Supplementary Materials

Table S1. TRIPOD Checklist for Prediction Model Development and Validation.

Section	Item	Checklist Item	Page
Title and Abstract			
Title	1	Identify study as developing/validating a prediction model, target population, and outcome	1
Abstract	2	Provide summary of objectives, study design, setting, participants, sample size, predictors, outcome, statistical analysis, results, and conclusions	1
Introduction			
Background and objectives	3a	Explain medical context and rationale for developing/validating prediction model	2-3
	3b	Specify objectives, including whether developing/validating model or both	3
Methods			
Source of data	4a	Describe study design or source of data	3
	4b	Specify key study dates	3
Participants	5a	Specify key elements of study setting	3
	5b	Describe eligibility criteria	3-4
	5c	Give details of treatments received, if relevant	N/A
Outcome	6a	Clearly define outcome	4-5
	6b	Report actions to blind outcome assessment	N/A
Predictors	7a	Clearly define all predictors	4
	7b	Report actions to blind predictor assessment	N/A
Sample size	8	Explain how study size was arrived at	5
Missing data	9	Describe how missing data were handled	5
Statistical analysis	10a	Describe how predictors were handled	5
	10b	Specify type of model, selection process, internal validation	5-6
	10d	Specify all measures used to assess model performance	6
Risk groups	11	Provide details on grouping of predicted probabilities	N/A
Results			
Participants	13a	Describe flow of participants	3-4, Fig 1
	13b	Describe characteristics of participants	7, Table 1
	13c	For validation, show comparison with development data	N/A
Model development	14a	Specify number of participants and events	7
	14b	If applicable, report unadjusted associations	N/A
Model specification	15a	Present full prediction model	Proprietary
	15b	Explain how to use the model	8
Model performance	16	Report performance measures with CIs	7, Table 2
Discussion			
Limitations	18	Discuss limitations (non-representative sample, few events, missing data)	8-9
Interpretation	19a	For validation, discuss results with reference to other studies	8
	19b	Give overall interpretation of results	8-9
Implications	20	Discuss potential clinical use and implications	9
Other			
Supplementary information	21	Provide information about availability of supplementary resources	1
Funding	22	Give source of funding and role of funders	1

Table S2. Predictor Definitions

Predictor Category	Predictor	Definition	Source
Demographics	Age	Age at admission, years	Registration
	Sex	Male/Female	Registration
	Race	Self-reported	Registration
Mobility	AM-PAC T-score	Basic Mobility domain, standardized (mean=50, SD=10)	PT/OT/RN documentation
	Barthel Index	Total score (0-100), converted to T-score equivalent	PT/OT documentation
	Baseline mobility category	Independent/Needs assistance/Dependent	Derived from T-score
Comorbidities	Charlson Index	Quan adaptation, 12-month lookback	ICD-9/10 codes
	Individual comorbidities	Diabetes, CHF, COPD, CKD, cancer, etc.	ICD-9/10 codes
Clinical context	Admission source	ED/Transfer/Direct	ADT system
	Admitting unit	Med-surg/Step-down/ICU	ADT system
	Admission urgency	Emergency/Urgent/Elective	ADT system
	Diagnosis category	CCSR groupings	Primary diagnosis
Medications	High-risk medications	Anticoagulants, opioids, benzodiazepines, etc.	MAR within 24h
Cognition	Delirium/confusion	Positive screen or CAM-ICU	Nursing documentation

Table S3. Outcome Definitions

Outcome	Definition	Ascertainment Method	Validation
Functional decline	≥4.5 T-score decrease (AM-PAC) OR ≥10 point decrease (Barthel) from admission to discharge, among community discharges	PT/OT documentation comparison	MDC thresholds per published literature
VTE	ICD-10 I26.x, I82.4x, I82.5x, I82.9x with confirmatory imaging	Discharge diagnoses + radiology	Chart review validation (95% PPV)
Falls	Date/time-stamped safety report	Institutional safety reporting	Mandatory reporting system
Pressure injuries	Stage ≥2 HAPI documented during admission	Wound care nursing	Nursing documentation
Prolonged LOS	>7 calendar days	ADT system	—
Post-acute discharge	Discharge to SNF, IRB, or LTAC	Disposition codes	Standard CMS definitions
30-day readmission	Unplanned readmission within 30 days	ADT system + CMS algorithm	Planned Readmission Algorithm v4.0

Table S4. Missing Data Patterns

Variable	N Missing	% Missing	Handling
AM-PAC T-score	832	8.5	Barthel crosswalk
Barthel Index (admission)	606	6.2	Imputation
Opioid MME	412	4.2	Imputation
Cognition screen	492	5.0	Indicator variable
All other predictors	0	0.0	Complete

Table S5. Calibration Metrics After Recalibration

Outcome	Calibration Slope	Calibration Intercept	Mean Observed	Mean Predicted
Functional decline	1.00	0.00	0.190	0.190
VTE	0.96	−0.19	0.011	0.011
Falls	1.00	0.00	0.020	0.020
Pressure injuries	1.01	0.03	0.032	0.032
Prolonged LOS	1.00	0.00	0.330	0.330
Post-acute discharge	1.00	0.00	0.290	0.290
30-day readmission	1.00	0.01	0.150	0.150

Table S6. Temporal Validation (Train 2013–2019, Test 2020–2023).

Outcome	Train AUC	Test AUC	ΔAUC
Functional decline	0.82	0.83	+0.01
VTE	0.77	0.78	+0.01
Falls	0.74	0.74	0.00
Pressure injuries	0.81	0.79	−0.02
Prolonged LOS	0.76	0.77	+0.01
Post-acute discharge	0.80	0.81	+0.01
30-day readmission	0.72	0.73	+0.01

Table S7. Decision Curve Analysis: Net Benefit at Key Thresholds.

Outcome	Threshold	IHRS Net Benefit	Comparator	Comparator Net Benefit	Δ Net Benefit
Pressure injuries	1.6%	0.0177	Braden	0.0165	+0.0012
	3.2%	0.0110		0.0063	+0.0047
	6.4%	0.0097		0.0007	+0.0090
VTE	0.5%	0.0082	Padua	0.0062	+0.0019
	1.1%	0.0071		0.0022	+0.0050
Falls	1.0%	0.0112	Morse	0.0100	+0.0012
	2.0%	0.0050		0.0042	+0.0008
	4.0%	0.0038		0.0000	+0.0038
30-day readmission	7.5%	0.0842	LACE	0.0856	−0.0015
	15.0%	0.0386		0.0335	+0.0051
	30.0%	0.0266		0.0208	+0.0058

Table S8. Net Reclassification Index vs. Comparators.

Outcome	IHRS AUC	Comparator	Comp AUC	cNRI	NRI (events)	NRI (non-events)
Pressure injuries	0.80	Braden	0.64	+0.59	+0.25	+0.35
Falls	0.74	Morse	0.61	+0.38	+0.10	+0.28
VTE	0.77	Padua	0.66	+0.26	+0.02	+0.24
Prolonged LOS	0.76	Charlson	0.70	+0.24	+0.13	+0.11
Readmission	0.72	LACE	0.68	+0.19	+0.15	+0.04

Table S9. Subgroup Performance (Functional Decline).

Subgroup	N	Events	AUC
Age ≥65 years	4,818	1,323	0.90
Age <65 years	5,024	547	0.63
Female	5,118	987	0.82
Male	4,724	883	0.82
White	7,086	1,373	0.82
Non-White	2,756	497	0.82
ICU admission	1,464	429	0.90
Non-ICU	8,378	1,441	0.79