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Supplementary Materials

Supplementary Material 1. Post-hoc Sensitivity Power Analyses for All Regression Models

Analysis	Baseline Probability (p_1)	Original N	Adjusted N	Minimum Detectable Effect
Logistic Regression Models				
SES → Disease Severity	0.744	86, 40	78, 37	OR >6.40 or <0.16
SES → Surgical Intervention	0.865	74*, 40	68, 37	OR <0.26
SES → Treatment Success	0.547	86, 40	78, 37	OR >3.48
Continuous Time Models		N	Reduced R^2	Minimum Detectable ΔR^2
Diagnostic Interval (GLM Gamma)	—	126	0.0337	0.0575
Treatment Delay Duration (Hurdle Part 2)	—	78	0.0268	0.0912

Analyses were conducted using Stata's power commands with $\alpha = 0.05$ and power = 0.80. For logistic regression models, variance inflation factor (VIF) adjustments based on $R^2 = 0.087$ from regressing SES on aetiology and comorbidity count were applied to effective sample sizes. For delay–outcome associations, the narrow confidence intervals (e.g., aOR 1.01, 95% CI 0.99–1.03) exclude clinically meaningful effect sizes, suggesting true absence of association rather than type II error.

For the surgical intervention model, 12 traumatic cases in the low SES group were excluded due to perfect prediction.

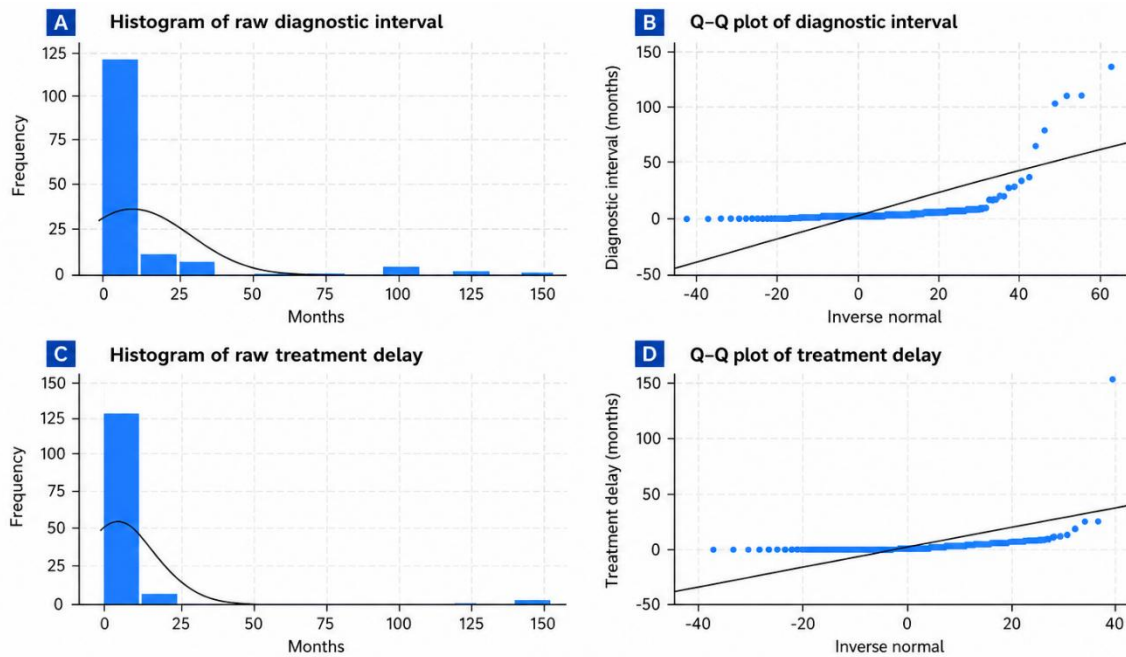
Supplementary Material 2. Adapted Social Capital Assessment Tool (A-SCAT) Items and Scoring Criteria

Domain	Item	Scoring Criteria	Points
Social Support	Next of Kin/Support Person	2: Named local contact involved in care	0-2
		1: NoK listed but involvement not documented	
		0: “No known kin,” “unaccompanied,” or “homeless”	
	Social Work Involvement	1: Formal referral OR social worker note	0-1
		0: No documentation	
Financial & Structural Capital	Funding Source	2: Medical aid/private insurance	0-2
		1: Government grant or documented financial support	
		0: Self-pay, unemployed, undocumented distress	
	Accommodation Stability	1: Documented fixed address	0-1
		0: Informal settlement, homeless, no fixed abode	
	Employment Status	1: Documented employed or pensioner	0-1
		0: Unemployed, disabled (without grant), informal	
Health System Navigation	Travel Burden	1: Same district as hospital OR local referral	0-1
		0: Distant rural district	

Domain	Item	Scoring Criteria	Points
	Health Literacy/Engagement	1: Asked questions, compliant, attended follow-up	0-1
		0: Defaulted, non-compliant, lost to follow-up	
Total Score			0-9

The A-SCAT was developed for retrospective application to quantify social capital across three domains. Seven objectively verifiable items were extracted from clinical records. Total scores range from 0 to 9, with higher scores indicating stronger documented social capital. The dichotomisation threshold (0–6 Low/Moderate SES; 7–9 High SES) was empirically validated against employment status (Cramer's $V = 0.69$).

Supplementary Material 3. Distribution Diagnostics for Time Delay Variables



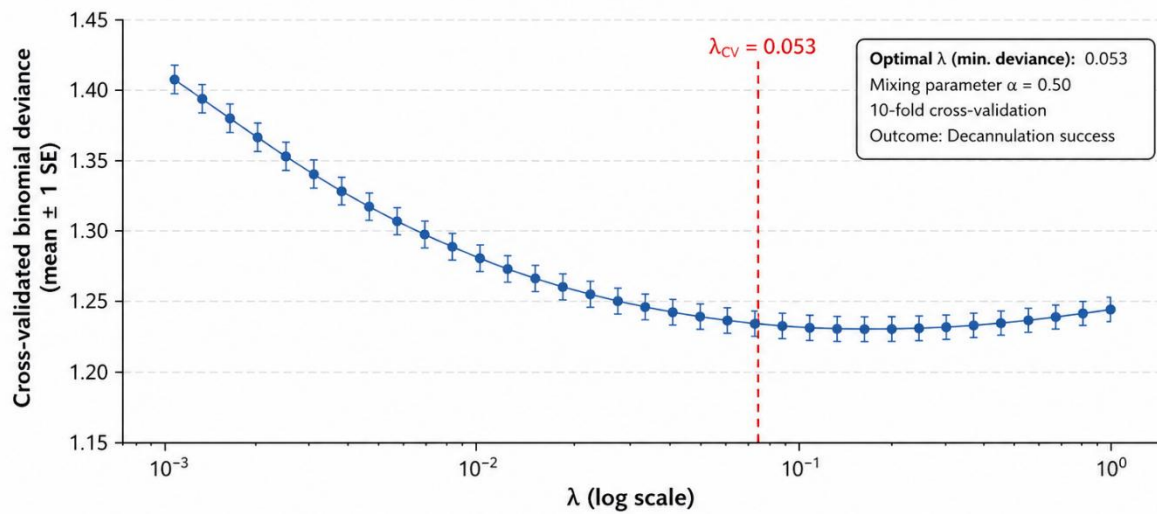
Supplementary Material 3. Distribution Diagnostics for Time Delay Variables

(A) Histogram and (B) Q-Q plot for diagnostic interval (months).

(C) Histogram and (D) Q-Q plot for treatment delay (months).

Both variables demonstrate pronounced right-skew with marked upper-tail deviation from normality. These findings support the use of generalised linear models with a Gamma distribution and log link for analysis of time delay outcomes.

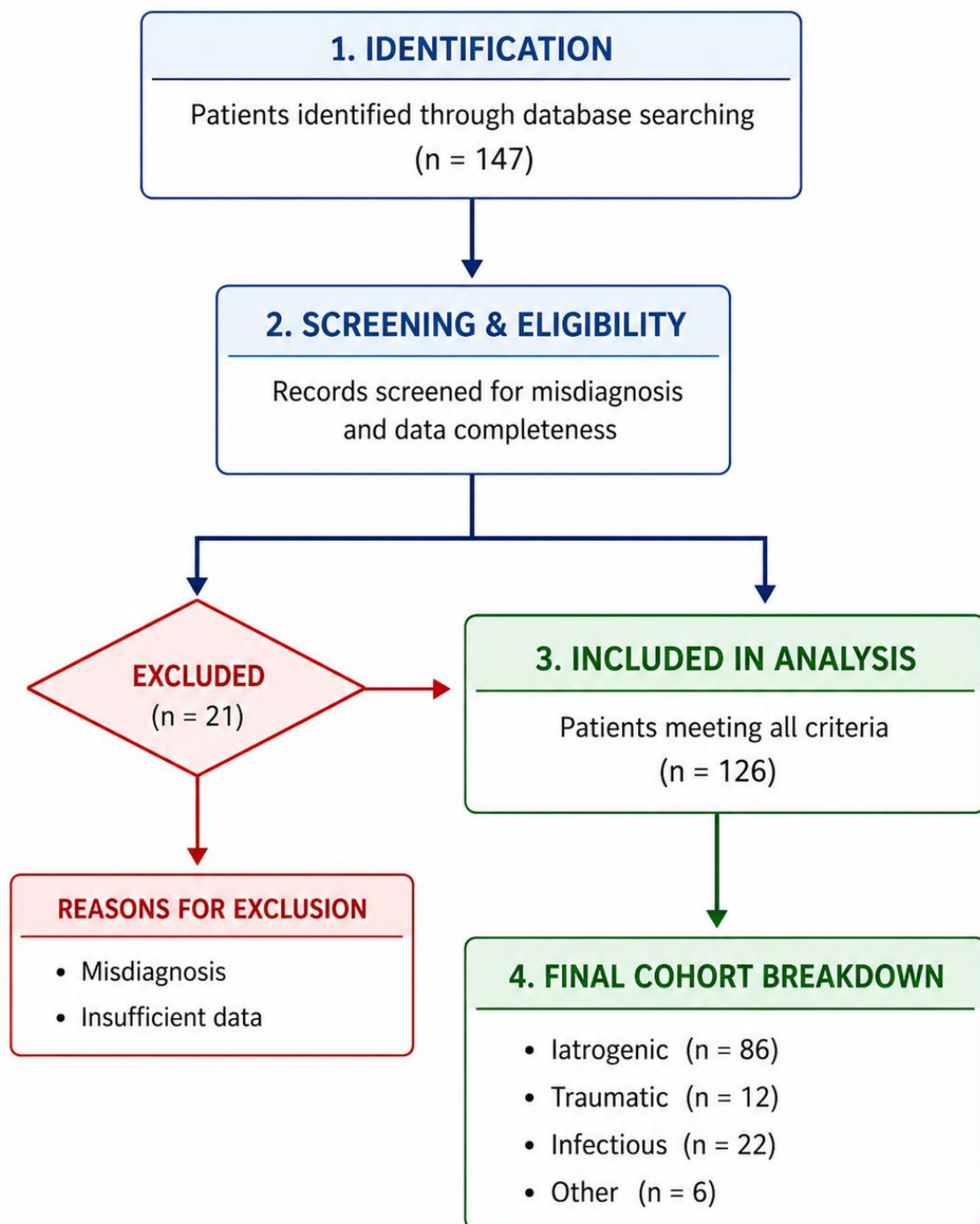
Supplementary Material 4. Ten-fold Cross-validation Error Curve for the Elastic Net Prognostic Model for Decannulation Success



Supplementary Material 4. Ten-fold Cross-validation Error Curve for the Elastic Net Prognostic Model for Decannulation Success

The mixing parameter α was fixed at 0.50. The vertical dashed line indicates the optimal penalty parameter ($\lambda = 0.053$), selected by minimising the out-of-sample binomial deviance. The curve shows the cross-validated deviance (with 1-SE error bars) as a function of $\log(\lambda)$. The selected predictors and their coefficient magnitudes are reported in Table 5 of the main manuscript.

Supplementary Material 5. STROBE-Compliant Participant Flow Diagram



Supplementary Material 5. STROBE-Compliant Participant Flow Diagram

Of 147 patients identified through database searching, 126 met inclusion criteria and were analysed. Exclusion reasons: misdiagnosis (n = 12; conditions mimicking LTS but pathologically distinct) and insufficient data (n = 9; missing critical variables such as primary aetiology, key dates, or outcome status).

Supplementary Material 6. Linear Predictor Equation for the Elastic Net Prognostic Model for Decannulation Success

The final Elastic Net prognostic model for decannulation success had an intercept of -0.142 . The linear predictor (log-odds of success) is:

$$\text{Logit}(\text{Success}) = -0.142$$

$$\begin{aligned} &+ 0.317 \times (\text{Traumatic aetiology}) \\ &+ 0.194 \times (\text{Informal residence}) \\ &+ 0.100 \times (\text{Black race}) \\ &+ 0.053 \times (\text{Subacute presentation}) \\ &+ 0.058 \times (\text{Poor adherence}) \\ &+ 0.031 \times (\text{Current smoker}) \\ &- 0.329 \times (\text{LPR}) \\ &- 0.118 \times (\text{Acute life-threatening presentation}) \\ &- 0.086 \times (\text{Objective oxygen requirement}) \\ &- 0.085 \times (\text{Asymptomatic HIV}) \\ &- 0.004 \times (\text{Iatrogenic aetiology}) \\ &- 0.051 \times (\text{Well-controlled hypertension}) \end{aligned}$$

All predictors are binary (coded as 1 if present, 0 if absent). Black race was coded as 1 for Black African and 0 for all other racial groups. The full coefficient table (Table 5 in the main manuscript) provides the magnitude of each effect with standard errors.