# HUMAN FACTORS, POLICY AND NEW TECHNOLOGIES TO IMPROVE HEALTH

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3

### **GUIDING QUESTIONS**

What are innovative uses of health information technology...

based on human factors and experience in other domains? How could this affect policy?

- CMS Medicare Promoting Interoperability Program ONC-HIT Safer Guides (2022 hospitals)
- FDA MedWatch incident reporting (post-market)





#### **HUMAN FACTORS**

**Applies theoretical** frameworks from behavioral and social sciences to enable experts in specialized roles to effectively and easily use complex systems with embedded automation



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# INNOVATIVE TECHNOLOGY: VOICE LOOPS

OK, we're looking real good. I think the regulators have locked up.

Flight, Booster. The engines look very good.

Copy that!

I think we had another spit on that center engine.



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#### **SUPPORT COMMUNICATION**

- Work remotely
- Direct attention
- Integrate events & actions
- Request communication







#### WHILE 'LISTENING IN' TO...

- Detect emerging issues
- Synchronize activities
- Judge availability
- Broadcast updates
- Shared situation awareness



Flight Director Loop	Air-to-Ground Loop
Booster to Flight: Well, we did have it on the deck alpha. And we did get it on $>$ as well. I think they were on the decks before but never an alarm.	
	FDO to CAPCOM: Negative return.
	CAPCOM to Atlantis: Atlantis, negative return.
	Atlantis to CAPCOM: Copy negative return.
	FDO to CAPCOM: On my proposed ATO, mark.
Synchronizing activities	CAPCOM to Atlantis: Atlantis, press-to-ATO.
with temporal landmarks	Atlantis to CAPCOM: Press ATO.



#### ...AT MULTIPLE LEVELS OF DETAIL

More detail for those

responsible for

mechanical &

electrical systems

Less detail for

supervisor







#### ...ON MULTIPLE LOOPS AT ONCE



- Work on 1 Support
- Update Flight Director
- Monitor Air/Ground
- Monitor ~5 others





### SUMMARY: INNOVATIVE FEATURES OF VOICE LOOPS (1/2)

- Supports the ability to "listen in"
- Supports communicating at different levels of detail
- Supports integrating information about events with responses to events in relation to time horizons
- Monitoring and transmitting information without interrupting ongoing activities/communications

### SUMMARY: HOW LOOPS SUPPORT COORDINATION (2/2)

- Can remain peripherally aware of system events and other practitioners' activities
- Facilitates group synchronization by broadcasting landmark events
- Little additional workload for people directly communicating



#### IMPLICATIONS FOR PREDICTIVE ALGORITHMS AND SMART ALARMS

- Low number of high-reliability indicators
- Judge interruptability and relative priority before alerting
- Early detection of failures and emerging issues
- Integrates recommended action with alarm
- Justification for interpretation on demand

#### IMPLICATIONS FOR SHARED DISPLAYS AND AUDITORY SPACES

- Provide visibility into system status & resource availability
- Structure around landmark events
- Synchronize ad hoc group activities
- Can increase/decrease detail ('zoom')
- Not incorporated into legal/formal record



#### NEW TECHNOLOGY: BARCODED WRISTBANDS AND MEDICATIONS





## DESIGN INTENT: IMPROVE MEDICATION SAFETY







#### **UNINTENDED CONSEQUENCES**

	Surprises when automation is "strong and silent"	Aviation accidents, lab research	1992 Strasbourg, France; 87/96 died	
Deg <b>coc</b> tran elec	graded <b>team</b> ordination when sition from paper to ctronic	Electronic flight st in air traffic contro	trips	
	Advisory systems increase workload during escalating situations	"Explanation" sy anesthesiology	stems in	
	Monitoring raises priority	On-time departures in	×	* *
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#### DEGRADED TEAM COORDINATION



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#### **UNINTENDED CONSEQUENCES**

Surprises when automation is "strong and silent"		Aviation accidents, lab research 1992 Strasbourg, Fra	ance; 87/96 died
	Degraded <b>team coordination</b> when transition from paper to electronic	Electronic flight strips in air traffic control	X00 (660Pt CH22 (kg))         0943         1020         LOCAL
	Advisory systems increase workload during escalating situations	"Explanation" systems in anesthesiology	
	Monitoring raises <b>priority</b>	On-time departures in aviation	* *
Autom or una	ation increases <b>rigidity</b> anticipated situations	Automated SOPs in nuclear power	Cattalizand Badrag Benerican Beneric



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#### **RIGID SYSTEM: PT REFUSES MED**

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<u>Comment (Requ</u> :	<u>ired)</u> :			
				I
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#### **NEW FEATURE: PT REFUSES MED**

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#### **IMPLICATIONS: NEW HIT DESIGN**

- Summary overview display
- 'View only' access to other roles
- Highlight changes
- Avoid rigid activity sequences



#### 2022 hospitals self-attest ONC-HIT

#### 9 SAFER Guides

Recommended practices to optimize safety and safe use of Electronic Health Records

	Foundational Guides	<ul> <li>High Priority Practices*</li> <li>Organizational Responsibilities*</li> </ul>				
	Infrastructure Guides	<ul> <li>Contingency Planning*</li> <li>System Configuration*</li> <li>System Interfaces*</li> </ul>				
)	Clinical Process Guides	<ul> <li>Patient Identification*</li> <li>Computerized Provider Order Entry with Decision Support*</li> <li>Test Results Reporting and Follow-Up*</li> <li>Clinician Communication*</li> </ul>				

https://www.healthit.gov/topic/safety/safer-guides



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# **FDA MEDWATCH: REPORTING FOR APPROVED MEDICAL DEVICES**

#### Safety Information and Adverse Event Reporting

- 3500: Health Professional
- 3500B: Consumer/Patient





https://www.accessdata.fda.gov/scripts/medwatch/index.cfm?action=reporting.home



#### **MODEL OF USE ERRORS AND HARM**





#### **SOURCES OF SYSTEM RESILIENCE**

System-Level **Resilience Sources** 





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Characteristics that

Resilience

Used with permission of The MITRE Corporation. Neville et al., 2021, Resilience Engineering Association



#### **CONCLUSION: INNOVATIVE HIT USE**

- 'Listening in' is a smart alarm
- Scale up/down detail with C&C hierarchy
- Synchronize around broadcasted landmarks
- Negotiate resources to support margin of maneuver
- Role fluidity and action ordering flexibility in crises



#### **CONCLUSION: HEALTH POLICY**

- CMS: Add prediction & mitigation of negative unintended consequences for EHR upgrades to SAFER guides
- FDA: Investigate reduction in sources of system resilience as contributing causes to reported events
- FDA: Post-market reporting of negative, unintended consequences





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