



# HOW DOES THE ICU REQUIREMENT SCORE COMPARE TO TOXICOLOGISTS IN PREDICTING THE NEED FOR ICU CARE IN POISONED PATIENTS?

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## Introduction

- Approximately 40% of poisoned patients admitted to the Intensive Care Unit (ICU) do not require ICU care.
- Identifying poisoned patients who do not need ICU treatment will reduce unnecessary admissions.
- The ICU Requirement Score (IRS) predicts which reported or suspected poisoned patients require ventilatory or hemodynamic support in the first 24 hours after presentation.
- In a retrospective study in the Netherlands, IRS reduced ICU admissions by 33%.

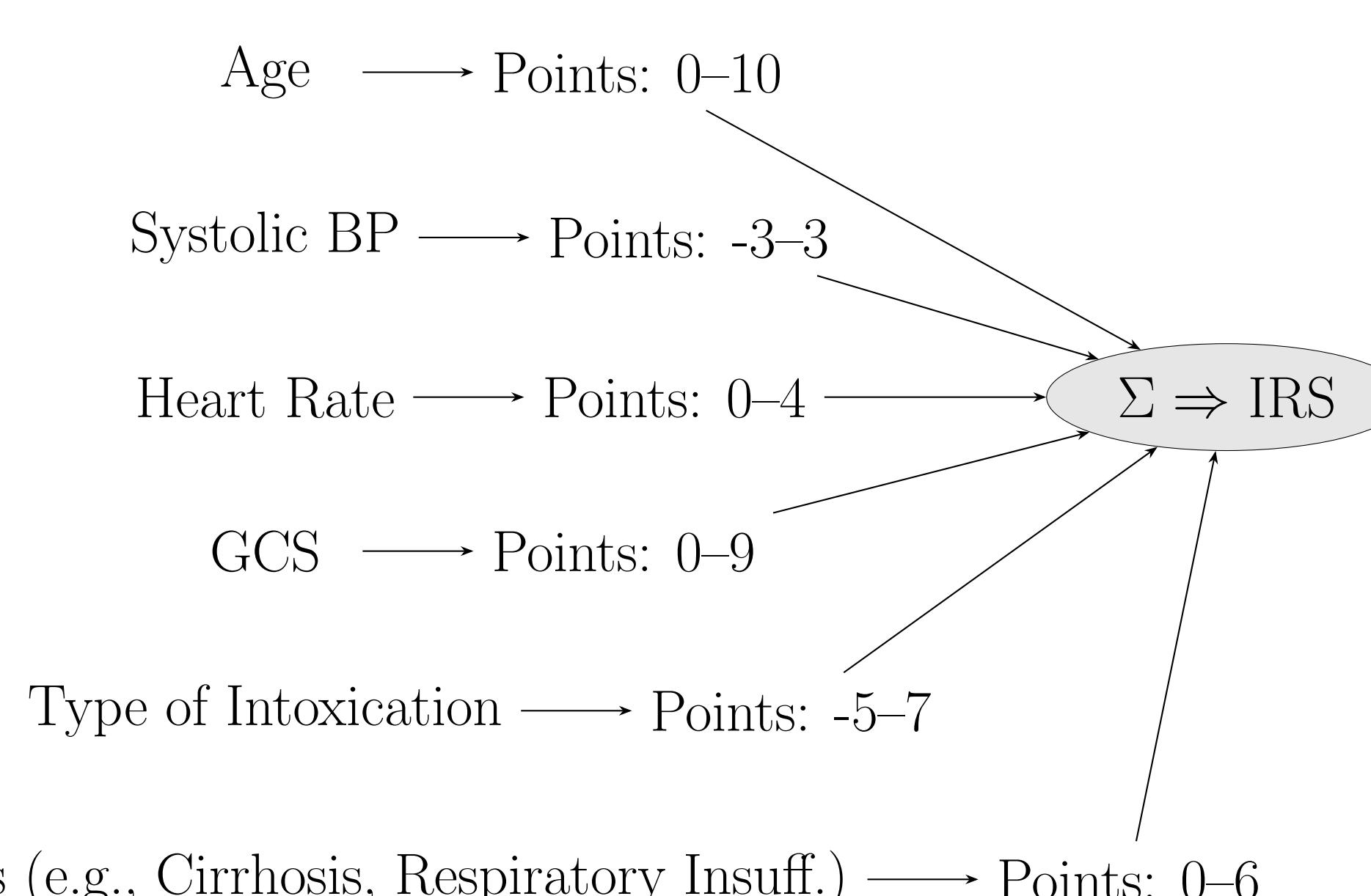
## Objective

Determine IRS performance in the United States.

## Methods

- A retrospective study of bedside toxicology consultations at one urban quaternary care center from 2023 to 2024.
- Our **outcome measures** were the **accuracy** of IRS in predicting the need for ventilatory or hemodynamic support and the **agreement** between IRS and toxicologist's recommended disposition, quantified by Cohen's kappa.
- Our study was powered to detect a change in ICU admissions of 15.

## Calculation of INTOXICATE RISK SCORE (IRS)



Comorbidities (e.g., Cirrhosis, Respiratory Insuff.) — Points: 0–6

**Interpretation:** If IRS > 6, ICU care is likely required. This score is derived by summing assigned points from age, vitals, GCS, toxin type, and comorbidities.

## Model Performance

Toxicologist INTOXICATE		
	ICU	Not ICU
	20	61
	81	42

Table 1: INTOXICATE recommended ICU admission more frequently than the bedside toxicologist.

## Toxicologists and IRS Disagree

	Adolescent		Adult			
	Pred.	Total	Pred.	Total		
ICU Not			ICU Not			
Actual						
ICU	2	2	4	11	4	15
Not ICU	9	11	20	39	23	62
Total	11	13	24	50	27	77

### Cohen's $\kappa$ estimates:

Adolescents: 0.029 (95% CI: -0.29 to 0.35)  
Adults: 0.05 (95% CI: -0.08 to 0.19)

Table 2: Using the threshold derived from an ICU cohort, we found that there is no significant agreement between INTOXICATE and the bedside toxicologist's recommendations. CI: 95% confidence interval. Pred., predicted disposition.

## Acknowledgments

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## Description of Patient Population

Characteristic	Adolescent, n = 24	Adult, n = 77	P-value
Age	15 (14, 16)	35 (27, 50)	<0.001
Gender			0.3
Female	13 (54%)	39 (51%)	
Male	10 (42%)	38 (49%)	
Nonbinary	1 (4.2%)	0 (0%)	
Pulse	99 (89, 110)	90 (71, 106)	0.068
SBP	116 (106, 119)	120 (112, 140)	0.033
Actual Disposition			0.5
Discharge	18 (75%)	48 (62%)	
General Medical Floor	2 (8.3%)	14 (19%)	
ICU	4 (17%)	15 (19%)	
Respiratory Insufficiency	2 (8.3%)	16 (21%)	0.2
Cirrhosis	0	2 (2.6%)	>0.9
Dysrhythmia	12 (50%)	28 (36%)	0.3
Secondary Reason for ICU Admission	0	1 (1.3%)	>0.9
GCS			0.024
3	0	3 (3.8%)	
5	0	1 (1.3%)	
10	3 (13%)	0 (0%)	
11	0	1 (1%)	
12	0	1 (1.3%)	
13	0	2 (2.6%)	
14	3 (13%)	2 (2.6%)	
15	18 (75%)	67 (87%)	
Exposure Category			0.11
Alcohol	2 (8.3%)	4 (5.2 %)	
Analgesic	6 (25%)	11 (14%)	
Antidepressants	6 (25%)	11 (14%)	
CO, As, CN	0	9 (12%)	
Combination	1 (4.2%)	15 (19%)	
Sedatives	0	6 (7.8%)	
Street Drugs	5 (21%)	10 (13%)	
Unknown	4 (17%)	11 (14%)	
Confirmed Exposure			0.4
Confirmed - Yes	15 (63%)	48 (62%)	
Confirmed - No	1 (4.2%)	11 (14%)	
Unconfirmed	8 (33%)	18 (23%)	

Table 3: Description of Data Source Adolescents and adults have similar patterns of exposure and clinical outcomes. IQR, interquartile range. P-values calculated for continuous variables with Wilcoxon rank sum test, for categorical data, Fisher's exact test if category counts less than 5, Pearson's  $\chi^2$  otherwise.

## Agreement Improves with Adjusting Threshold

	Adolescent		Adult			
	Pred.	Total	Pred.	Total		
ICU Not			ICU Not			
Actual						
ICU	1	3	4	7	8	15
Not ICU	0	20	20	1	61	62
Total	1	23	24	15	62	77

### Cohen's $\kappa$ estimates:

Adolescents: 0.258 (-0.164 to 0.878)  
Adults: 0.55 (0.294 to 0.801)

Table 4: Using the threshold derived from ROC analysis, there is significant agreement between INTOXICATE and the bedside toxicologist's recommendations for adults or adolescent in the study. Pred., predicted disposition

## Discussion

- The distribution of xenobiotics was comparable to IRS validation studies.
- The primary team followed the toxicologist's recommendations in all cases.
- All consults were staffed with a board-certified toxicologist.
- In the United States, more critical care may happen in the Emergency Department.

## Conclusions

- Compared to toxicologist's recommendations, IRS increased United States ICU admissions, admitting patients that did not require ICU care.
- There was minimal agreement between IRS and toxicologist's recommendations without model recalibration.