

Predictive Value of Biological Sex for Determining Level of Care in Symptomatic Poisoned Patients

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Introduction

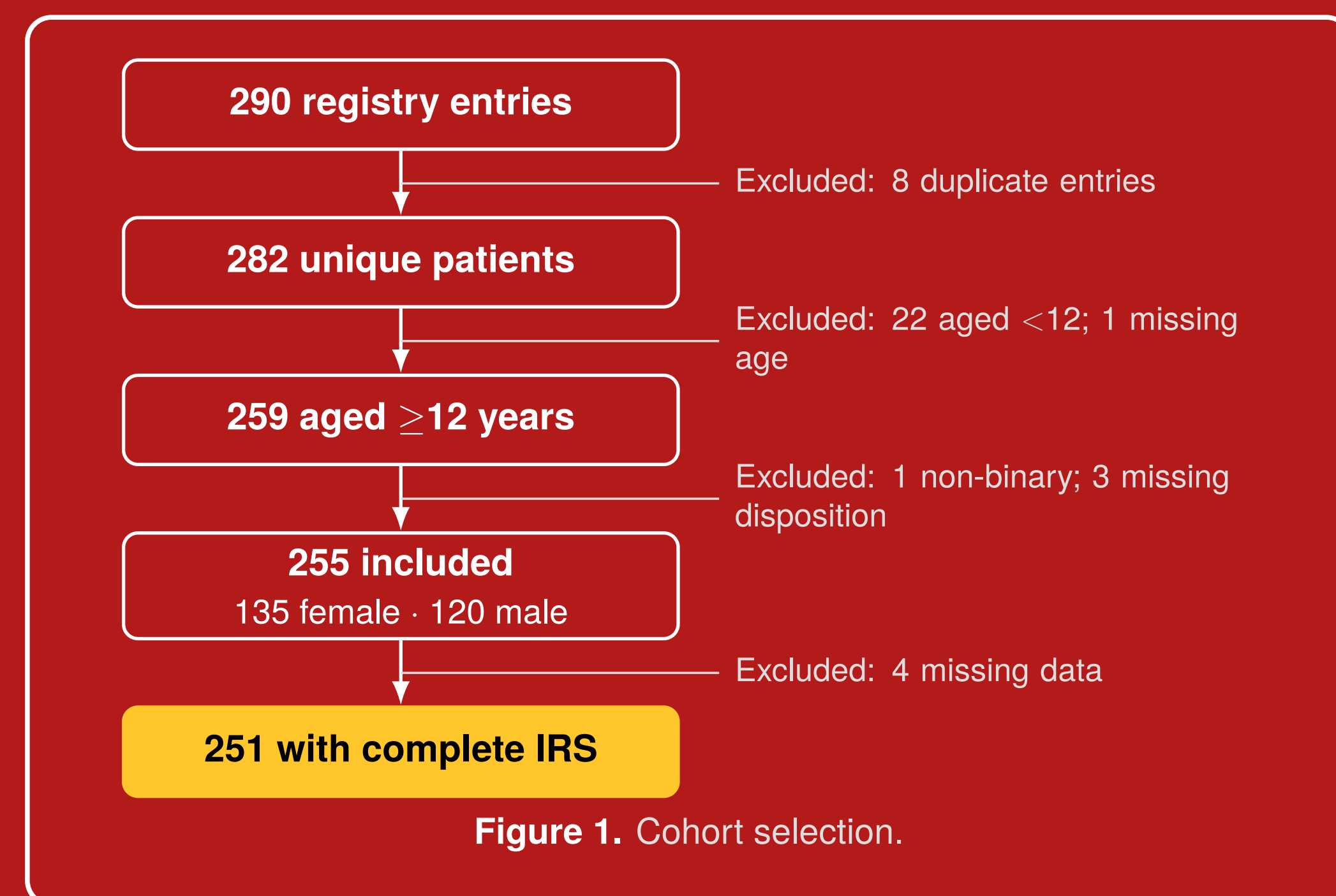
- Nearly 25% of admitted poisoned patients require no treatment.¹
- The ICU Requirement Score (IRS) predicts which poisoned patients do not need ICU care,^{2–4} but its predictions do not agree with bedside toxicologists.⁵
- Females have higher reported rates of intentional self-poisoning, yet the IRS does not include biological sex.

Objective

Determine whether IRS is equally well calibrated for biological females and males.

Methods

- Design:** Secondary analysis of registry from single-center bedside toxicology service, April 2024–October 2026
- Population:** Symptomatic poisoned patients ≥ 12 years with a toxicology consultation
- Outcome:** Admission to ICU or step-down unit
- Predictor:** IRS at ED presentation²
- Analysis:** logistic regression of ICU admission on IRS $\pm$ biological sex; re-calibration by biological sex



How the IRS Works

Patient	Older age, cirrhosis
Physiology	Faster heart rate, lower blood pressure, lower GCS, respiratory insufficiency, dysrhythmia, second reason for ICU
Exposure	More points for analgesics, street drugs, unknown; fewer for alcohol, CO/smoke

Total > 6 points $\Rightarrow$ ICU suggested

Points for findings at ED presentation add up to a score estimating the need for ICU-level treatment (e.g., intubation, vasopressors).² Biological sex is not part of the score.

Results

24% vs 13%

admitted to ICU or step-down,
males vs females

aOR 2.1

male biological sex, adjusted for IRS
(95% CI 1.0–4.3)

1.27 vs 0.75

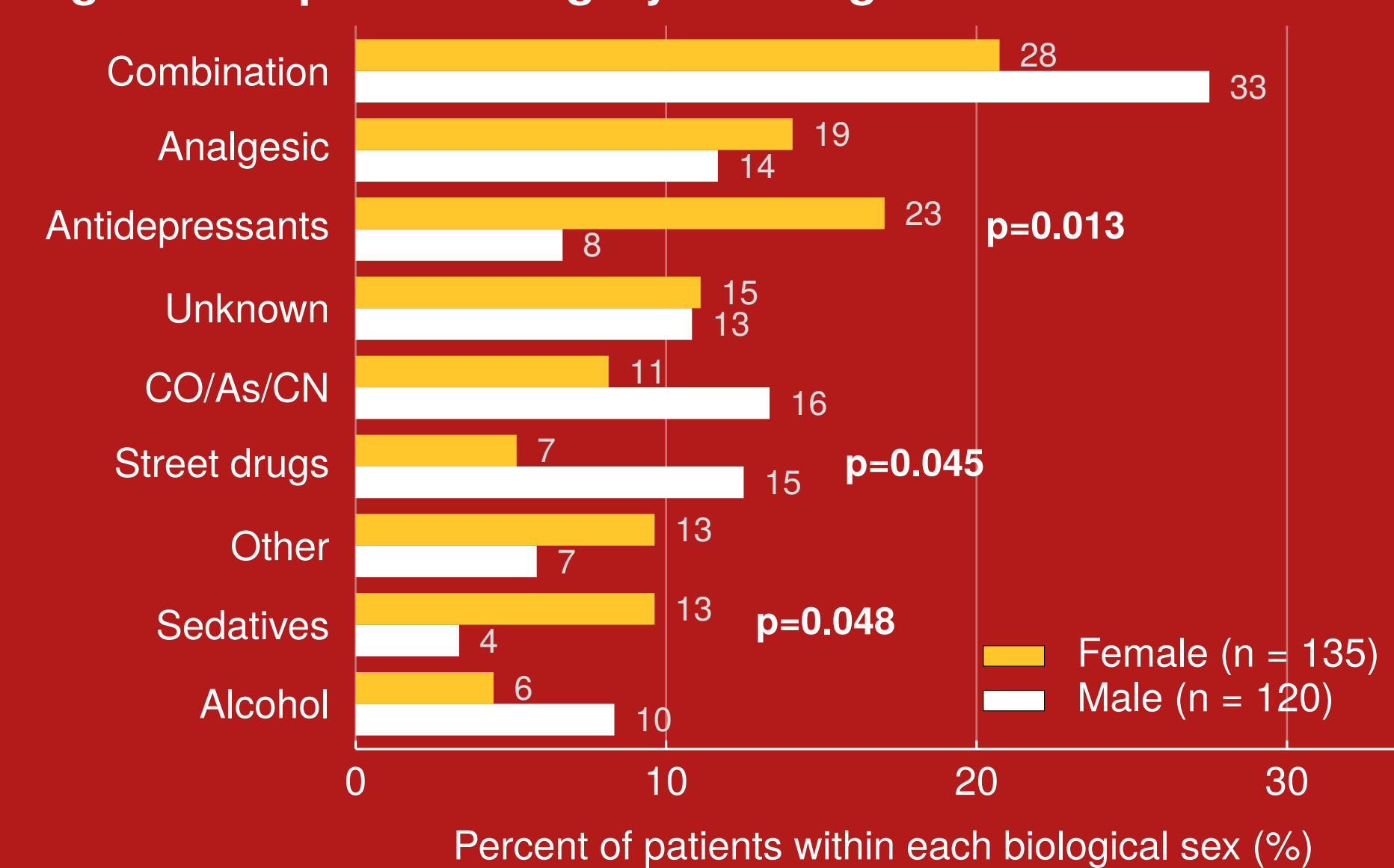
observed $\div$ IRS-expected ICU admissions,
males vs females

Table 1. Description of cohort

	Female n = 135	Male n = 120	p
Age, y, median [IQR]	30 [20–56]	38 [28–63]	0.02
Adolescent (12–17 y)	27 (20)	16 (13)	0.18
IRS, median [IQR]	6 [4–12]	8 [5–13]	0.32
IRS >6 (ICU predicted)	67 (50)	69 (59)	0.13
Disposition, n (%)			
ICU or step-down	17 (13)	29 (24)	0.02
Medical floor	22 (16)	16 (13)	
Psychiatry	15 (11)	5 (4)	
Discharged	81 (60)	70 (58)	

n (%). p-values (Mann–Whitney U, Fisher exact).

Figure 2. Exposure category $\times$ biological sex



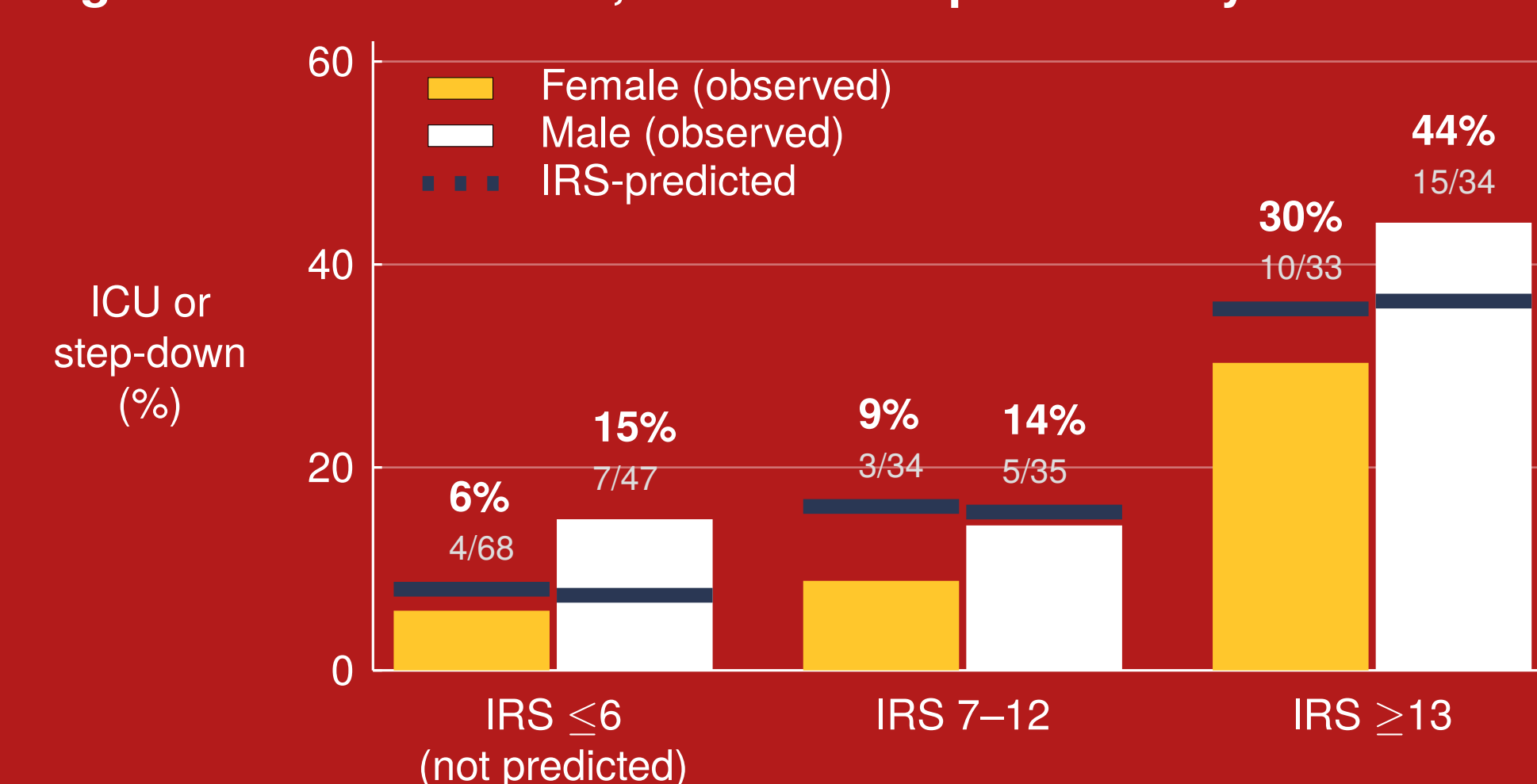
Exposure category differed by biological sex ($p = 0.014$) and partly explained its effect: adjusting for it lowered the aOR from 2.1 to 1.8 (95% CI 0.8–4.0).

Table 2. IRS $\pm$ biological sex

	IRS alone	IRS + biological sex
AUC _t (95% CI)	0.71 (0.62–0.80)	0.74 (0.64–0.82)
Sensitivity, IRS >6	0.75 (33/44)	0.89 (39/44)
Specificity, IRS >6	0.50 (104/207)	0.36 (74/207)
Specificity at max sensitivity	0.21 (IRS >3)	0.36
Missed ICU cases	11	5

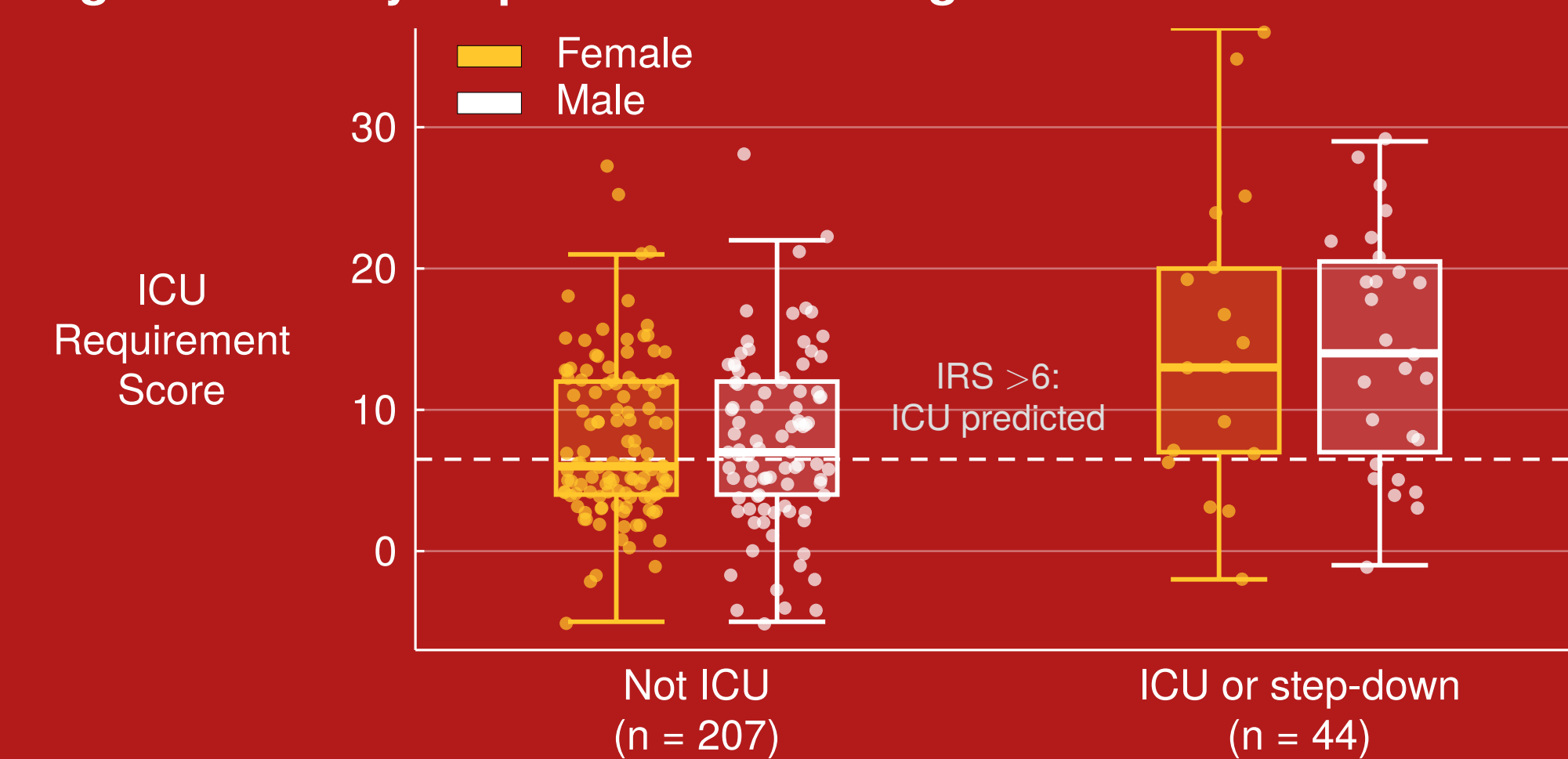
IRS + biological sex adds 6 points for males ($p = 0.041$), predicting 36 more patients needed ICU, of whom 6 were admitted to the ICU. aOR for male biological sex: adults only 2.4 (1.0–5.4), excluding unclassified exposures 2.3 (1.1–4.8).

Figure 3. ICU admission, observed vs predicted by IRS



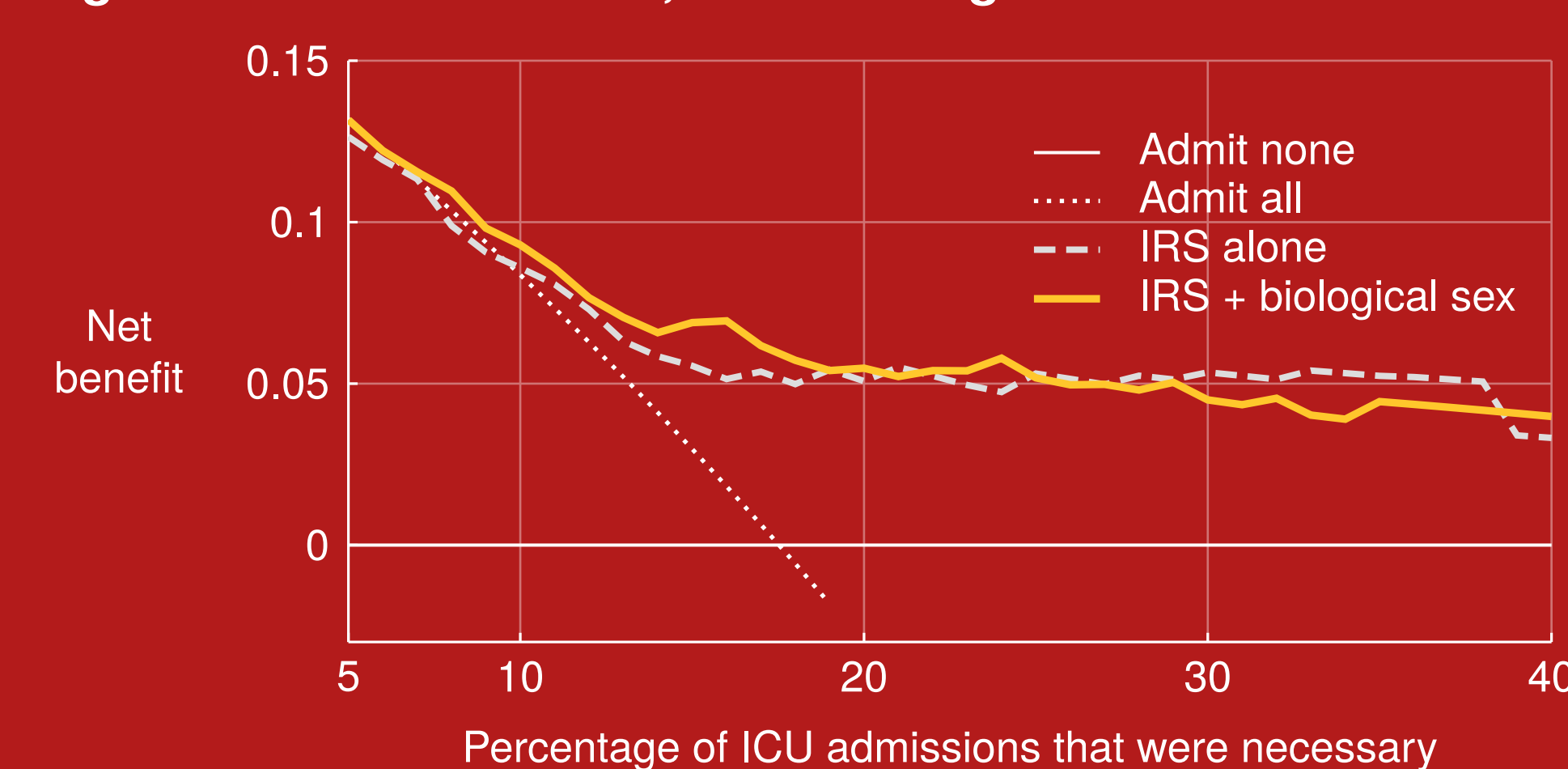
The IRS-only model over-predicted ICU need in females (predicted 17%, observed 13%) and under-predicted it in males (predicted 18%, observed 23%). Gap largest at IRS ≤ 6 .

Figure 4. IRS by disposition and biological sex



Males and females have comparable IRS within each disposition, yet males were admitted more often. Boxes: median $\pm$ IQR; whiskers: $1.5 \times$ IQR.

Figure 5. Decision curves, IRS $\pm$ biological sex



IRS and IRS + biological sex are better than admitting everyone to the ICU if you are ok with no more than 6 unnecessary ICU admissions for 1 necessary one (at least 15% hit rate).

Conclusions

- The IRS was miscalibrated by biological sex:, overpredicting ICU need in females.
- At the same IRS, males were about twice as likely to need ICU-level care, partly due to type of ingestant.
- Adding biological sex improved sensitivity by identifying more ICU cases (11 $\rightarrow$ 5 missed), but decreased specificity, leading to no net improvement in model performance, AUC 0.71 (0.62–0.80) vs 0.74 (0.64–0.82)
- Biological sex effect not independent predictor after adjusting for exposure category (aOR 1.8, 95% CI 0.8–4.0).
- Next steps:** Identify what biological sex stands in for, then recalibrate the IRS in multisite data.

Limitations

- Single center, retrospective; 44 ICU events.
- No external validation.
- Outcome was actual disposition, not ICU interventions; may reflect considerations other than medical acuity

Acknowledgements

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Try the INTOXICATE App



Scan to calculate the
IRS at the bedside.