THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

What can Aviation and Pharmaceuticals Teach us about how to set up a System of Assurance for Different Types of AI-Enabled Systems?

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GW/TAI
TRUSTWORTHY AI INITIATIVE

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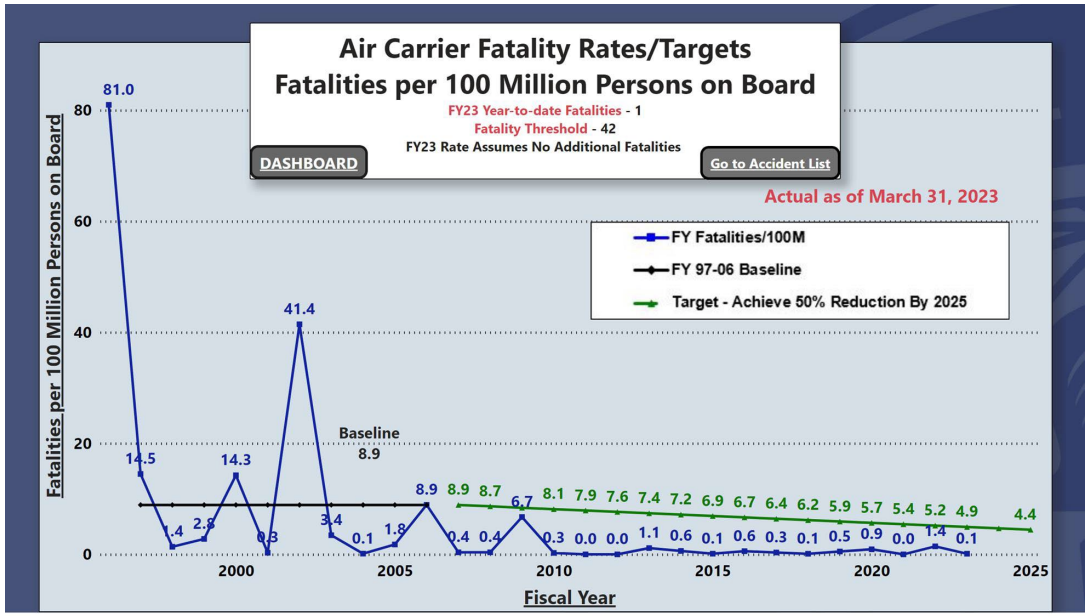
Motivation

https://sofrep.com/news/artificial-intelligence-in-warfare/

Motivation

Currently, to mitigate risk of AI, researchers and practitioners are focused on the model development.



Commercial Aviation Safety, USA[1]

Sex, race and Hispanic origin[1], and age	At least one prescription drug in past 30 days			
	1988–1994	1999–2002	2011–2014	2015–2018
All ages, age adjusted[2]				
Both sexes[3]	39.1	45.2	46.9	45.7
Male	32.7	39.8	42.6	41.7
Female	45.0	50.3	51.2	49.5

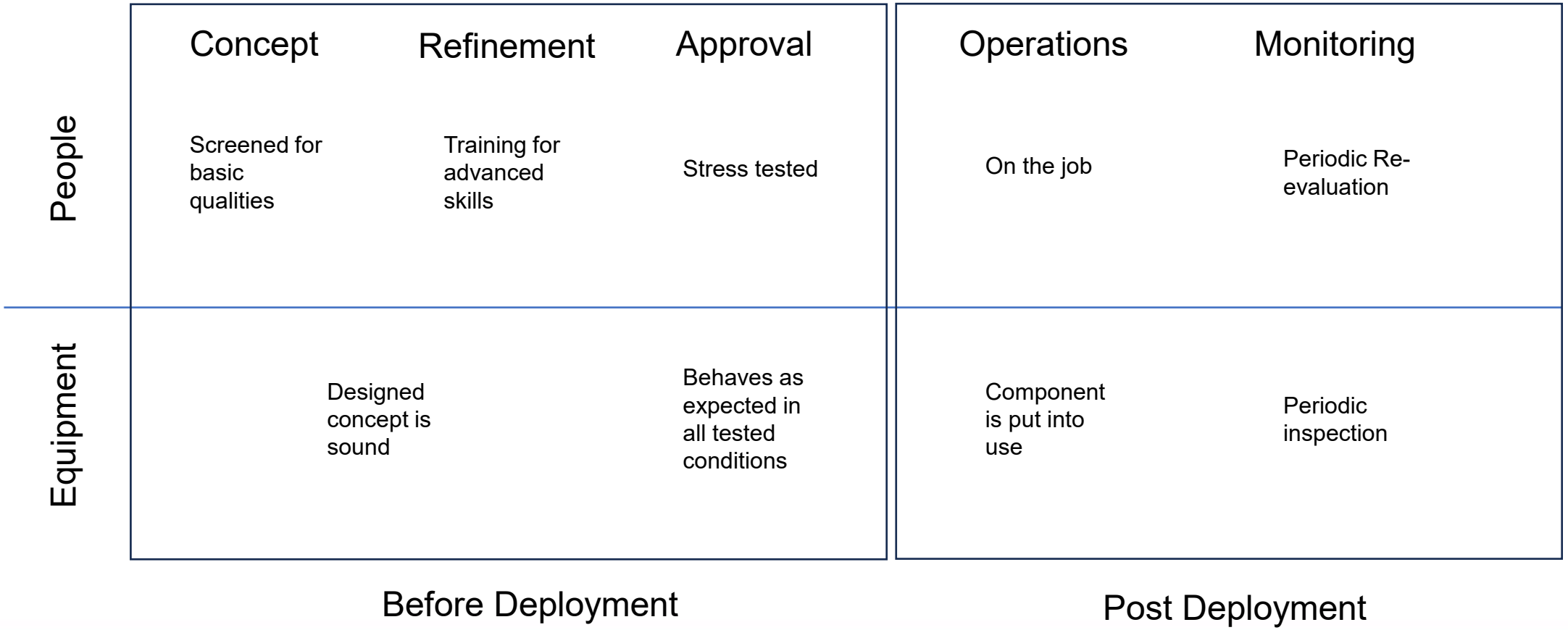
Prescription Drug Use, USA[2]

1. https://assets.performance.gov/APG/files/2023/june/FY2023_June_DOT_Progress_Aviation_Safety.pdf
2. https://www.cdc.gov/nchs/fastats/drug-use-therapeutic.htm

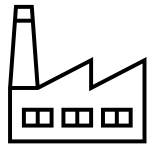
Methodology

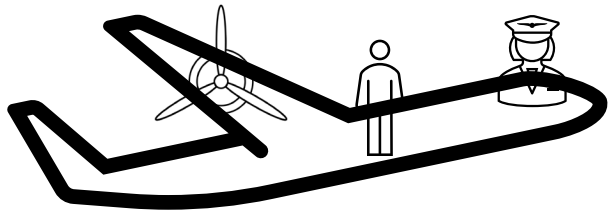
Two Industries Selected for their Risk Profiles → Conduct Systemic Review and Mapping of Ecosystems → Identify and Map Location of Risks → Identify Who, How, and When Risks are Mitigated

Approach

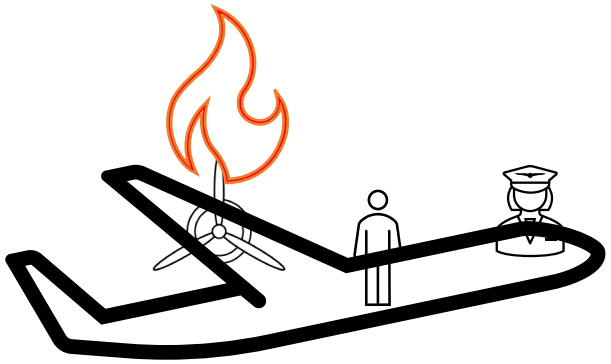

Concept
Refinement
Approval
Operations
Monitoring
People
Screened for basic qualities
Training for advanced skills
Stress tested
On the job
Periodic Re-evaluation
Equipment
Designed concept is sound
Behaves as expected in all tested conditions
Component is put into use
Periodic inspection
Before Deployment
Post Deployment

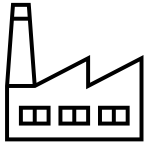
Aviation



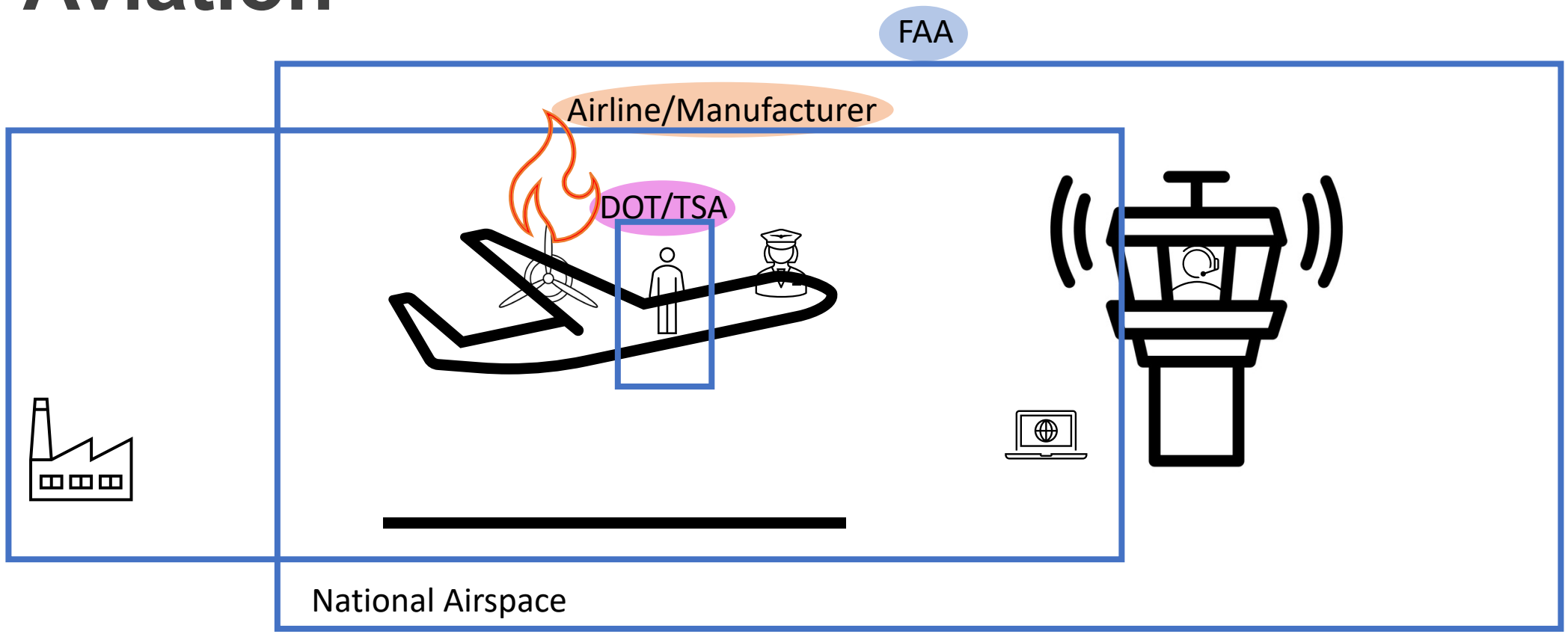


Aviation





Aviation



Aviation

	Concept	Refinement	Approval	Operations	Monitoring
People	• Aptitude tests	• Medical • **Flight school**	• **Qualification**	• **Dual pilots** • Pilot progression	• **Annual checkride**
	• FAA standards of employment		• FAA approved academy	• On the job training • Certification • Progression	• FAA academy
Equipment	• Application • **Design assessment**	• **Performance assessment**	• Certification		• **Scheduled inspection based on calendar time and flight hours**

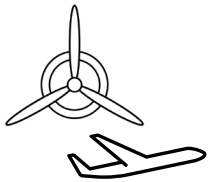
Before Deployment

Post Deployment

Aviation

Risk	Description	Who	When
Component Failure	A flight critical part fails in flight	Maintainers/Pilot	Concept/Refinement/Monitoring
Pilot Incapacitation	Pilot is no longer capable of operating aircraft	FAA	Refinement
Hazardous Weather	Un-forecasted weather	Pilot/ATC	Monitoring
Congested Airspace	Too many aircraft cause deconfliction of airspace difficult	ATC	Monitoring
Hijacking	Unauthorized individual takes control of aircraft in flight	Pilot/TSA	Monitoring
Flight Delays	Congestion of ground traffic or air traffic causes a delay to scheduled flights	ATC	
Component Malfunction	A component malfunctions making further flight ill-advised	Maintainers/Pilot	Concept/Refinement/Monitoring

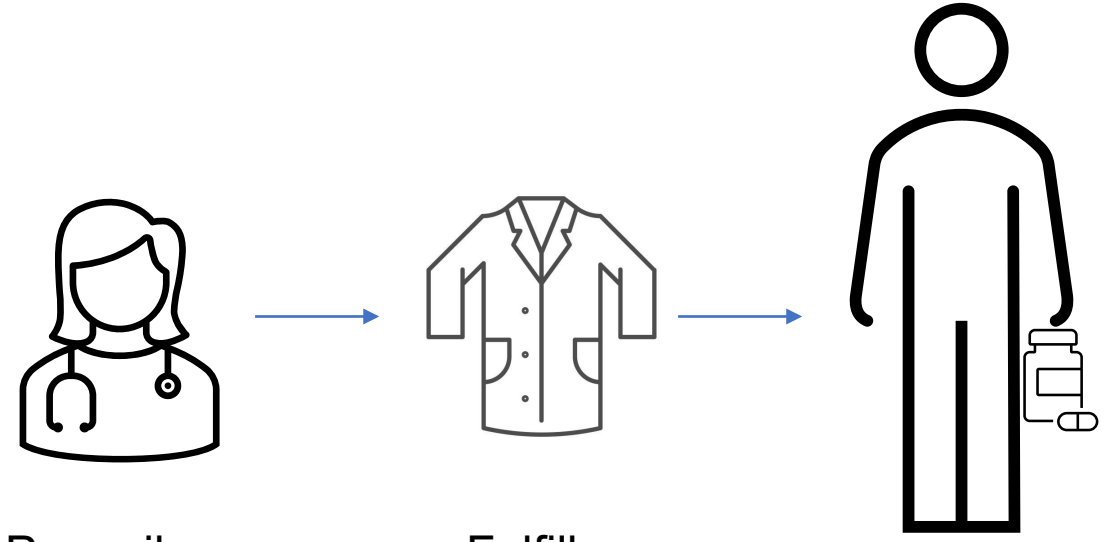
Aviation

	Concept	Refinement	Approval	Operations	Monitoring
People 	• Aptitude tests	• Medical • Flight school	• Qualification	• Dual pilots • Pilot progression	• Annual checkrides
	• FAA standards of employment		• FAA approved academy	• On the job training • Certification • Progression	• FAA academy
Equipment 	• Application • Design assessment	• Performance assessment	• Certification		• Scheduled inspection based on calendar time and flight hours

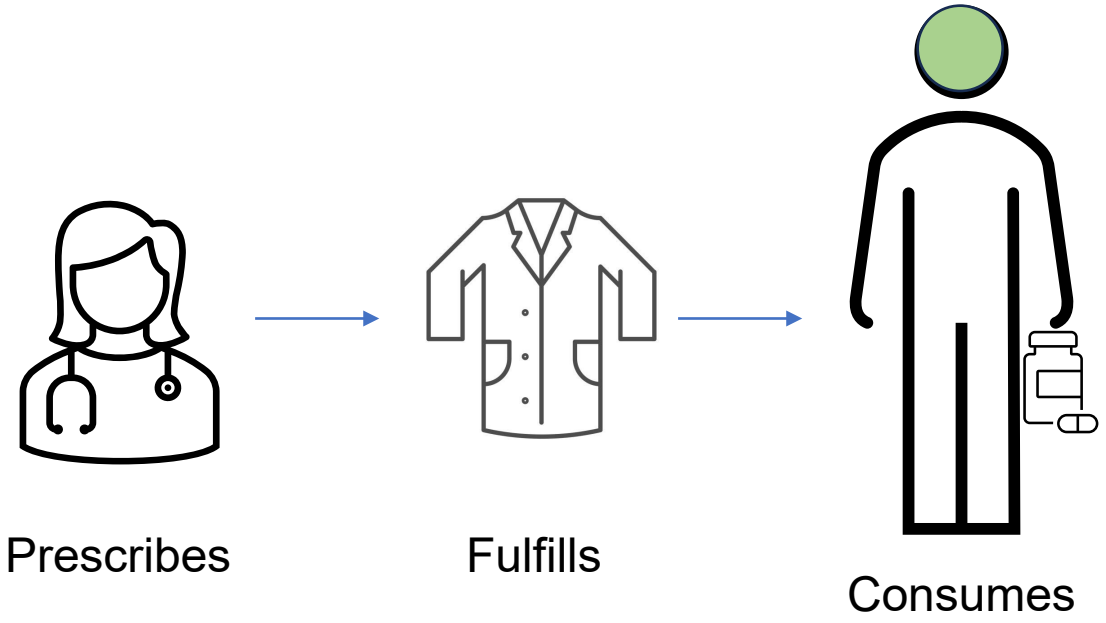
Before Deployment

Post Deployment

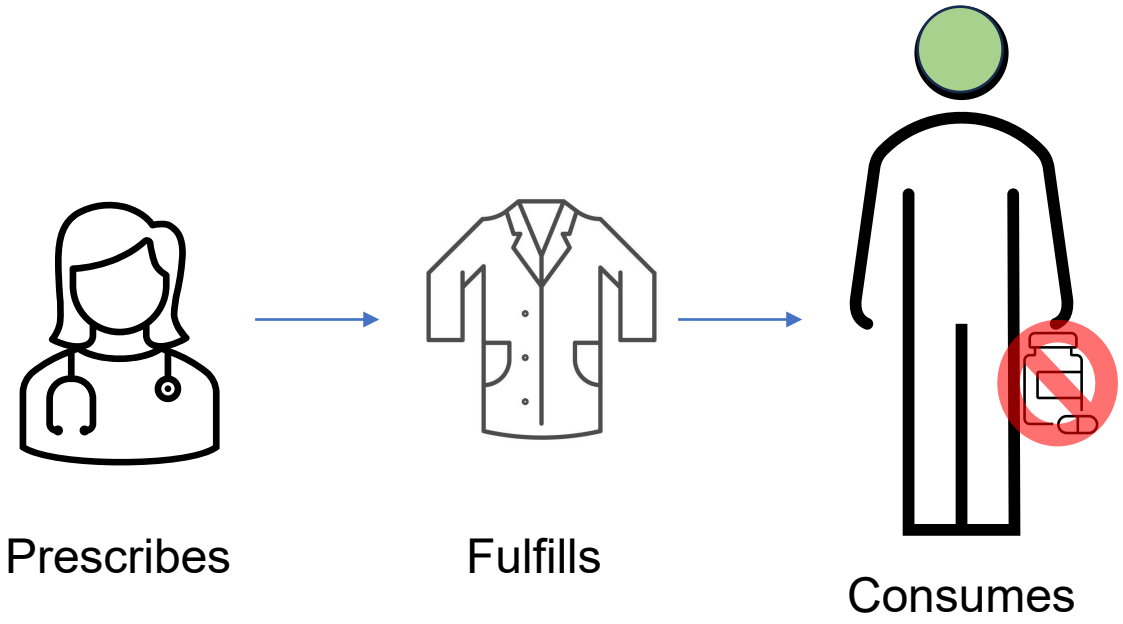
Pharmaceuticals



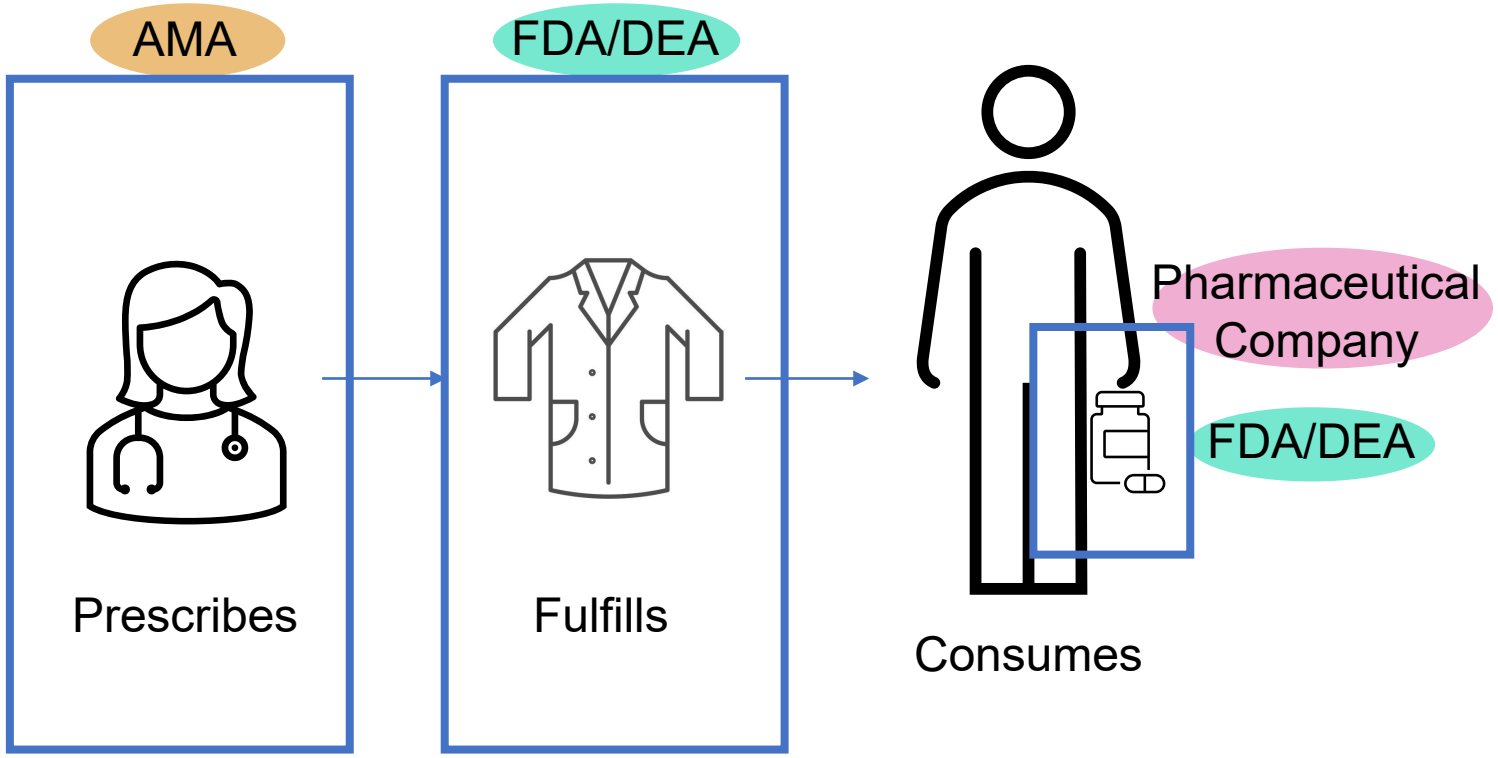
Pharmaceuticals



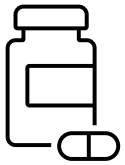
Pharmaceuticals



Pharmaceuticals



Pharmaceuticals

	Concept	Refinement	Approval	Operations	Monitoring
People 	• MCATS	• Medical School	• Doctor	• Progression	• Recertification (7-10 years)
		• Associates or greater	• Licensure		• Annual education credits
Equipment 	• Drug developed	• Animal testing • Investigational New Drug App • Clinical Trials	• Facility inspection	• Drug deployed	• Post market safety monitoring

Before Deployment

Post Deployment

Pharmaceuticals

Risk	Description	Who	When
Ineffective Drug	Medication does not do what it claims to do	FDA	Concept/Monitoring
Malicious Drug	Medication causes more harm than good	FDA	Concept/Monitoring
Poor Quality Control	Medication is effective but inconsistent quality	FDA	Approval
Drug Interactions	Medication interacts dangerously with other prescriptions the patient is taking	Doctor/Pharmacist	Implementation/ Monitoring
Wrong Drug	Wrong medication is prescribed for patent's condition	Doctor	Operations
Drug Taken Incorrectly	Patient does not follow dosage instructions	Doctor/Pharmacist/Patient	Operations

Preliminary Findings

- It’s an ecosystem!
- Where risk is mitigated in an ecosystem is not always or necessarily where it resides
- Different risks require different controls both by type and temporally
- Responsibilities for risks are distributed throughout the ecosystem

AI Implications

- AI risks can be mitigated elsewhere in the ecosystem rather than just in the model itself
- Future work: continue to review other industries to use as examples for different AI ecosystems

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