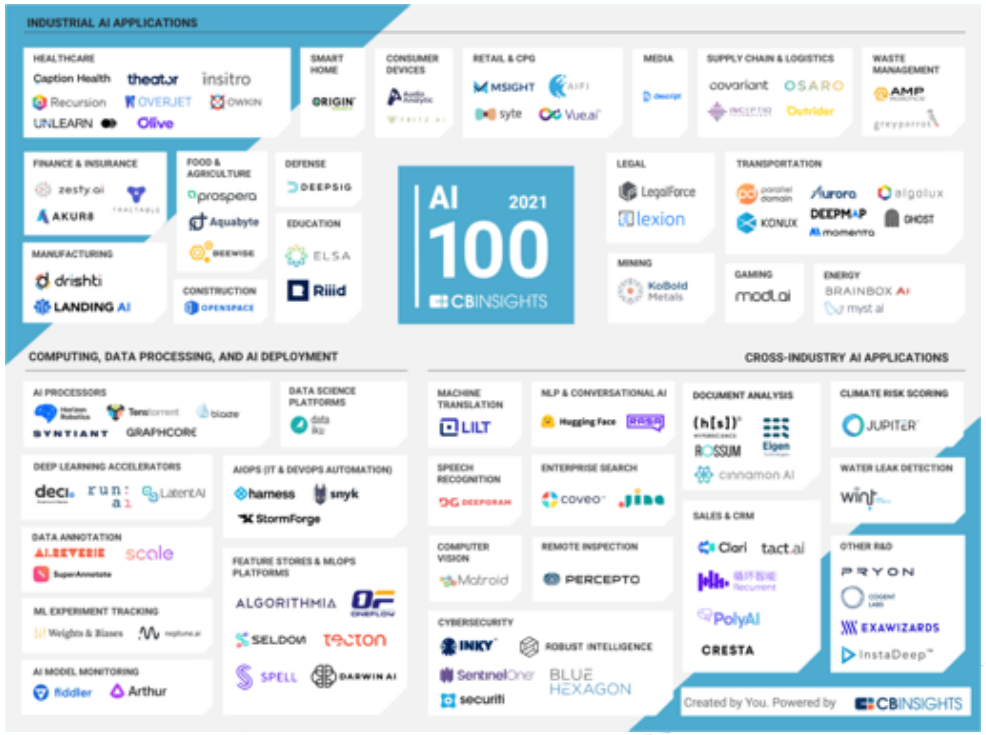
Artificial Intelligence (AI)

- **The use of automated computational techniques, tools, and applications to accomplish tasks that previously required the use of human skill/knowledge.**
  - AI has almost limitless potential applications across a broad range of disciplines and is particularly well suited to pattern recognition tasks such as complex image interpretation.
  - Many market sectors are already applying AI tools and a new industry has exploded around creating these tools.





navigatevc.com/ai-100-the-artificial-intelligence-startups-redefining-industries/

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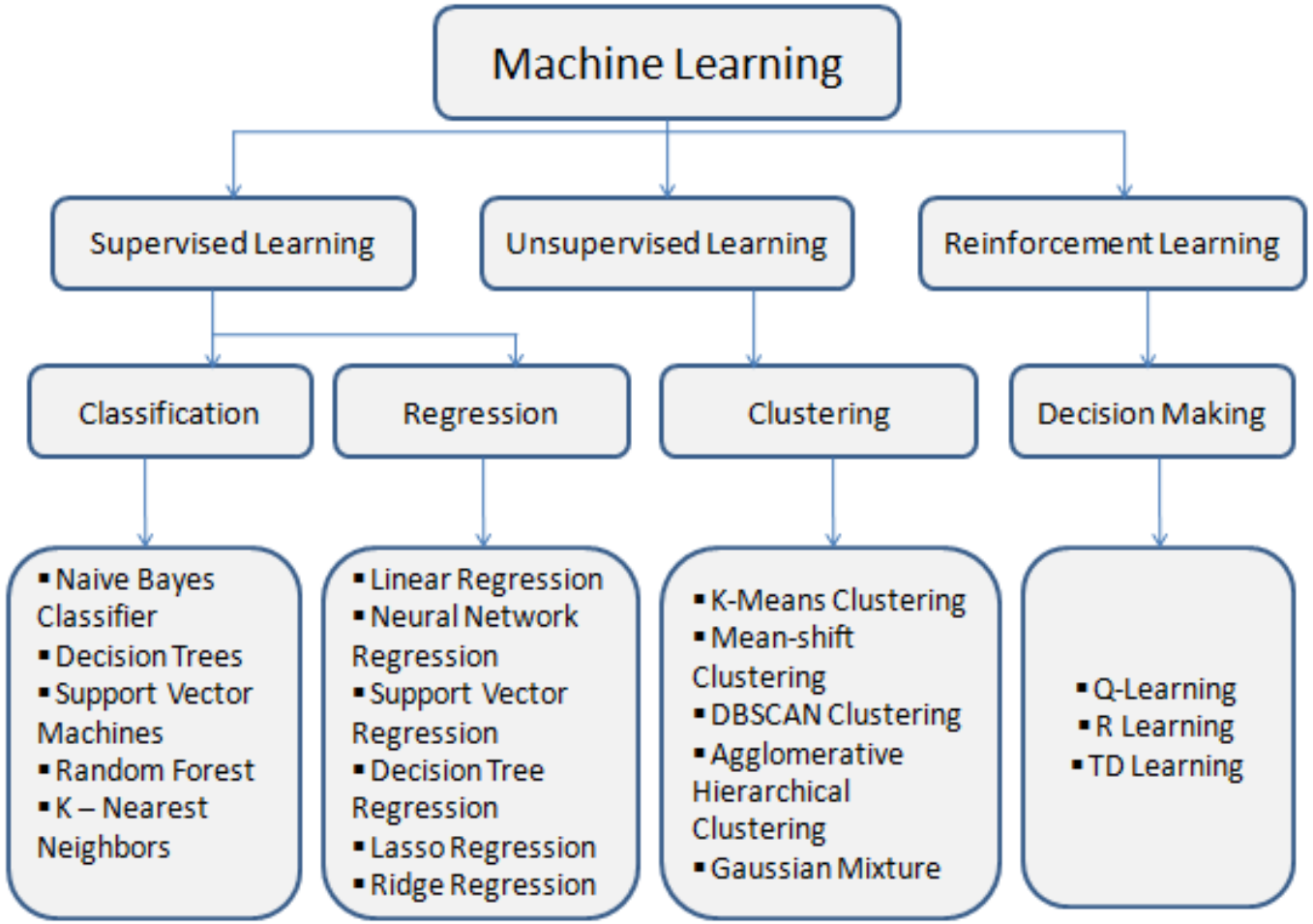
Machine Learning

- A division of AI that focuses on the use of mathematical algorithms that are designed to automatically improve through experience.
  - These algorithms can “learn” from iterative exposure using large training data sets.
  - Over time these algorithms are designed to automatically become more efficient as they are trained using cleaned data sets.
  - Data set preparation is time intensive and critical to the quality of the resulting models developed.



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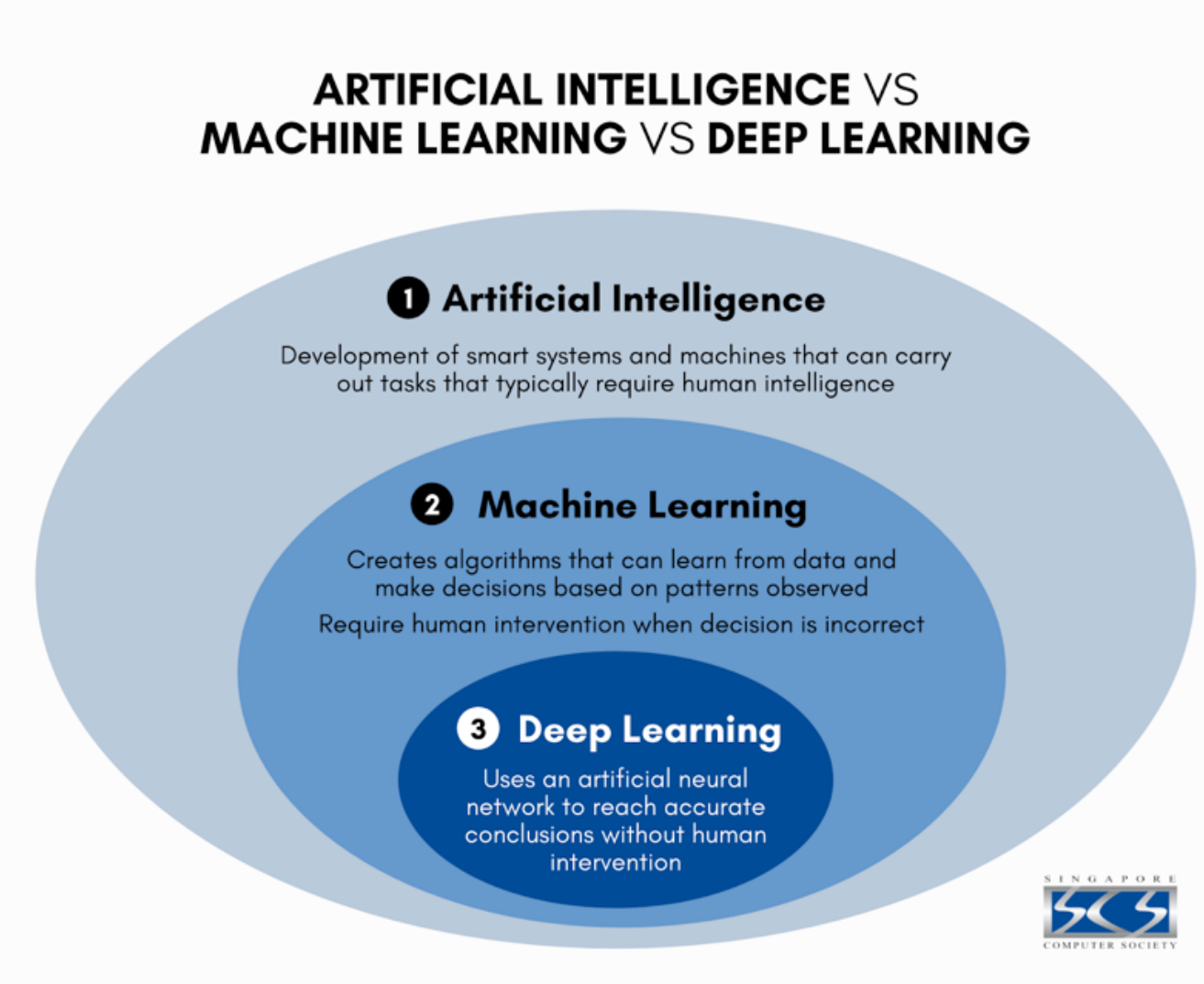
Deep Learning

- A method of implementing machine learning algorithms that involves the use of artificial neural networks.
- Multiple layers of processing are used to derive increasingly subtle features from training or test data sets.
- Deep Learning functions are particularly well suited to applications in image interpretation because of their ability to hone algorithms to enable identification of critical details amongst large data sets.



AI Applications in Neuroradiology

- Practice elements currently being addressed by AI.
  - Multiple companies have entered the market with products aimed at improving almost every aspect of a radiologists practice from workflow to image interpretation.
- AI in Neuroradiology
  - The complex and time sensitive nature of neuroradiology make it particularly well suited for the application of AI.

Applications
Classification of abnormalities (eg, urgent findings such as hemorrhage, infarct, mass effect)
Detection of lesions (eg, metastases)
Prediction of outcome (eg, predicting final stroke volume, predicting tumor type, and prognosis)
Postprocessing tools (eg, brain tumor volume quantification)
Image reconstruction (eg, fast MR imaging, low-dose CT)
Image enhancement (eg, noise reduction, super-resolution)
Workflow (eg, automate protocol choice, optimize scanner efficiency)

Lui et al. 2020

Key Players

RAPIDAI

iz.ai

TEMPUS

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- 2,247 bed acute-care tertiary referral medical center located in Orlando FL.
- Named AHCA comprehensive stroke center 2010.
- Named DNV Certified comprehensive stroke center in 2021.

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Neuroradiology at AdventHealth

- Large multispecialty group employing over 160 radiologists.
- 35 dedicated, fellowship trained neuroradiologists.
- Over 100 thrombectomy cases each year.

Advent Health Neuroscience Institute at Innovation Tower

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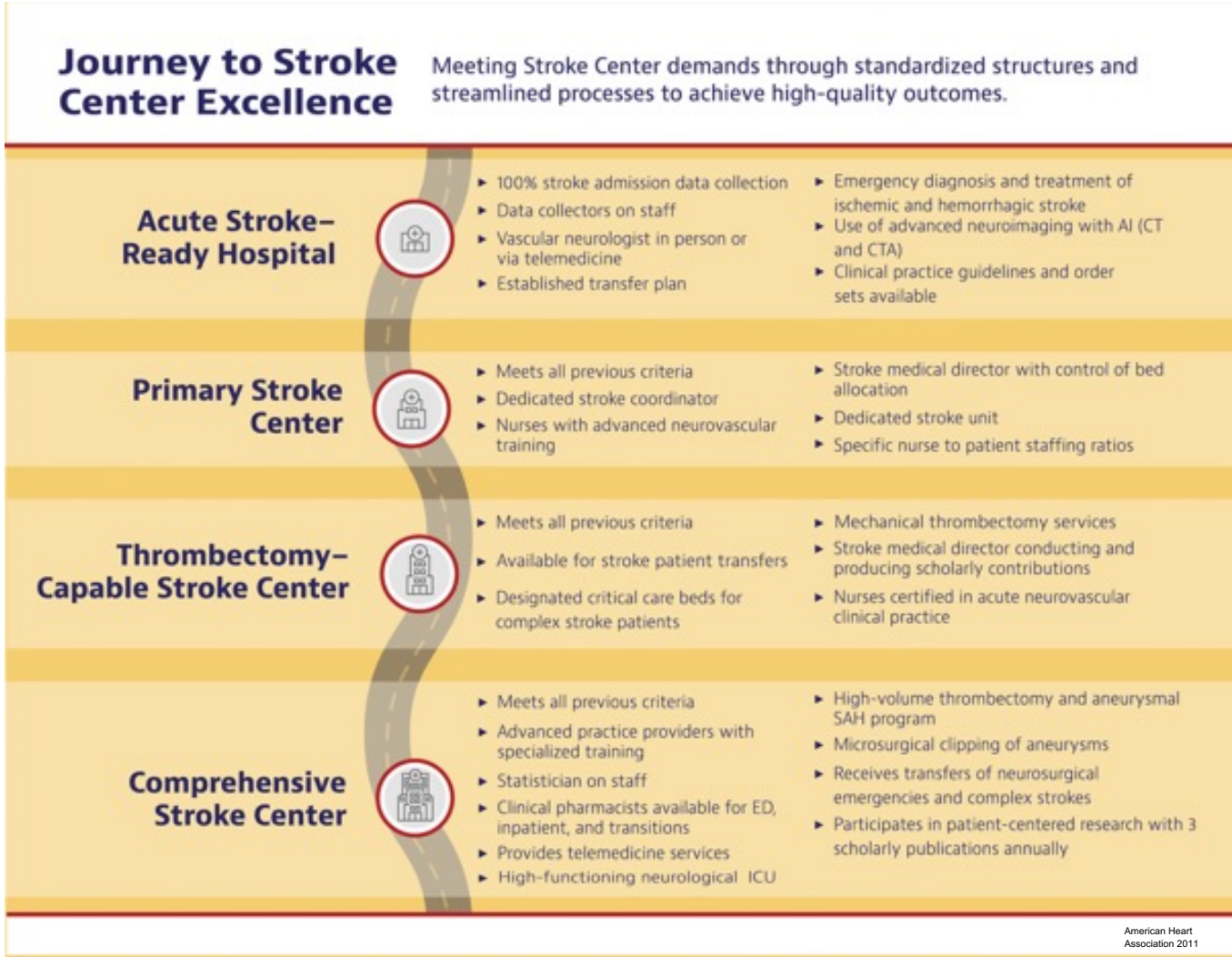
Comprehensive Stroke Centers

- The American Heart Association identifies 26 core and secondary metrices for measuring the quality of care in a comprehensive stroke center which can be viewed through the link provided below. (https://www.ahajournals.org/doi/10.1161/STR.0b013e318208eb99)

- To achieve the status of comprehensive stroke center a hospital must be able to provide a complete suite of stroke related services and be involved in patient centered research.



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Key Metrics For Stroke Outcomes

- Time from patient arrival to identification of stroke.
- Time from stroke identification to administration of TPA.
- Time from stroke ID to vascular access and or first thrombectomy catheter pass.
- Stroke patient 30-Day mortality.

Goal for Stroke Outcomes

- There is always room for improvement! In 2018 AdventHealth was named an AHA ELITE PLUS institution with a target of reaching ELITE PLUS Honor Roll status.
- Target: Stroke **ELITE PLUS Honor Roll** requirements:
  - Door-to-needle times within 60 minutes for at least 85 percent of applicable patients.
  - Door-to-needle times within 45 minutes for at least 75 percent of applicable patients.
  - Door-to-needle times within 30 minutes for at least 50 percent of applicable patients.

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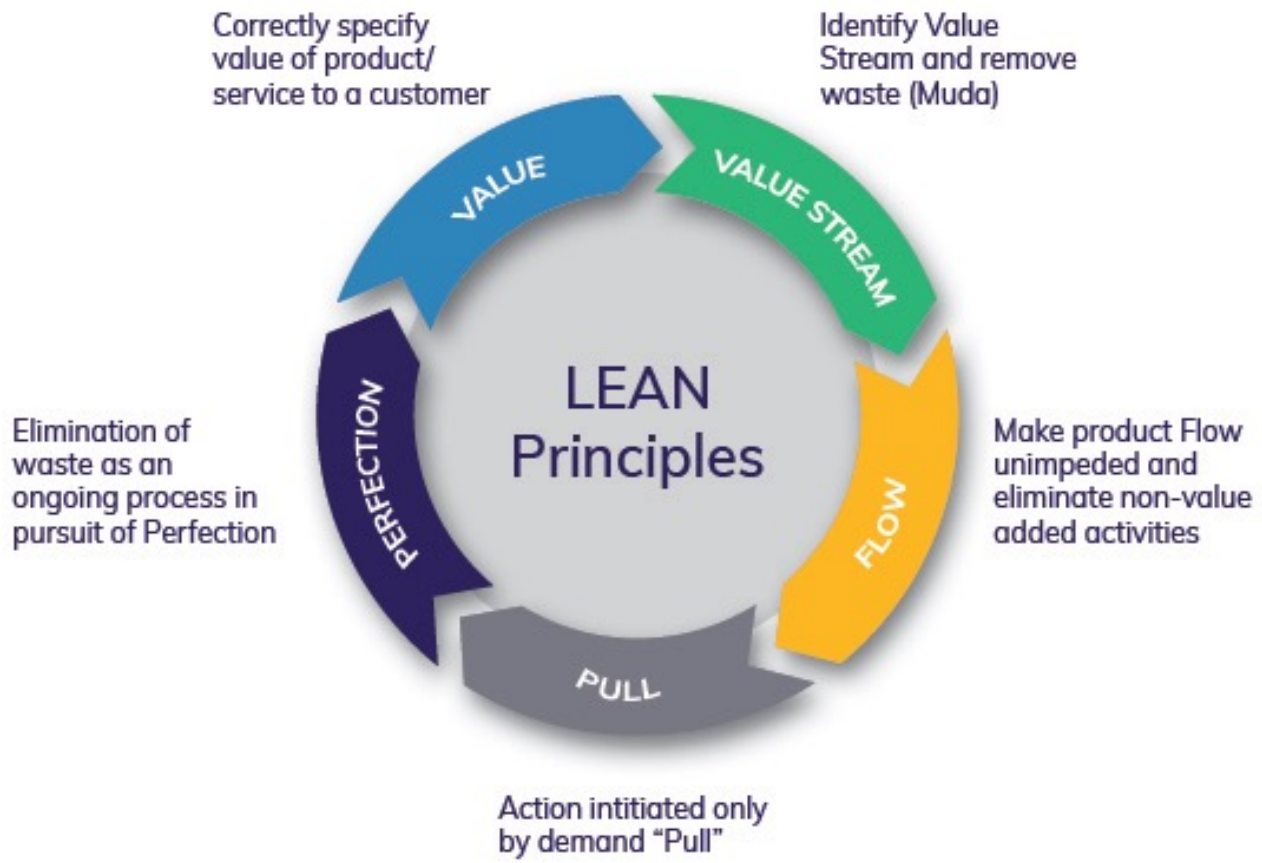
Identifying Areas of Potential Improvement

- Using the “LEAN” methodology several areas of potential improvement were identified within the stroke care process.
- Within the radiology department delays in results communication and team collaboration were identified as areas of particular interest.



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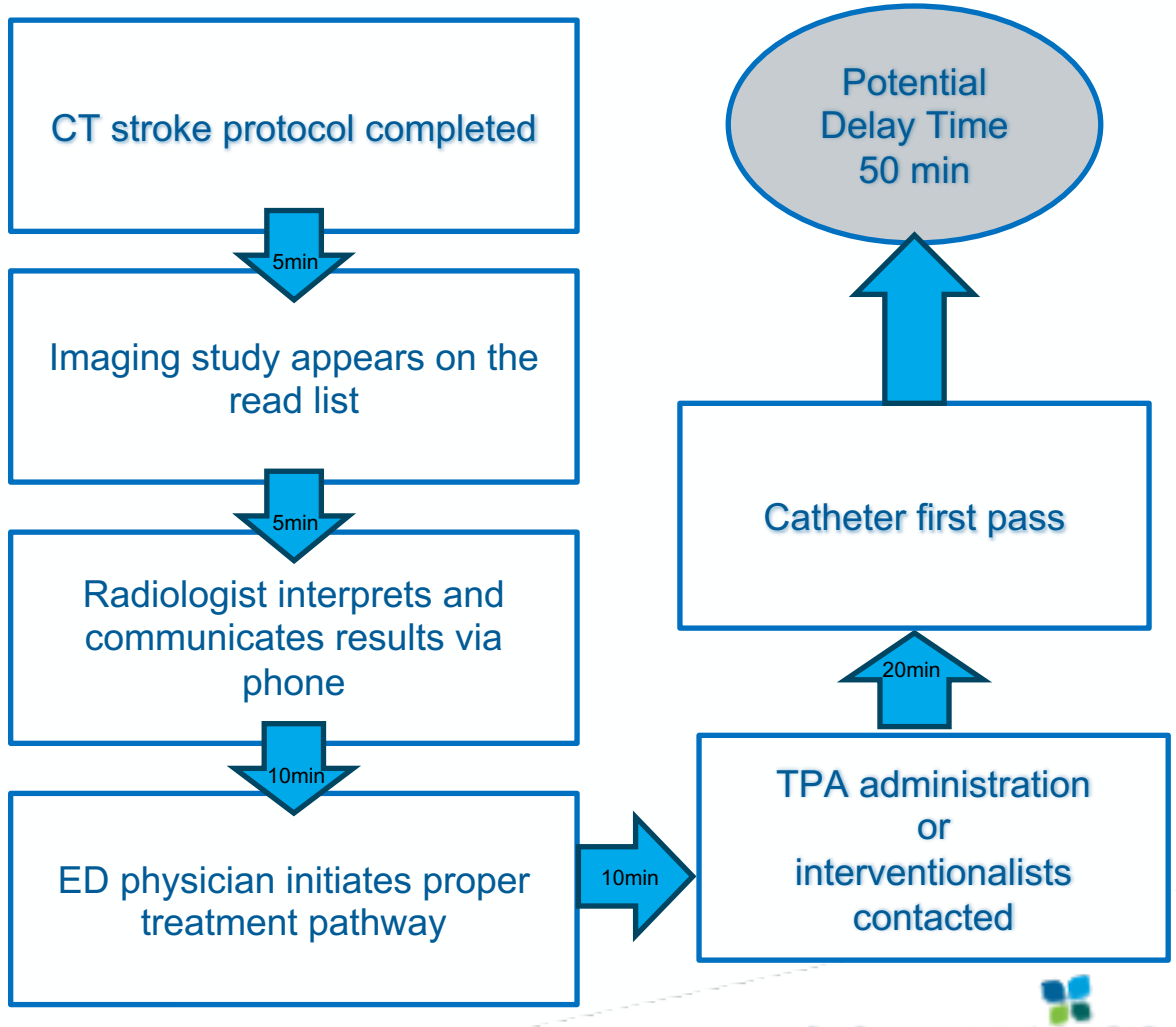
Delay Points in Traditional Stroke Protocol

- Studies take time to populate on the read list.
  - CT technologists must complete studies prior to population.
  - Radiologists are not notified of stroke studies until they appear on the read list.
- ED physicians must wait for phone communication prior to initiating treatment.
- Key players are not included in the progression of actions until further down the decision tree.
  - Patients requiring possible thrombectomy are not communicated to interventionalists until after advanced imaging has been interpreted and conveyed to the ED.



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Goals for AI system Implementation

Increase diagnostic efficiency by addressing delay points in current stroke protocol.

- Decrease stroke ID time.
  - Allow for faster/more accessible image processing and interpretation by the radiologist.
- Reduce time to downstream stroke protocol activation.
  - Notify key stroke team members faster.
  - Add value with automated decision making capacities early in the protocol activation stage.

Streamline stroke team communications without overburdening team members.

- Automate stroke team notifications/data dissemination.
  - Use AI to determine actionable cases and automatically notify key team members while providing the data needed to make clinical decisions.
- Provide a unified communication environment for key players to collaborate in real time with minimal delay.
  - Utilize mobile platform integration to allow fast communication.
  - Provide accurate documentation and log functions for future reference and verification.

Outcome Metrics

- Several key patient outcome metrics were chosen to track the impact of our new AI system. These metrics fall in line with the AHA's core stroke center metrics.

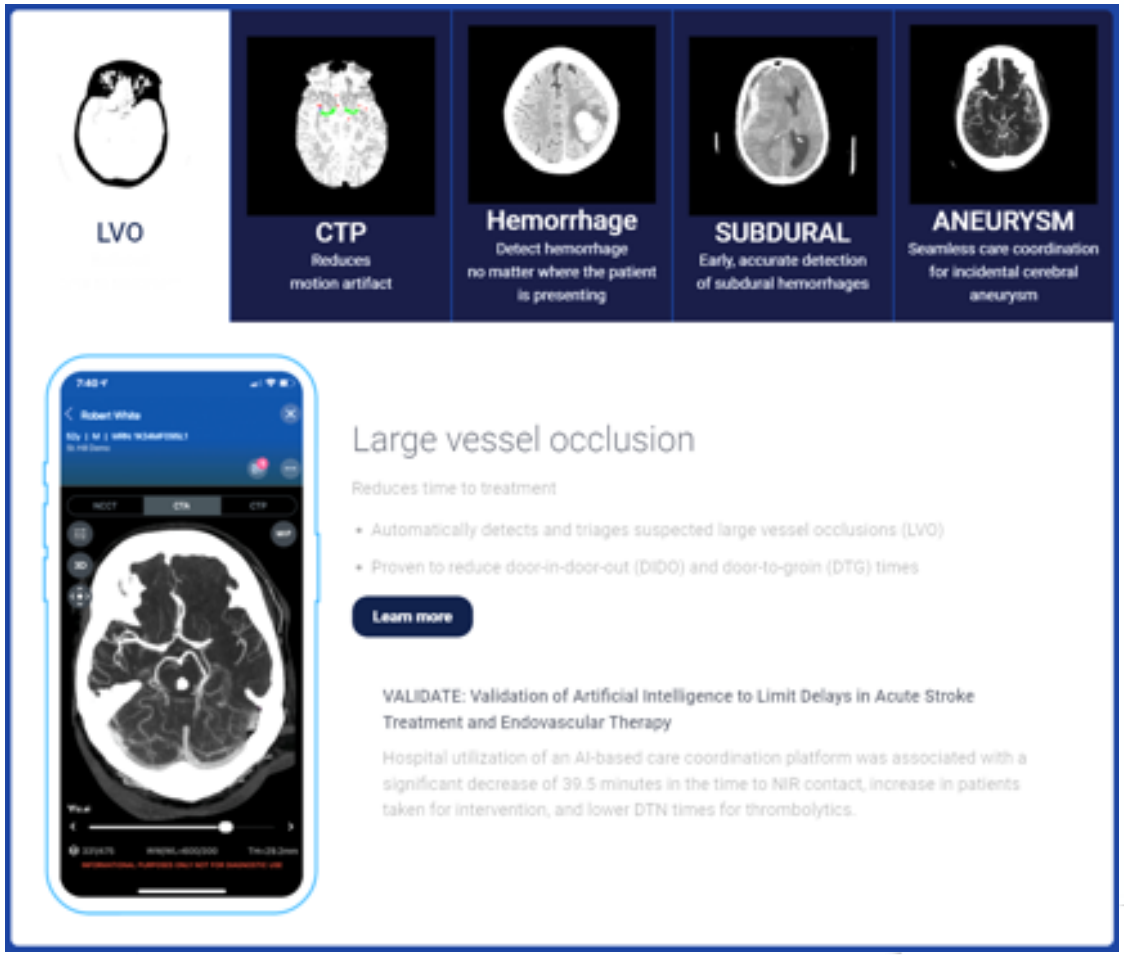
  - Reduced door to needle (TPA) time.
  - Reduced door to first pass thrombectomy time.
  - Reduction of overall patient mortality.

Action	Time
Door to Physician	≤ 10 min
Door to Stroke Team	≤ 15 min
Door to CT Initiation	≤ 25 min
Door to CT Interpretation	≤ 45 min
Door to ECG*	≤ 45 min
Door to Chest X-Ray*	≤ 45 min
Door to IV t-PA	≤ 60 min
Door to Interventional	≤ 90 min
Door to Stroke Unit	≤ 3 hours

AI System Core Functions

After evaluating multiple AI products our group decided to employ the FDA/CMS approved Viz.Ai system.

Of note, multiple other vendors offer similar functionality.



Primary Functions

-LVO auto detection.

-Automatic CT-perfusion motion artifact elimination.

-Mobile integrated notification, image sharing, and communication platform.

This system integrates the entire stroke team on one mobile platform where information, decision making, and imaging data interpretation can be shared in real time.

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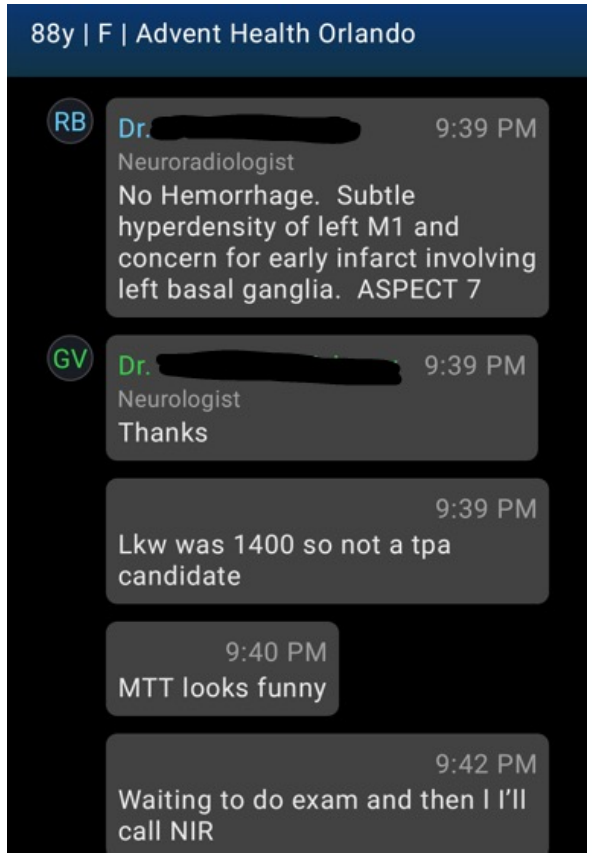
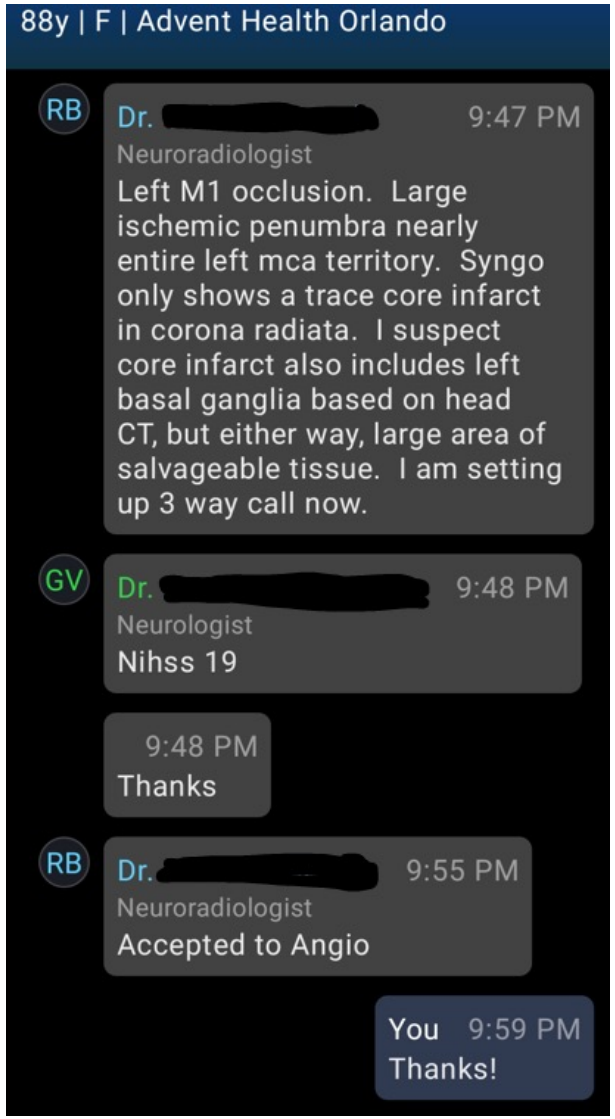
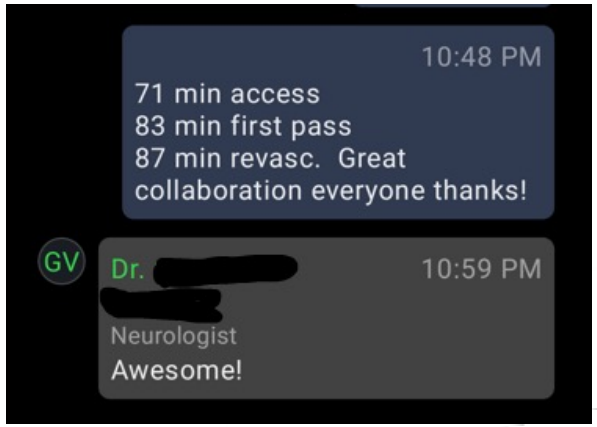
AI Use Example

88-year-old female, with PMH of A-fib (non-compliant with Xarelto), arrived to AHO ED via EMS from home with right side weakness, left gaze deviation, and aphasia, initial NIHSS=19, pre mRS=2.





- The group collaboration messenger application proved to be exceptionally useful. It allowed our physicians to communicate quickly and efficiently in order to coordinate proper patient care.



PROCESS TIMELINE ORL ED STK Alert – LM1/TICI 3	
ED ARRIVAL	2114
CTP ORDER	2117 3 mins
CTP START first slice	2129
3D lab complete ctp/cta	CTP 2142; CTA 2150
VizAi LVO alert	2145 31 mins from ED arrival
Case shared with INR	2149
RAD 3-way CALL	2150 TS note 2153 RAD report
Who notified you to go to INR/what time?	2155, RAD on Viz 41 mins from ED arrival 2159, Stroke Manager on teams
ED DEPART	2202 48 min
INR ARRIVAL	2205 or 2210
GROIN ACCESS	2225 71 min
FIRST PASS	2237 83 min
Revasc	2241 87 min

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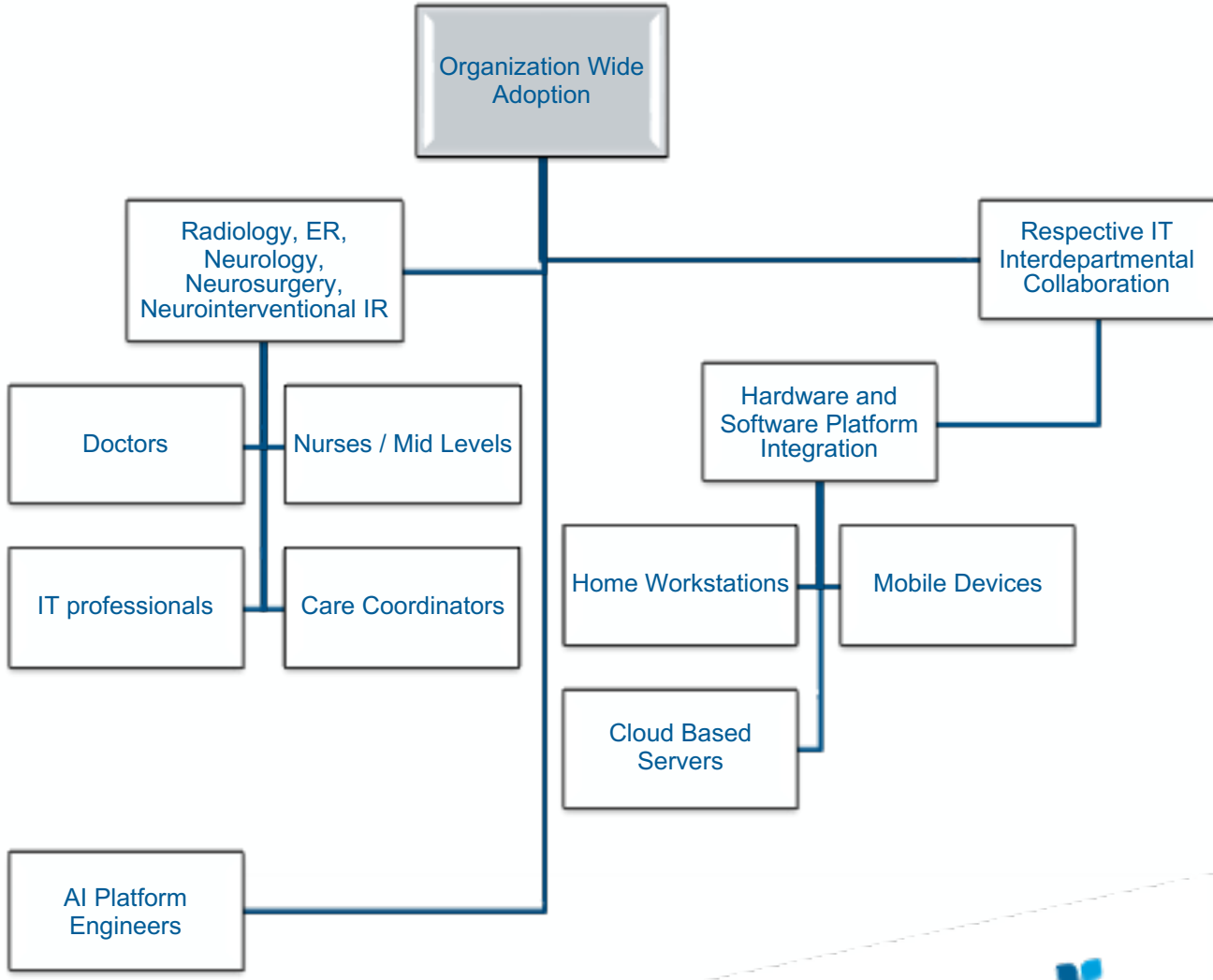
AI Implementation Challenges

- Interdisciplinary involvement required.
  - ED, Radiology, Neurology, and Neurosurgery / Neurointerventional IR departments must all be on board.
- Multilevel provider and support staff involvement.
  - Physicians, nurses, IT professionals, and midlevel providers must be trained in using the new system.
- Multiple data sharing / storage systems integration required.
  - Hardware and software compatibility issues can lead to inefficiencies if not properly anticipated.
- Software system updates and integration must be seamless and intuitive.
  - Accessible training from both the institution and the platform provider must be provided.



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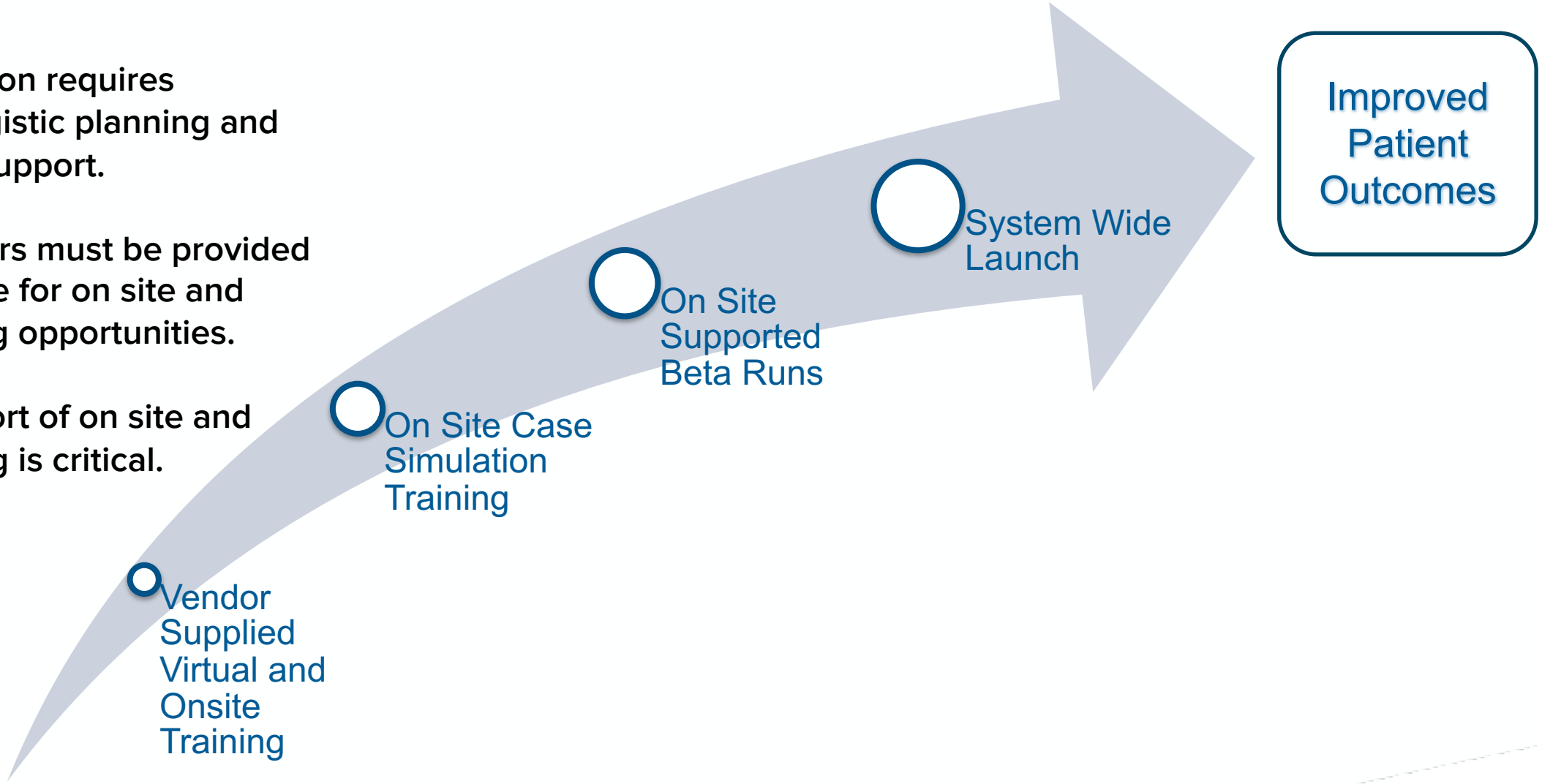
Team Education

- Team education requires significant logistic planning and institutional support.
- Team members must be provided adequate time for on site and virtual training opportunities.
- Vendor support of on site and virtual training is critical.



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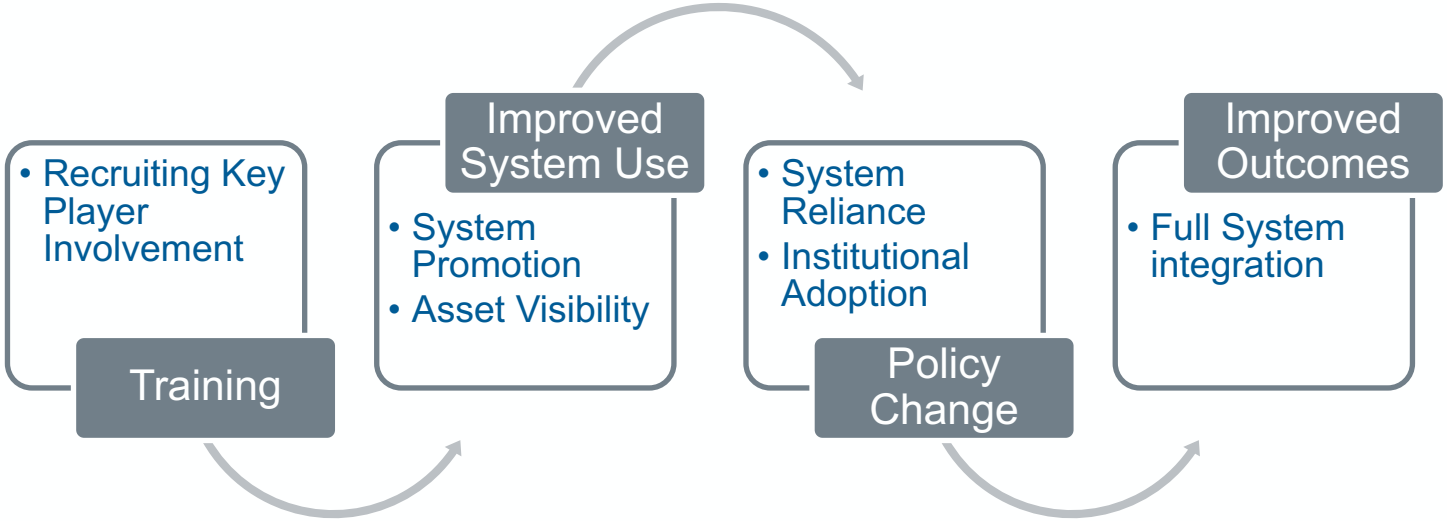
Changing Organizational Culture

- Improving system utilization and establishing reliance takes time and requires repeated promotion, training, retraining, and key player recruitment.
  - Changing institutional policy to include use of a new system can be challenging as well and often is the last step prior to realizing full system integration.
- Asset visibility is a critical component of achieving adoption of new systems.
  - End users must be made aware of the full functionality of a system in order to take part in utilizing it.
  - Keeping reminders visible on a daily basis goes a long way to improving utilization.



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Dollars and Sense

- Funding
  - Choosing a CMS approved AI platform may be critical in making such a system financially feasible.
  - CMS granted reimbursement for the listed AI applications through the New Technology Add on Pathway (NTAP).
  - Payments are calculated using a formula that requires Medicare to share the financial risk of implementing new technologies.
  - Even with NTAP payments implementation of AI systems can be prohibitively expensive especially for smaller or lower volume practices.

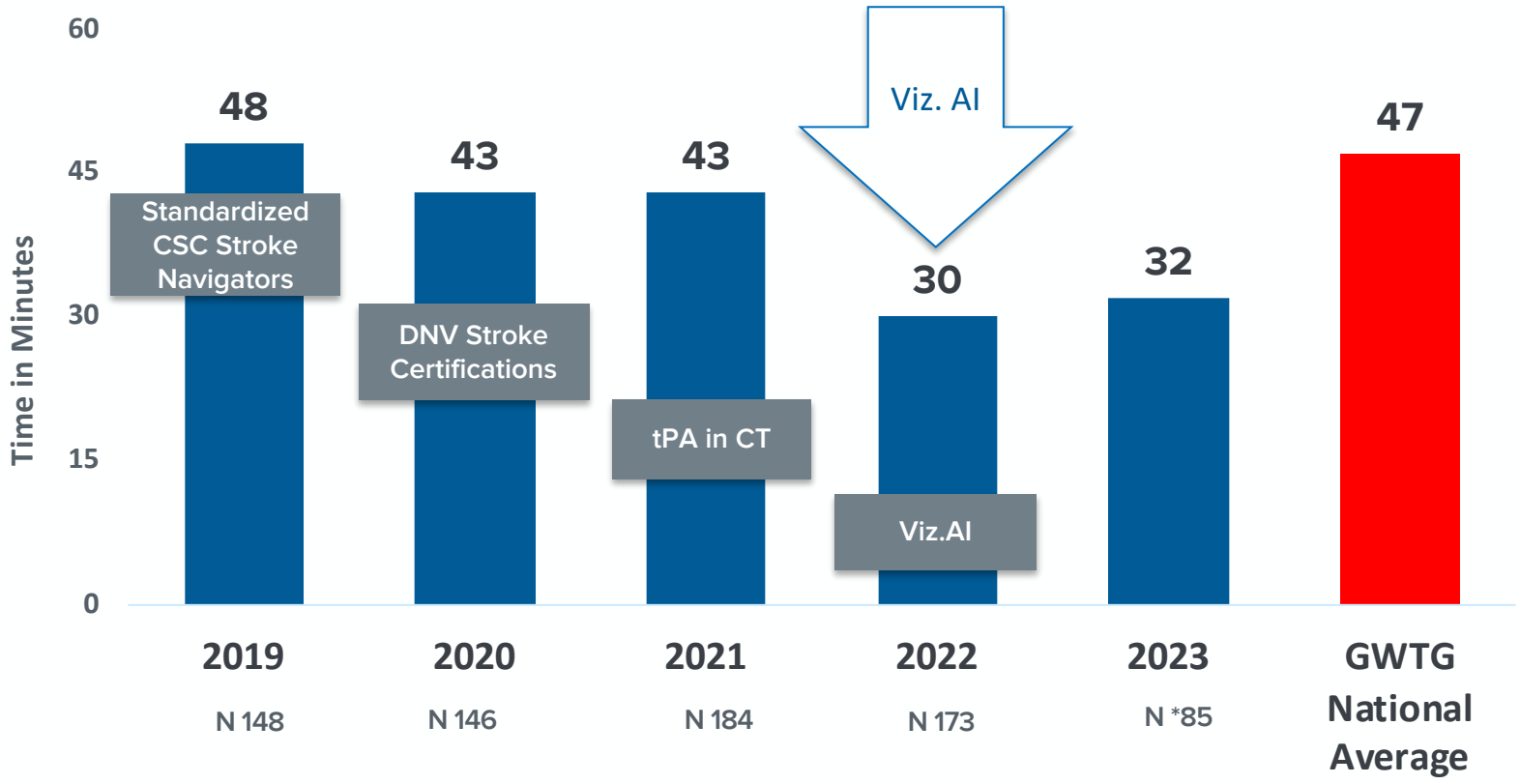
AI platforms that have been granted CMS approval for reimbursement:

- **Viz. AI**
- **Rapid AI**
- **Aidoc**
- **Avicenna**

Clinical Outcomes After AI System Implementation

- A clear reduction in average time from door to needle (TPA) can be seen in 2022 shortly after the Viz.AI application was launched.

AH Orlando Stroke Door to Needle (TPA)



IV tPA Utilization

20% Advent Health

11.8% National Rate

*Data Source – AH Stroke Alert Dashboard (CFDS) *Jan-July 2023

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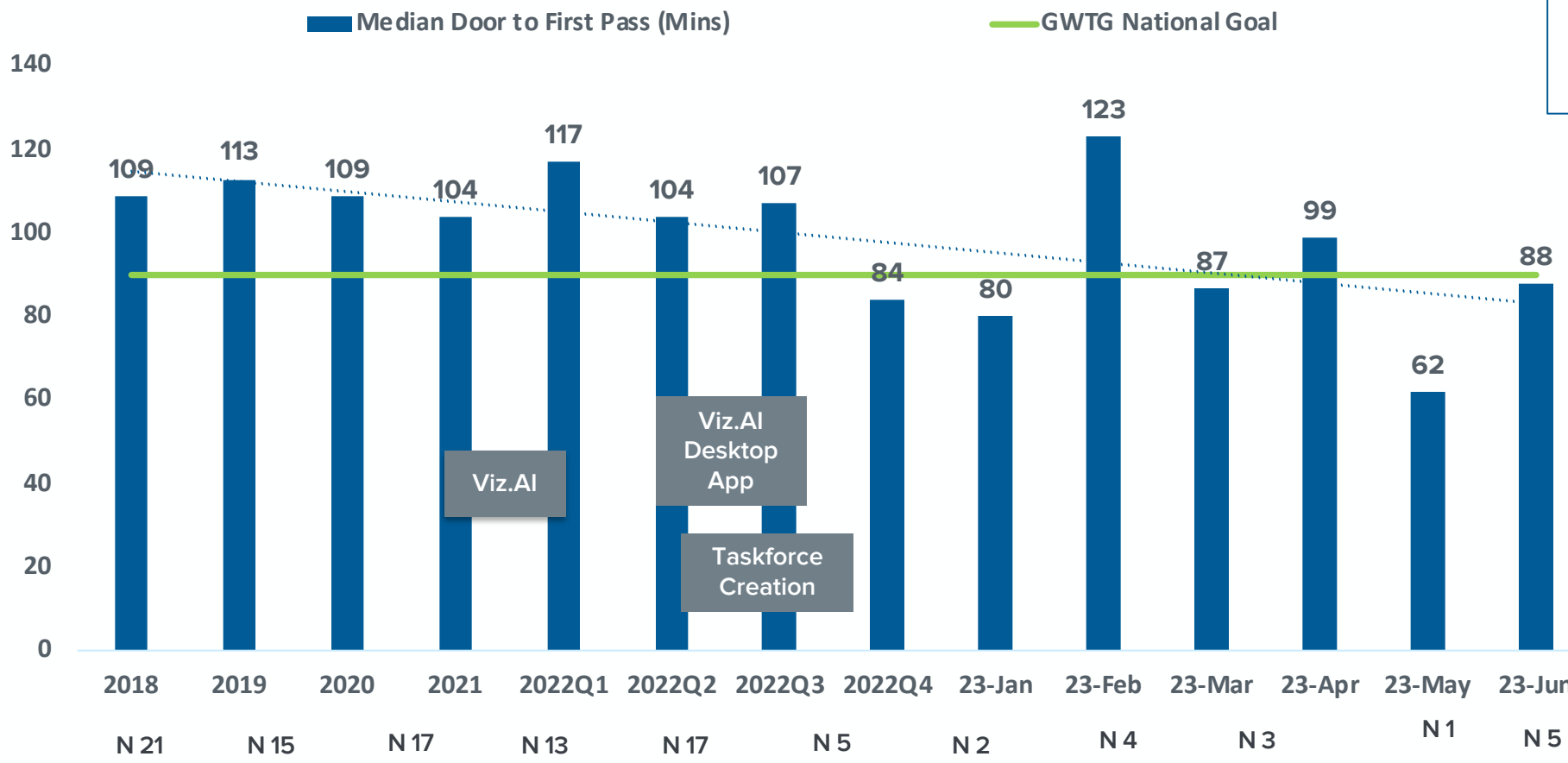
Clinical Outcomes After AI System Implementation

AdventHealth Orlando Stroke INR- Door to First Pass



- Excluding the month of February 2023 a consistent downward trend can be seen in door to first pass times after the implementation of the Viz. AI system in Q4 of 2021.

Viz.AI –Early LVO Detection

- South Region roll out in July ‘21
- North Region roll out in Nov ‘22
- Taskforce Creation
  - Increase Neuro Rad & INR MD Utilization
  - Evaluate INR/Viz Process Monthly
  - INR Quality Meetings

* Data Source: AH Stroke Alert Dashboard: ED Non-Transfer Population: Orlando

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Realized Clinical Outcomes

- In 2023 AdventHealth Orlando was again recognized as an ELITE PLUS quality achievement center.
- Although our core metrics of door-to-needle and door-to-first pass times are not yet at the ELITE PLUS Honor Roll target level the implementation of the Viz. AI neuro suite has helped us to continue in the right direction.
- With our current downward trends in door-to-needle and door-to-first pass times we are expecting to achieve ELITE PLUS Honor Roll status within the next year.

The American Heart Association and American Stroke Association proudly recognizes

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Orlando, FL

Get With The Guidelines® - Stroke GOLD PLUS with Target: Stroke Honor Roll Elite Plus and Target: Type 2 Diabetes Honor Roll

Achievement Award Hospital

The American Heart Association recognizes this hospital for its continued success in using the **Get With The Guidelines®** program.

Thank you for applying the most up-to-date evidence-based treatment guidelines to improve patient care and outcomes in the community you serve.*

Nancy Brown
Chief Executive Officer
American Heart Association

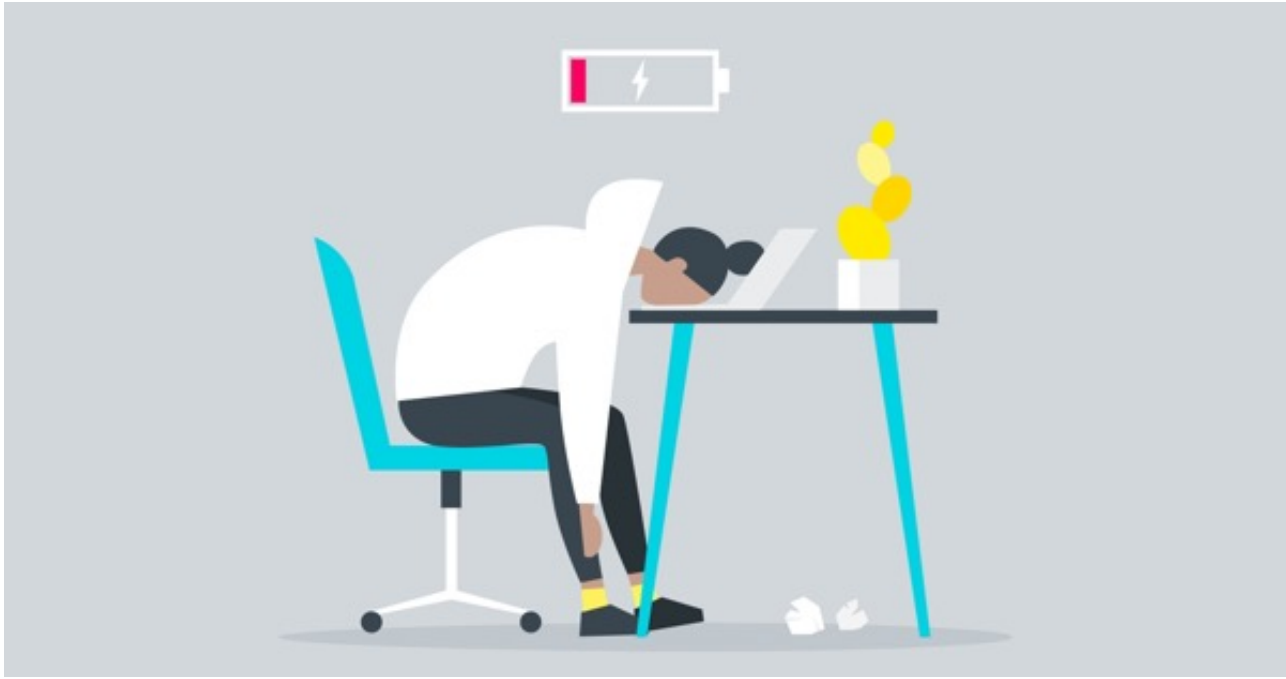
Michelle A. Albert, MD, MPH, FACC, FAHA
President
American Heart Association

*For more information, please visit Heart.org/GWTGQualityAwards.

Target: Stroke ELITE PLUS Honor Roll: Door-to-needle times within 60 minutes for at least 85 percent of applicable patients. Door-to-needle times within 45 minutes for at least 75 percent of applicable patients and door-to-needle times within 30 minutes for at least 50 percent of applicable patients.

Post AI Implementation Challenges

- Increased Physician Fatigue.
  - Significantly increased notifications on mobile devices and work stations.
  - Increased work flow interruptions create more opportunity for loss of productivity and errors.
    - Being interrupted while reading another study can cause diagnostic errors that would otherwise not occur.
  - Additional training added to onboarding process.
    - With a growing department adding another significant training element to a new hires plate can be challenging.



Conclusions

- Implementing a neuro AI system may be beneficial in the right practice environments.
  - Outcomes may vary in different practice settings.
- There are significant financial, logistic, and technical hurdles that must be anticipated and overcome.
- Choosing an AI platform requires in depth analysis of the applications capabilities, reimbursement potential, and real world applicability.
  - The AI portion of the application may not be the most valuable asset to your daily practice.
- Involving key players as early as possible in the decision making process is critical.
  - IT, Radiology, Interventionalists, and the ED must be on board from the very beginning.

Thank You!

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Presentation Sources

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