Unveiling Challenges: A Contextual Inquiry into Barriers to Implementing AI-Powered Predictive Analytics in the CT-ICU

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INTRODUCTION

Cardiothoracic intensive care units (CT-ICU) are focused on caring for cardiothoracic surgical patients by a highly trained and specialized care team.

Morbidity and mortality among critically ill patients remain high, with known variation between high-volume and lower-volume centers and surgeons.

AI predictive algorithms to identify patients at risk for adverse events in the CT-ICU after cardiac surgery are a potential tool for care teams. Identifying and considering barriers to implementing artificial intelligence predictive algorithms can inform predictive analytics development and user interface design in this space.

This study evaluates the attitudes and barriers to implementing predictive analytics in the CT-ICU.

METHODS

Observations and semi-structured interviews were conducted with fourteen healthcare providers (n=14) in the CT-ICU at a tertiary care facility (Table 1).

Thematic Analysis: Thematic analysis was conducted to answer the research question: *What are the attitudes and barriers of end users to implementing predictive analytics in the CT-ICU?*

Observed	Subgroup	Number	Interview Structure
Nursing	Newer nurses	3	Semi-structured Interviews
	Experienced nurses	4*	
	Nursing Supervisors	2	
Advanced Practice Providers (APPs)	PAs and NPs	3	Observational and Individual Interviews
Physicians	Surgeons	2	
	Cardiovascular Critical Care	2	

Table 1. Healthcare providers were identified as key members of the CT-ICU. These healthcare team members were observed and interviewed. Total participants (n=14). *including nursing supervisors.

RESULTS

Trust and Validity of Artificial Intelligence (AI)

The healthcare team was overall optimistic but cautious about predictive analytics. Predictive AI introduced into the clinical setting must have added clinical value beyond provider acumen.

"You guys will do the numbers, and you'll be like the accuracy of this is like unbeatable, and …. we'll trust you for a little while, and then, you know, after a couple of months, we'll determine for ourselves, like, do we clinically experience it to be that accurate or not. And then that will shape our behavior" P6.

"We get alerts that way through Epic, but I'd say 99% or more of them are unhelpful and ignored by most providers." P6.

"It needs to be relevant and acted upon."

"Noise with chats and signals has the potential to create more noise without helping."

"Needs clinical validation." There is "no replacing hands and providers" P12

Discussing current equipment "…it will sometimes read erroneously." P5

"So, the data that the system is depending on is only as good as the person who puts it in.

I would have a lot of concerns about the integrity of and the reliability of the entry of the data that would then be (used) because, like, it would be hard to imagine how this system would be able to predict." P13

"I think probably the more we use it, the more powerful of a tool it will become. P14.

"…in my mind, this is a trust but verify type situation."

"…how high-quality data is going in such that they could then trust the product." P7

"It is so important these people are making strides every day. If we are not making progress, we are falling behind" P3.

Figure 1: A word cloud generated during thematic analysis highlights the importance and prevalence of alarms in the workflow of the CT-ICU.

Workforce Burden

Participants discussed the benefits and challenges of technology in the CT-ICU. Workflow and system efficiency were important to allow the focus to be on the patient. They discussed alarm fatigue, click fatigue associated with electronic medical records, and documentation burden.

"It's very easy for everyone to get annoyed by any box that comes up. Like lots and lots of click fatigue, it's real, very, very real." P8.

"It's like I can't think, when all the alarms are going off."

"You know how when you are driving and you turn down the radio (to concentrate), you can't turn them off. " P4

"Alarm fatigue is a problem - work smarter, not harder; if we are not going to respond to something, don't have it alarm." P3.

"The glucometer data populates in the patient chart, it doesn't seem like a big deal but oh my god it's so convenient." P2.

"In the chart, it's a lot of the things you can ignore, or it, like, comes up yellow and it wants you to do 5 million things. And you're already doing 5 million things and it's just getting in the way of you, like, progressing through your, what you're actually trying to do." P9

"not integrated into Epic and they need to be manually entered every hour. If it is very busy nursing can get behind in charting the results. They will often will chart them later when they have time. "Anything integrated into Epic is a huge time saver." P1.

We thank the CT-ICU staff for their enthusiastic participation in this study.

DISCUSSION

- Attitudes of the care team were cautiously optimistic.

- Potential barriers to implementing AI in the CT-ICU were identified as trust and validity in AI, the importance of added clinical value beyond current clinical acumen, and consideration of workforce burden.

- AI-powered predictive analytic development and design should consider clinical team burden and trust in AI. Examples include:
  - Integration with the patient charting system.
  - Customization in alarm notifications.
  - Identify alarm thresholds with the highest clinical value.
  - Verification of erroneous data that will inform the prediction.

- This study highlights the importance of involving the clinical team in developing and implementing AI in the clinical setting.

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