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# A Knowledge-based Risk Assessment Tool for Alert-overridden High-risk IV Drug Infusions

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Wan-Ting (Kerina) Su<sup>1,2\*</sup>,  
Poching DeLaurentis<sup>2</sup>,  
Mark Lehto<sup>1</sup>

<sup>1</sup> School of Industrial Engineering, Purdue University,

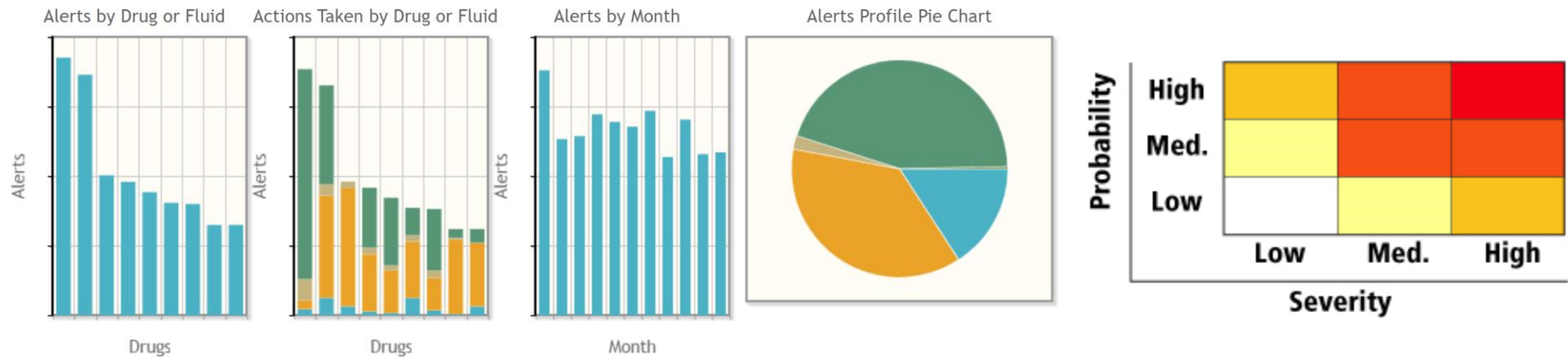
<sup>2</sup> Regenstrief Center for Healthcare Engineering, Purdue University

2017 REMEDI Spring Conference

Date: 04/20/2017



# Problem

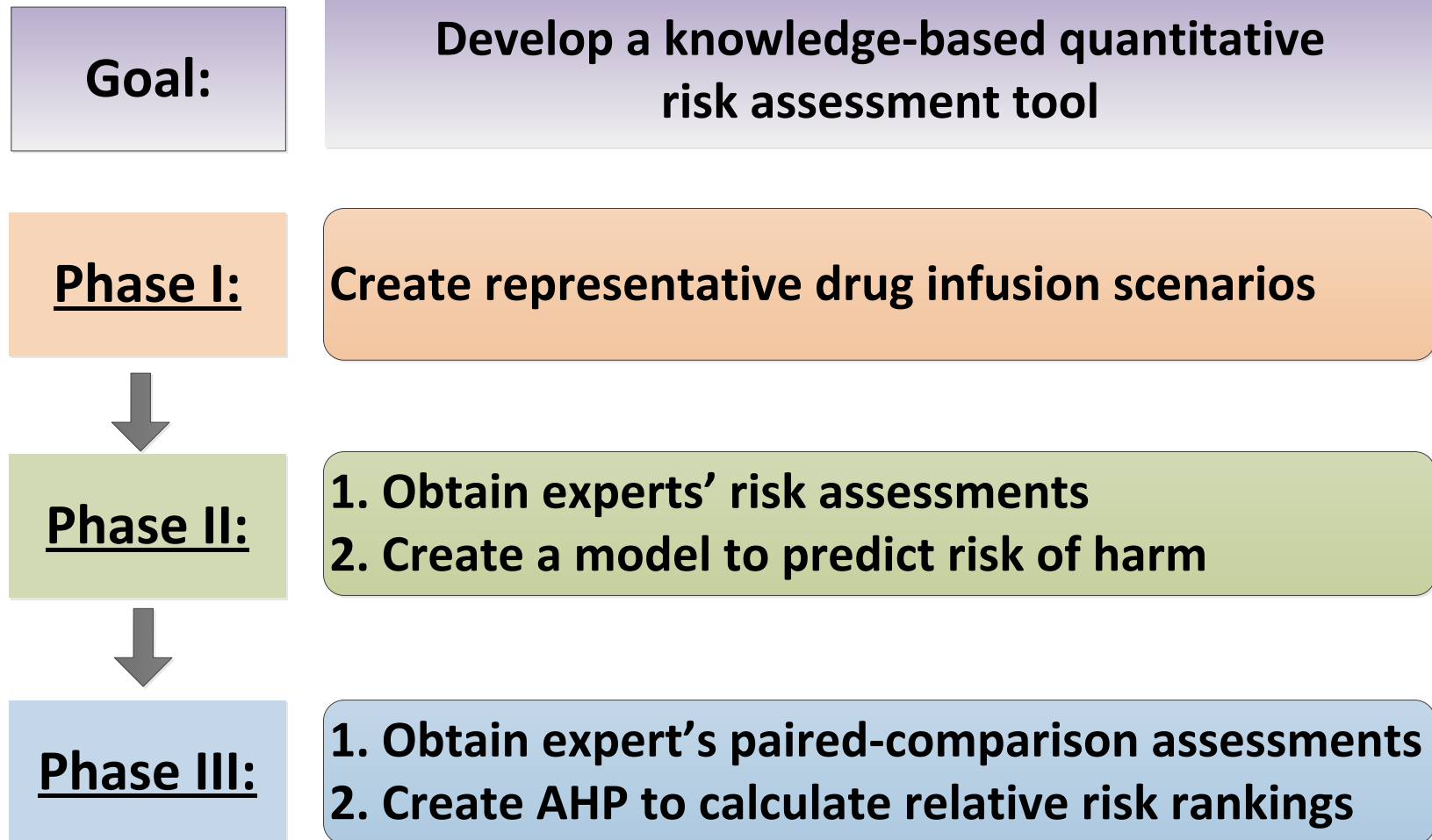


- Each alert-overridden IV infusion could potentially cause patient harm of various degrees
- Most analysis tools evaluate drug infusion performance by alert frequency:
  - Not consider that each alert-overridden infusion could cause patient harm of various degrees
  - No risk-based tool, considering likelihood of potential harm degrees, was developed

# Research Objectives and Importance

- Develop a quantitative risk assessment tool based on medical professionals' knowledge
- This proposed tool can
  - improve the existing analysis tools
  - quantify the potential risk of IV harm by several commonly used, high-risk drug infusions
- Application
  - help the medication safety teams efficiently highlight the clinical care areas and drugs with the highest risk of harm

# Research Framework

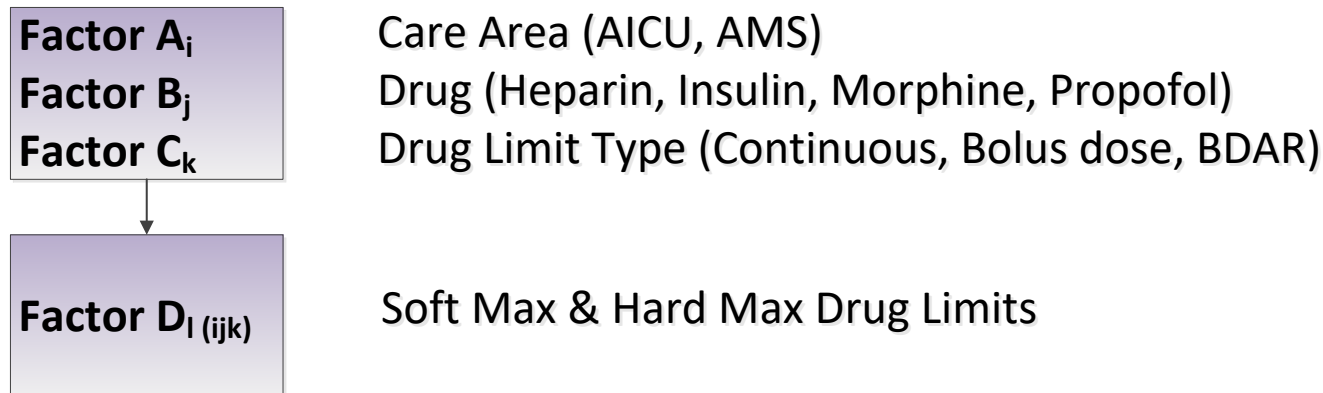


# Explore and Classify Pump Alert Data

- Data:

- A large hospital system (REMEDI hospital member)
  - Time frame: January 2010 – May 2015
  - Overdose and overridden alerts

- Classification

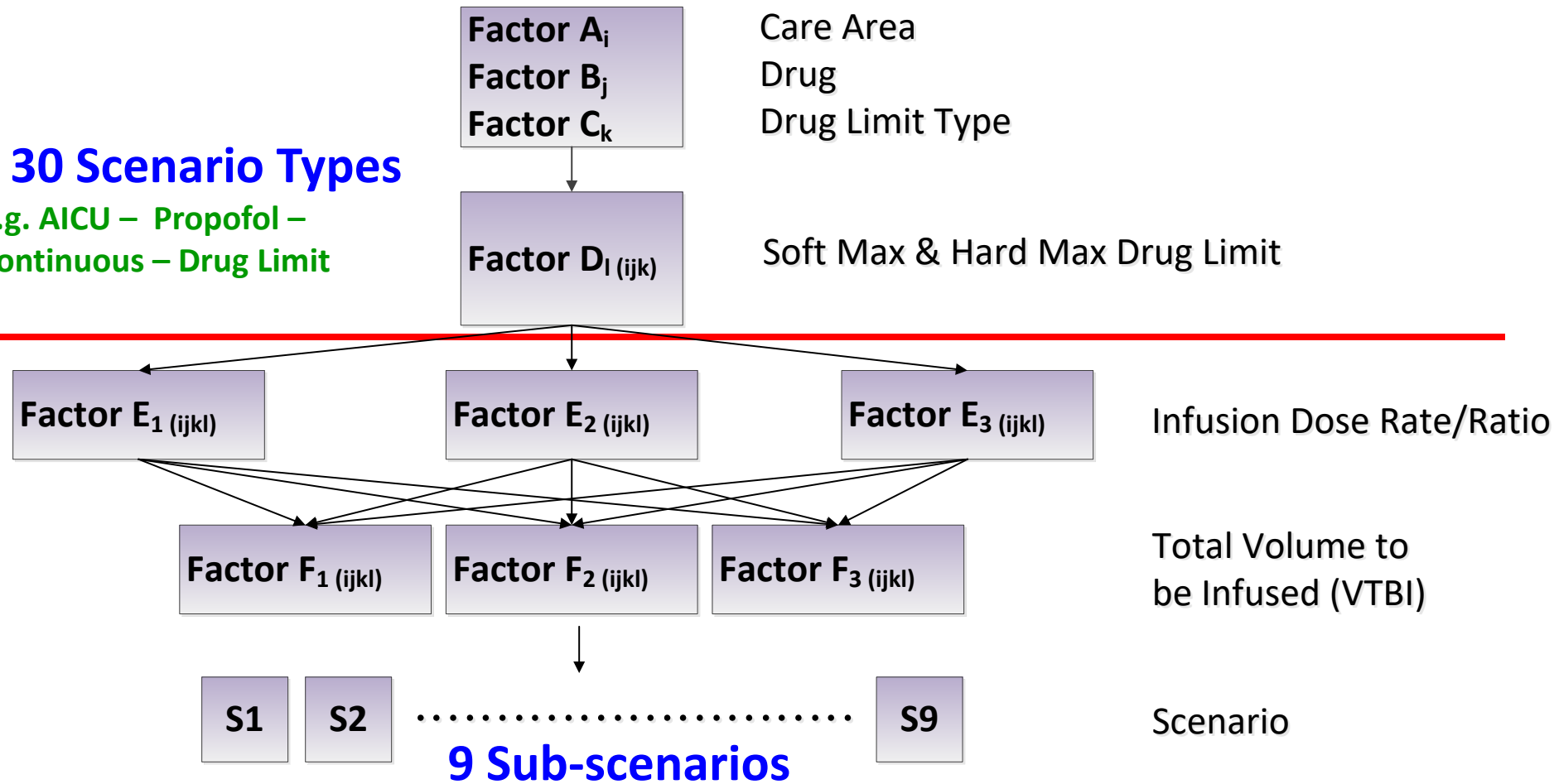


# Scenario Design Structure

One set of A, B, C, D with 9 combinations of E & F

## 30 Scenario Types

e.g. AICU – Propofol –  
Continuous – Drug Limit



**Phase I:**  
Scenario Design

**Phase II:**  
Experts' Risk Assessment

**Phase III:**  
Experts' Paired-  
Comparison Assessment

# Example of Scenarios and Assessment Table

Patient Information  
 - a 35-year-old male  
 - Patient Weight: 70 kg

**AICU - Propofol**

**Field Limit Type: Continuous Dose**

**Soft Max: 51 mcg/kg.min**

**Hard Max 80 mcg/kg.min**

**Scenario I - Infusion Information**

**Total Volume to be Infused (VTBI)**

**Dose (Dose Rate):** 56 mcg/kg.min

▶ **VTBI: 5 mL [A1]**

$$\text{Ratio} = \frac{\text{Dose (Dose Rate)}}{\text{Soft Max (51 mcg/kg.min)}} = 1.1$$

▶ **VTBI: 53 mL [A2]**

**Volume Rate:** 0.4 mL/min

▶ **VTBI: 100 mL [A3]**

Probability (%)

Very Likely	100				
	90	X			
	80				
	70				
	60				
	50				
	40				
	30				
	20				
	10				
	5		X		
	1			X	X
Unlikely	0	Default when no probability selected/marked			

**No Harm**      **Minor Harm**      **Moderate Harm**      **Major Harm**      **Extreme Harm**  
**NCC Category**      **(C)**      **(D)**      **(E)**      **(F, G)**      **(H, I)**  
**Severity of Harm**

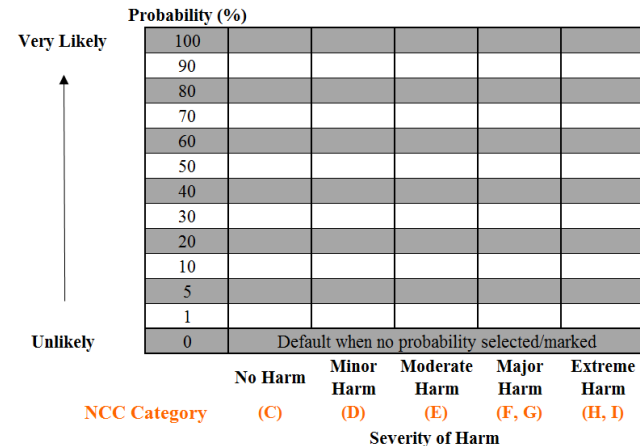
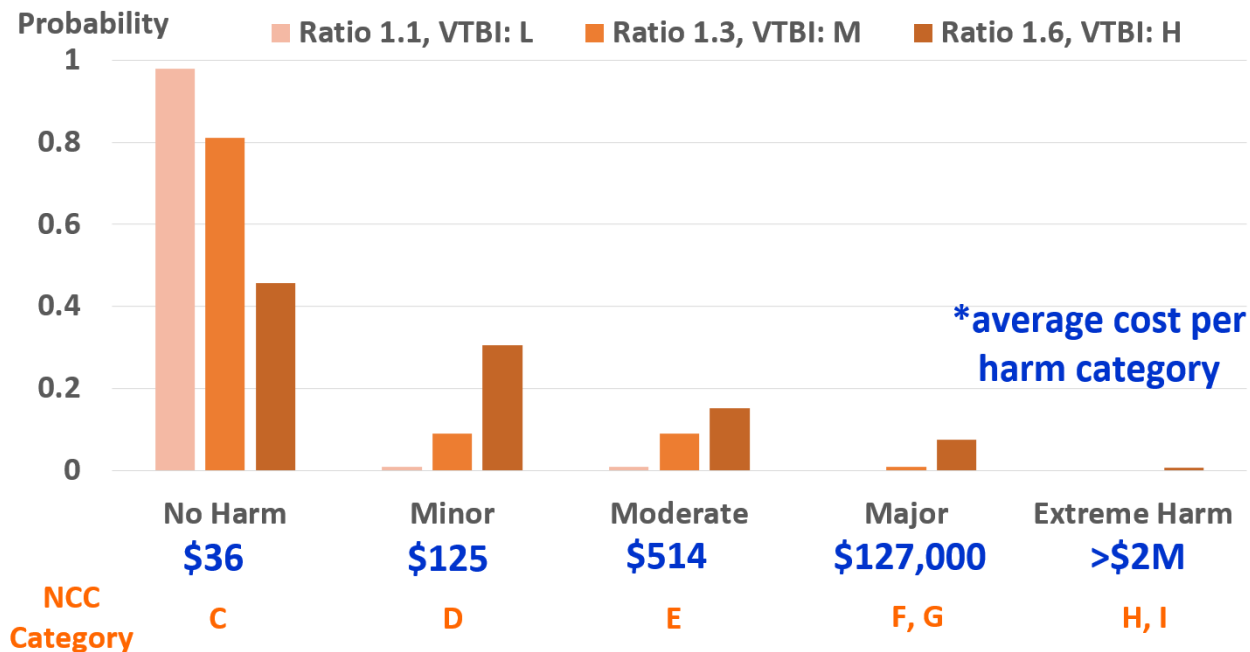
# NCC MERP – Harm Degree Category

NCC Category	Definition II (NCC, 2001) <sup>1</sup>	Severity of Harm <sup>2</sup>
C	A programming error occurred that reached the patient but did not cause patient harm <i>Harm is defined as “any physical injury or damage to the health of a person requiring additional medical care, including both temporary and permanent injury”</i>	No Harm
D	A programming error occurred that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to preclude harm <i>Monitoring is defined as “to observe or record physiological or psychological signs”</i>	Minor Harm
E	A programming error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention <i>A significant intervention is defined as “an intervention intended to relieve symptoms that have the potential to be life-threatening if not addressed”</i>	Moderate Harm
F	A programming error occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization <i>A significant intervention is defined as “an intervention intended to relieve symptoms that have the potential to be life-threatening if not addressed”</i>	Major Harm
G	A programming error occurred that may have contributed to or resulted in permanent patient harm <i>Permanent harm is defined as “harm lasting more than 6 months, or where end harm is not known (‘watchful waiting’)”</i>	
H	A programming error occurred that required intervention necessary to sustain life <i>An intervention necessary to sustain life is defined as including “cardiovascular and/or respiratory support (e.g., CPR, defibrillation, intubation)”</i>	Extreme Harm
I	A programming error occurred that may have contributed to or resulted in the patient’s death	

Source: The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) (2014)

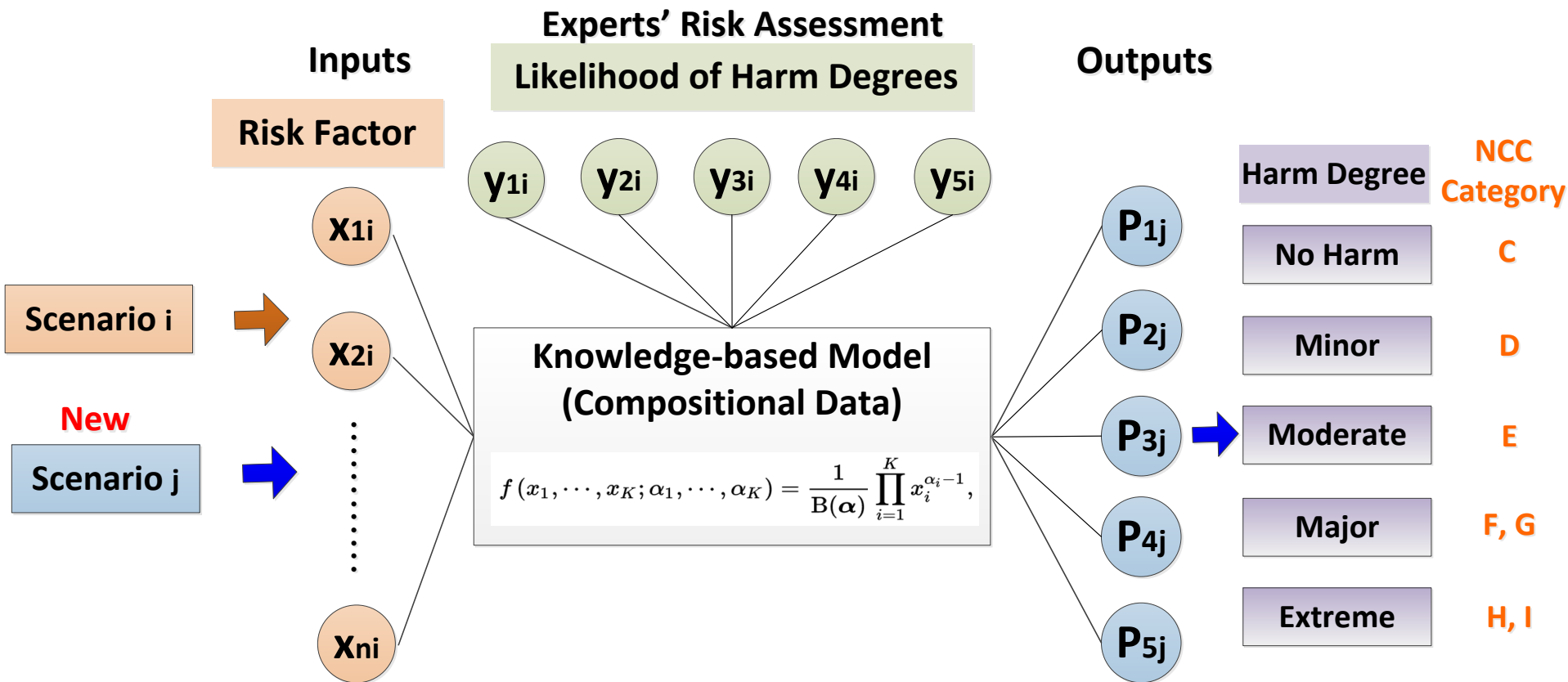


# Preliminary Risk Assessment Results



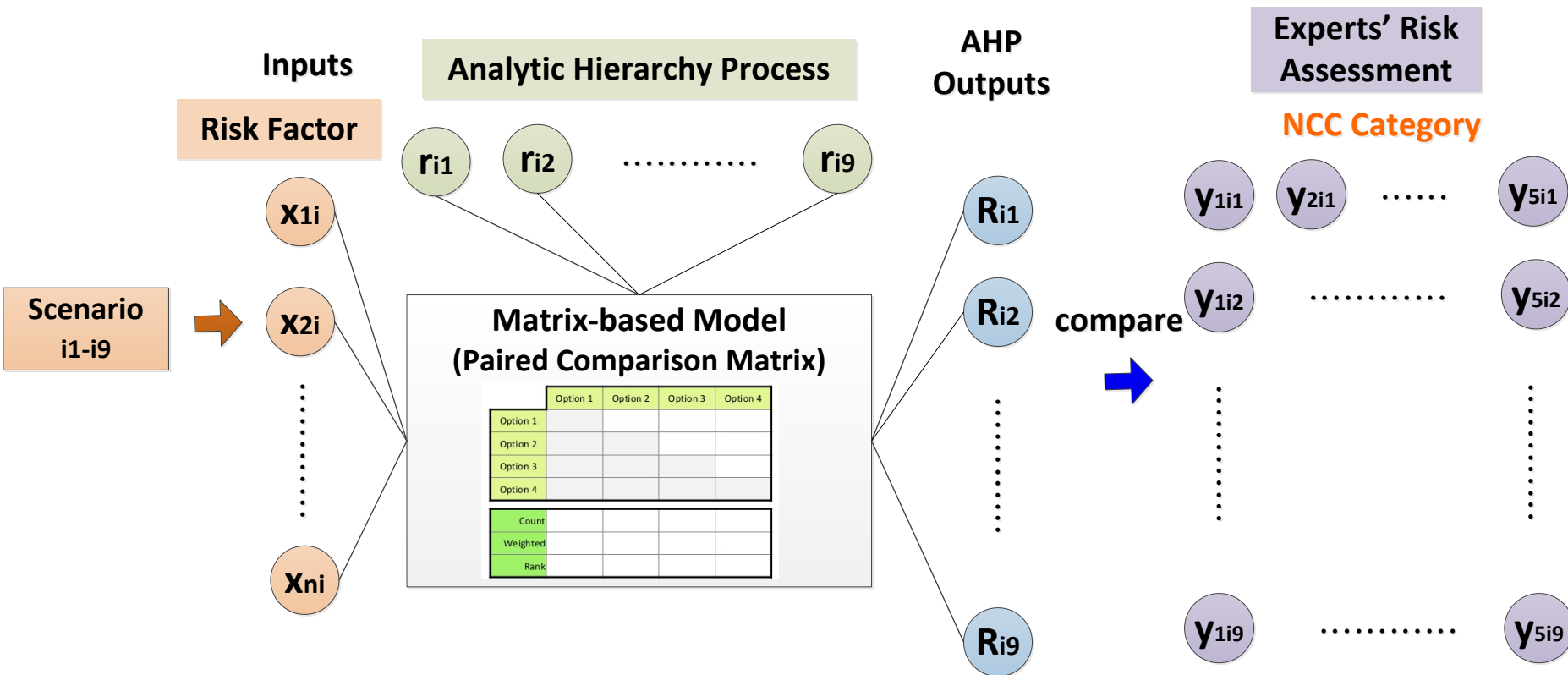
Source: Chang et al. (2003). Categorization, Frequency, and Cost Impact of Medication Errors

# Concept of Risk Assessment Model Development



# AHP Risk Scores v.s. Experts' Risk Assessments

Relative Importance Variables								
factor A	Very Strongly	<b>Strongly</b>	Moderate	Equally Important	Moderate	Strongly	Very Strongly	factor B



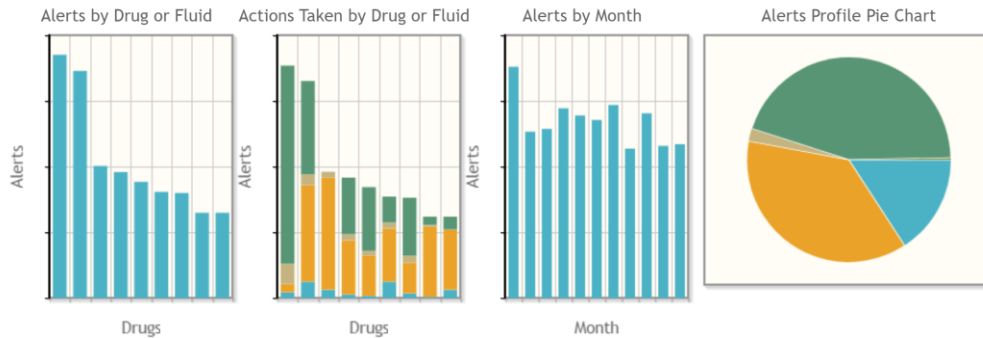
**Phase I:**  
Scenario Design

**Phase II:**  
Experts' Risk Assessment

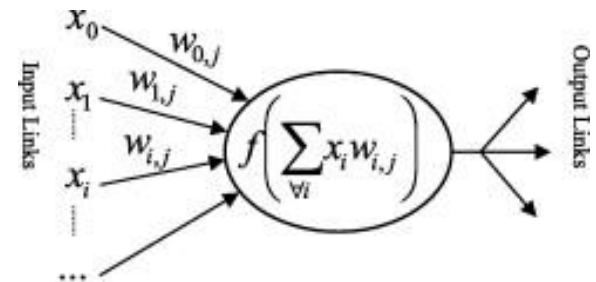
**Phase III:**  
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# Vision

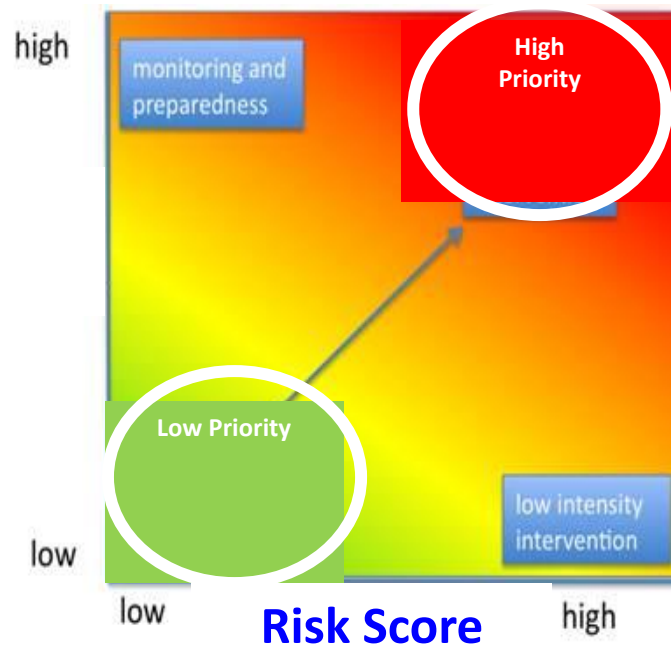
## Frequency-based Indicator



## Risk-based Indicator



Alert  
Frequency



Thank you!

[su33@purdue.edu](mailto:su33@purdue.edu)

