

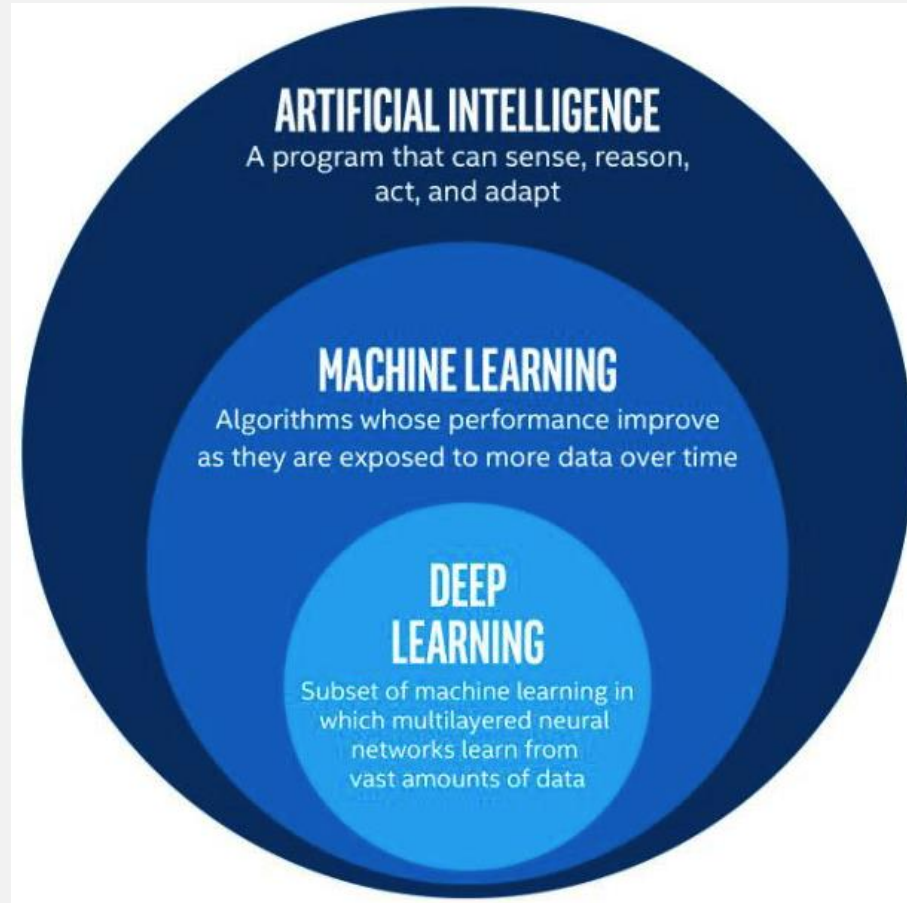
Stacy Olinger  
S.O.A.R 2023  
Scottsdale, AZ

# INNOVATIVE MACHINE LEARNING TRANSFORMING PATIENT CARE

# STORY OF MR. O



## QUICK REFRESHER





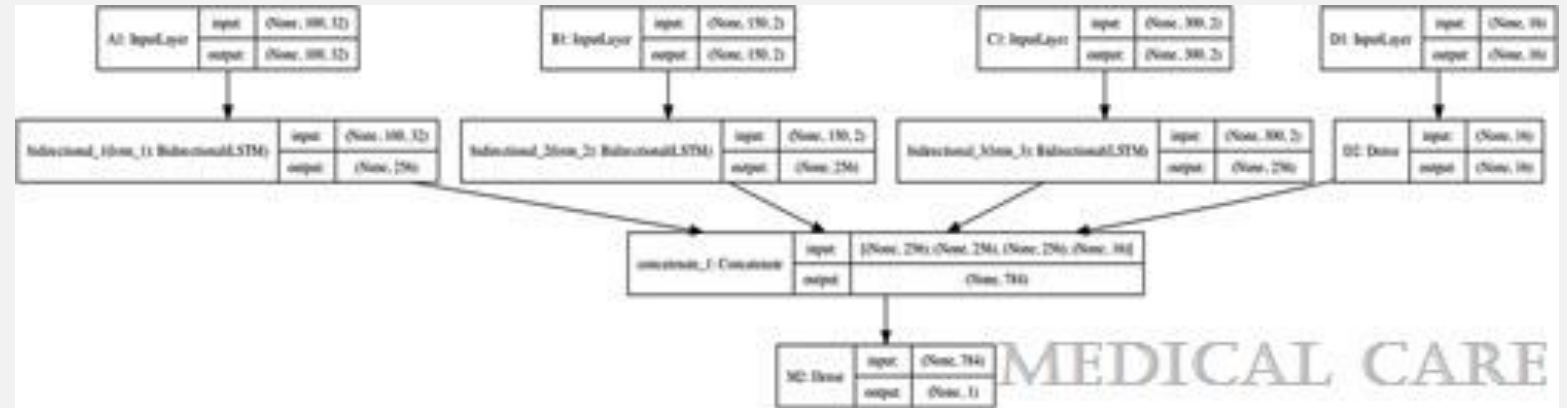
MACHINE  
LEARNING  
IN  
ADVANCED  
CARE  
PLANNING

- Advanced care planning (ACP) is a written document outlining preferences for medical care in the event one is not able to make decisions about the care and/or becomes seriously ill
- Advanced care planning is critically important for improving the quality of care, increasing patient/family satisfaction, and reducing unnecessary costs
- ACP and palliative care are significantly underutilized in nearly every health system in the US
- Major barriers:
  - Accurate identification of high-risk patients
  - Engaging providers to participate in goals of care discussions

# HIGH RISK INPATIENT IDENTIFICATION: MACHINE LEARNING

Epic data is obtained 24 hours after admission analyzing 500+ variables including:

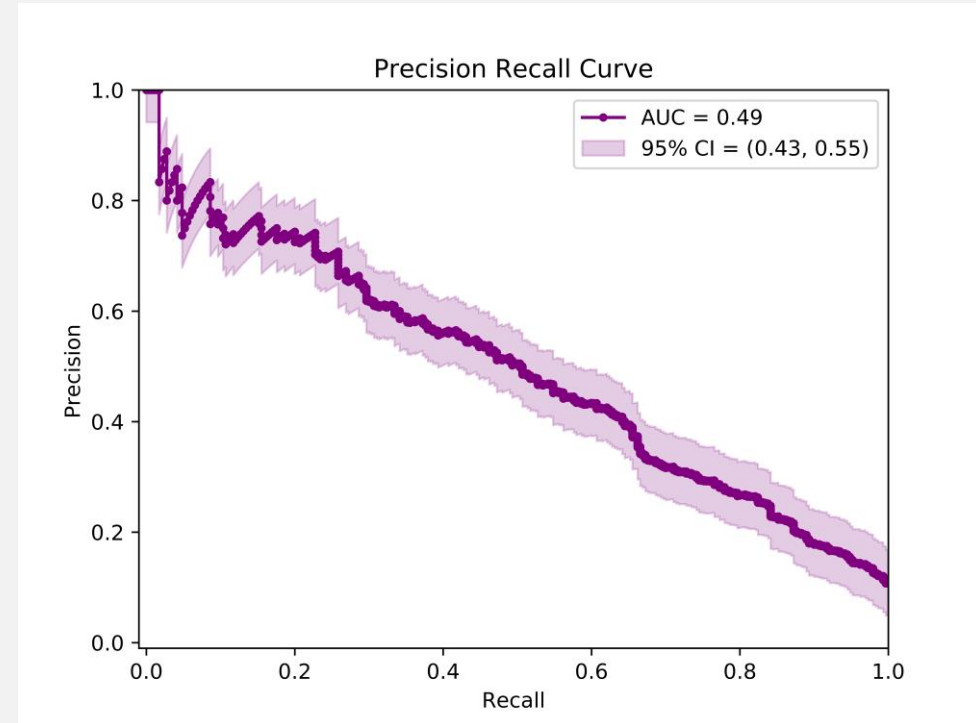
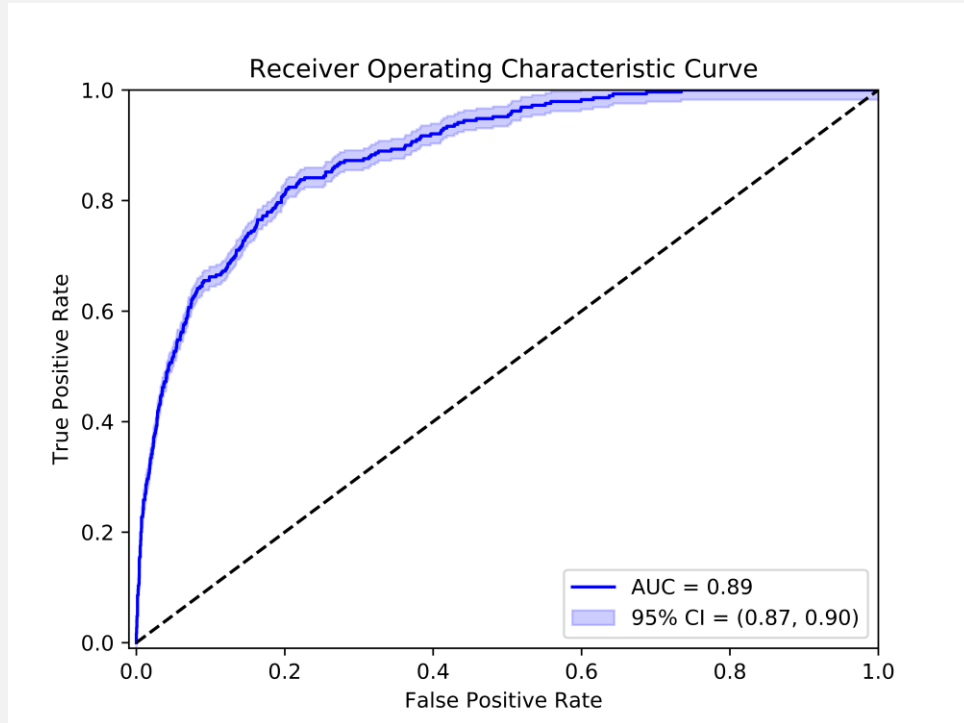
1. Diagnoses
2. Vitals
3. Labs
4. Medications/therapies
5. Demographics



Three bidirectional long short-term memory (LSTM) models  
100 most recent diagnosis, procedure, and medication codes (A);  
150 most recent laboratory test names and values (B)  
300 most recent vital sign names and values (C).

A fourth neural network model (D) was comprised of demographic and social history variables.

# PREDICTION PERFORMANCE



Death or hospice occurred in 1.4% of low encounters, 5.2% of medium encounters, and 18% of high risk encounters.

SUCCESSFUL IMPLEMENTATION AT  
WASHINGTON UNIV / BJC

*“I fundamentally believe the deployment of AI in the healthcare setting is 20% of a technology problem and 80% a human problem, especially around workflow engineering”*

**Philip Payne**

Professor and Founding Director of the  
Institute for Informatics, Data Science, and  
Biostatistics

Washington University in St. Louis

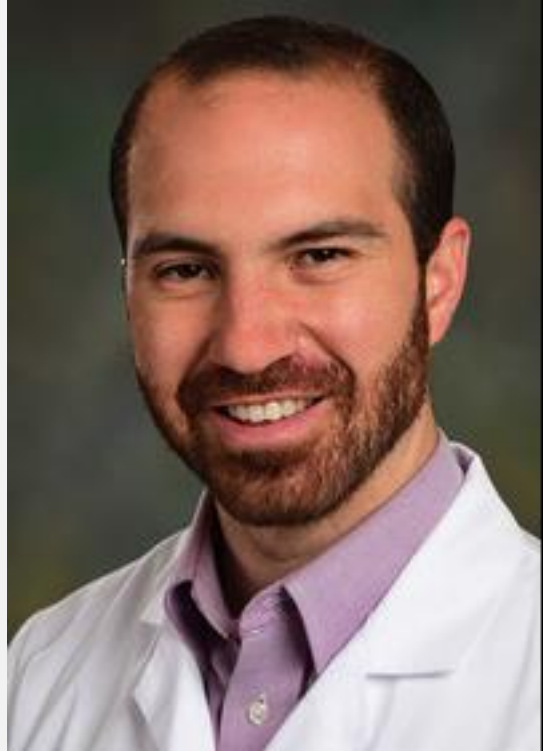
- Pilot inpatient deployment:
  - **3x higher rate of code status changes**
  - 87% response rate (typical rate ~20%)
  - 4x increase in ACP
  - Time to ACP cut in half
  - P-value <0.001
- Currently deployed at 8 BJC hospitals and 25+ primary care sites
- Has been used by 250+ providers for 1000+ patients

Chi, et al. *JAMA Open*, 2023.

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2803939>

# FIND A CHAMPION

<b>A</b>	<b>Awareness</b> – Of the need for change
<b>D</b>	<b>Desire</b> – To participate and support the change
<b>K</b>	<b>Knowledge</b> – On how to change
<b>A</b>	<b>Ability</b> – To implement desired skills & behaviors
<b>R</b>	<b>Reinforcement</b> – To sustain the change



Dr. Nathan Moore

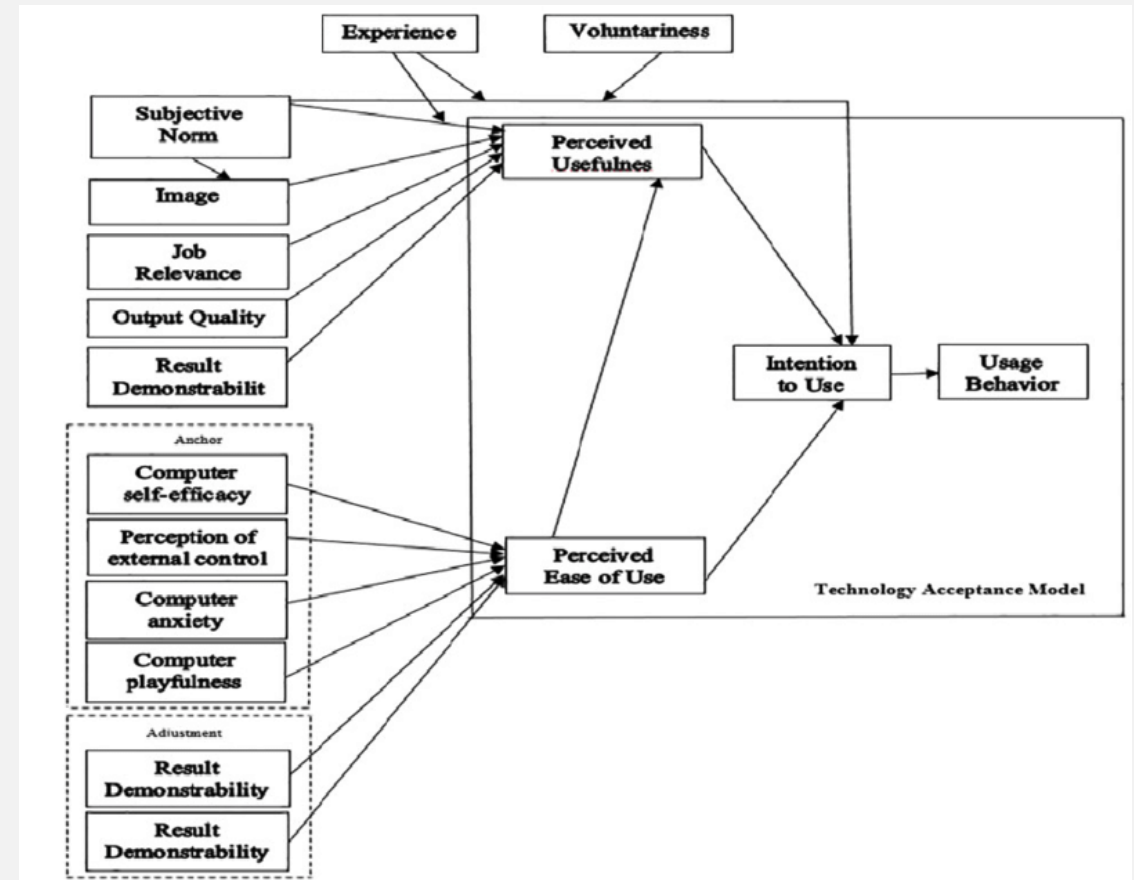
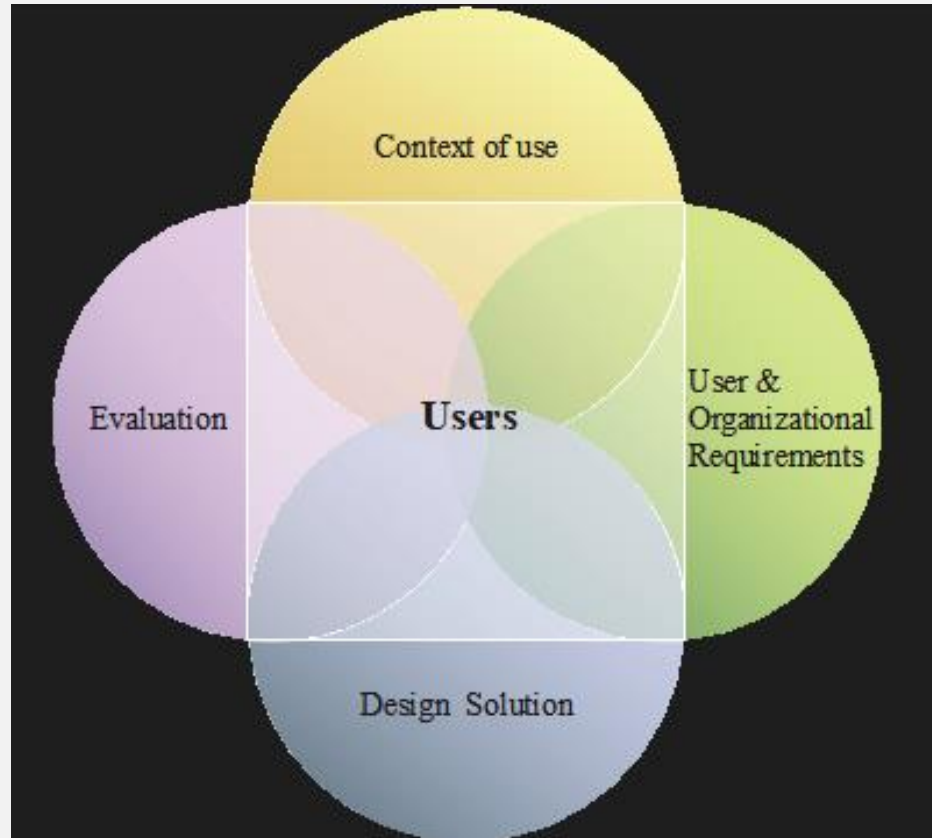


Dr. Pooja Vyas

<https://www.prosci.com/methodology/adkar>



# DESIGN WITH THE USER



Human-Centered Design Principles.

Photo from nist.gov

<https://www.nist.gov/itl/iad/visualization-and-usability-group/human-factors-human-centered-design>

Raeisi, Soheila. (2016). Factors Influencing to M-Commerce Adoption in China. The International Journal of Business & Management.

## Epic Secure Chat

MAKE IT ONE  
LESS THING &  
KEEP  
AUTONOMY

High Signal  
to  
Noise Ratio

This patient has been identified as potentially elevated risk of mortality in the next 30 days. Would you be willing to have a goals of care discussion and document a brief goals of care discussion to support this patient? Please respond with this message with a, b, c or d.

- a. Yes
- b. I would prefer to have the palliative care team address and document goals of care on this patient
- c. I have already addressed goals of care with this patient/family
- d. I decline to either address goals of care and do not want the palliative care team to address

12:02 PM

MD Response	
A	40%
B	24%
C	15%
D	8%
No response	13%

# SHOW ME HOW OR WHO

Crucial Learning

	MOTIVATION	ABILITY
PERSONAL	<b>1</b> Connect to values	<b>2</b>  Invest in deliberate practice
SOCIAL	<b>3</b> Provide encouragement	<b>4</b> Provide assistance
STRUCTURAL	<b>5</b> Reward with care	<b>6</b> Change the environment

Six Sources of Influence

- Communication Skills Academy
- Palliative Care Providers

# MAKE IT EASY

Crucial Learning

	MOTIVATION	ABILITY
PERSONAL	<b>1</b>  Connect to values	<b>2</b> Invest in deliberate practice
SOCIAL	<b>3</b> Provide encouragement	<b>4</b>  Provide assistance
STRUCTURAL	<b>5</b> Reward with care	<b>6</b> Change the environment

Six Sources of Influence

- ACP Note templates with billable notes
- Code status
- My Wishes
- Automated ordering
- Palliative Care team

# SHARE THE WINS

Crucial Learning

	MOTIVATION	ABILITY
PERSONAL	<b>1</b> Connect to values	<b>2</b> Invest in deliberate practice
SOCIAL	<b>3</b> Provide encouragement	<b>4</b> Provide assistance
STRUCTURAL	<b>5</b> Reward with care	<b>6</b> Change the environment



Six Sources of Influence



Mr. B – 57 year old with lung cancer  
93 visits to the ER and hospitalizations in 10 months with no goals of care conversation. After goals of care, no hospitalizations, and supported by the entire hospice team at home.

# WOW THE CFO

Crucial Learning

	MOTIVATION	ABILITY
PERSONAL	<b>1</b> Connect to values	<b>2</b> Invest in deliberate practice
SOCIAL	<b>3</b> Provide encouragement	<b>4</b> Provide assistance
STRUCTURAL	<b>5</b> ★ Reward with care	<b>6</b> Change the environment

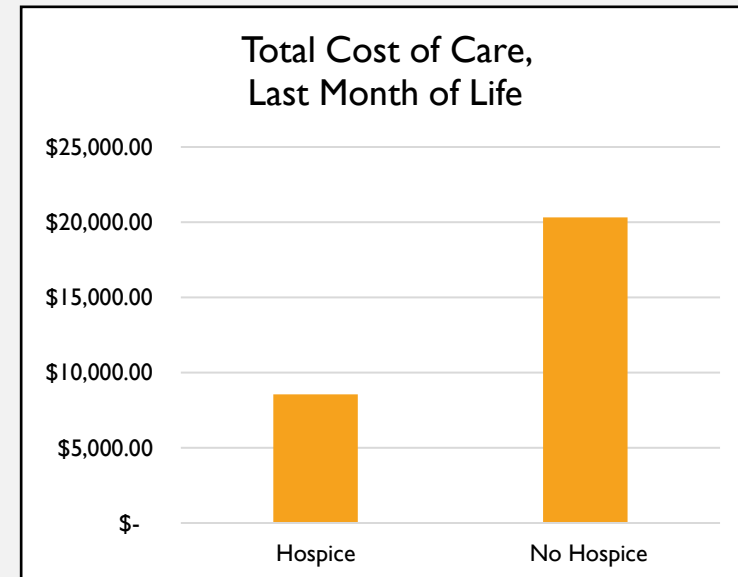
Six Sources of Influence

Primary Care lead discussions - reduced total cost of care by \$4000 per patient

Inpatient ACP:  
 Lower LOS and ICU utilization for low margin patients<sup>2</sup>  
 Decreased ICU costs: \$8200 per ICU patient transferred to an inpatient hospice facility<sup>2</sup>

<sup>1</sup> Lakin et al. Healthc (Amst), 2020

<sup>2</sup> Binney et al. Crit Care Med, 2014



Aldridge et al. JAMA Health Forum, 2022

# KEEP SCORE

Sample Dashboard For Triggered Goals of Care (TGI)

Crucial Learning

	MOTIVATION	ABILITY
PERSONAL	<b>1</b> Connect to values	<b>2</b> Invest in deliberate practice
SOCIAL	<b>3</b> Provide encouragement	<b>4</b> Provide assistance
STRUCTURAL	<b>5</b> Reward with care	 <b>6</b> Change the environment

Six Sources of Influence

Total Number of TGI Patients	TGI Patients with ACP Note	% TGI Patients with ACP Note	TGI Patients with PC Referral	% TGI Patients with PC Referral	TGI Patients with Hospice Referral	% TGI Patients with Hospice Referral
348	117	33.62%	111	31.90%	18	5.17%
TGI Patients Admitted to ICU	% TGI Patients Admitted to ICU	TGI Patients Average ICU LOS	TGI ICU Patients Intubated	% of TGI ICU Patients Intubated	# of PC Referral in TGI ICU Patients	# Hospice Referral for TGI ICU Patients
23	6.61%	4.48	8	34.78%	129	20
TGI Patients Vizient Length of Stay Index	TGI Patients Vizient Mortality Index	TGI Patients Vizient CMI	TGI Patients Vizient 30-Days Readmission	Median days btw admission and 1st Hospice Referral	Median Days btw 1st Hospice Referral and Discharge to Hospice	
1.00	0.30	1.64	15.09%	5		1

# INNOVATE THE MODEL

Crucial Learning

	MOTIVATION	ABILITY
PERSONAL	<b>1</b> Connect to values	<b>2</b> Invest in deliberate practice
SOCIAL	<b>3</b> Provide encouragement	<b>4</b> Provide assistance
STRUCTURAL	<b>5</b> Reward with care	<b>6</b> Change the environment



Six Sources of Influence

Embedded Nurse Practitioner in ICU  
Dual-trained in Palliative Care and Hospice





## KEY POINTS

- AI implementation is imperative to impacting health outcomes
- Key to success: change management & workflow engineering
- Impact the WHY
- Find the early adopter champions
- Iterate design with the user and make it one less thing
- Keep autonomy and high signal-to-noise ratio
- Scale with training and resources
- Use system thinking
- Prove the ROI and align incentives
- Keep score and share successes
- Innovate and iterate to keep it sticky and create raving fans

# QUESTIONS?

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