Supplementary Material

Table S1 The characteristics of three mortality prediction models

Index	Cohort	Items	Points	Points (observed mortality)
Walter Index[1] Walter et al. 2001 America	Hospitalized patients: general medical service Age≥70 years Development: n=1495 Mean age 81 years 1-year mortality 33% C- statistic 0.75 External Validation: n=1427 Mean age 79 years 1-year mortality 28% C- statistic 0.79	Male	1	1-year mortality
		ADL independencies at discharge		
		Dependent in 1-4 ADLs	2	0-1 (13%)
		Dependents in 5 ADLs	5	2-3 (20%)
		Comorbid conditions		4-6 (37%)
		Congestive heart failure	2	>6 (68%)
		Solitary cancer	3	
		Metastatic cancer	8	
		Creatinine >3.0 mg/dL	2	
		Albumin, g/dL		
		3.0-3.4	1	
		<3.0	2	
CCI[2] Charlson et al. 1987 America	Hospitalized patients Development: n=559 External Validation: n=685 with histologically proven primary carcinoma of the breast	Myocardial infarct	1	1-year mortality
		Congestive heart failure	1	
		Peripheral vascular disease	1	0 (12%)
		Cerebrovascular disease	1	
		Dementia	1	1-2 (26%)
		Chronic pulmonary disease	1	
		Connective tissue disease	1	3-4 (52%)
		Ulcer disease	1	>4 (85%)
		Mild liver disease	1	
		Diabetes	1	
		Hemiplegia	2	
		Moderate or severe renal disease	2	
		Diabetes with end organ damage	2	
		Any tumor	2	
		Leukemia	2	
		Lymphoma	2	
		Moderate or severe liver disease	3	
		Metastatic solid tumor	6	
		AIDS	6	
GPI[3] Jung H et al. 2016 Korea	Age ≥ 65 years Development: n=988 Community dwelling Mean age 75.8 3-year mortality 9.3% 5-year mortality 18.1% C-statistic: 3-year: 0.78 5-year: 0.80 External Validation: Hospitalized patients n=1109 Mean age 76.7	Age, years		3-year mortality
		65-74	0	
		75-84	0.5	0 (0)
		≥85	1	
		Gender		0 (0)
		Female	0	
		male	1	1 (0)
		Korea ADL		
		Independent	0	1.5 (1.3)
		Dependent in 1 ADL	0.5	2.0 (4.3)
		Dependent in ≥2 ADLs	1	2.5 (1.7)
		Korea IADL		
		Independent	0	3.0 (5.9)
		Dependent in 1 IADL	0.5	

		Score	
3-year mortality 20.3%	Dependent in ≥2 IADLs	1	3.5 (12.1)
5-year mortality 30.7%	Comorbidity		4.0 (14.4)
C- statistic:	CCI 0 (or CIRS-G 0–3)	0	
3-year: 0.73	CCI ≥ 1 (or CIRS-G ≥4)	1	4.5 (18.2)
5-year: 0.80	Mood		5.0 (23.9)
	GDS-15 <5	0	
	GDS-15 5-8	0.5	5.5 (23.1)
	GDS-15 9-15	1	6.0 (34.5)
	Cognition		
	MMSE 25-30	0	6.5 (33.3)
	MMSE 18-24	0.5	
	MMSE <18	1	7.0 (50.0)
	Nutritional status		
	MNA 24-30	0	
	MNA 17-23.5	0.5	
	MNA <17	1	

Abbreviations: CCI, Charlson Comorbidity index; GPI, Geriatric Prognostic Index; ADL, Activities of daily living; IADL, Instrumental activities of daily living; CIRS-G, Cumulative Illness Rating Scale for Geriatrics; GDS-15, Geriatric depression scale with 15 items; MMSE, Mini-Mental State Examination; MNA, Mini-Nutritional Assessment.

Notes: In our study, Nutritional status was evaluated by the Mini-Nutritional Assessment-Short Form (MNA-SF), including consists of a total of 6 items for food intake declined, weight loss, mobility, psychological stress or acute disease, neuropsychological problem, body mass index or calf circumference in cm. A score of MNA-SF>11 is defined as well-nourished, 8-11 as at risk of malnutrition, and <8 as malnourished, corresponding to a score of MNA>23.5, 17-23.5, and <17, respectively [4].

Table S2 The Characteristics of different ADL and IADL scales

Scales	A modified version of Katz-ADL[1,5]	Korea ADL[6]	PSMS ADL[7]	Korea IADL[6]	Lawton IADL[7]
Items	Feeding	Feeding	Feeding	Using telephone	Using telephone
	Dressing	Dressing	Dressing	Shopping	Shopping
	Bathing	Bathing	Bathing	Food preparation	Food preparation
	Toileting	Toileting	Toileting and Continence	Housekeeping	Housekeeping
	Transfer (Transfer from bed to chair)	Transfer (Transfer from bed to chair, room)	Transfer (Goes about grounds or city)	Laundry	Laundry
		Washing face and hand	Grooming (neatness, hair, nails, hands, face, clothing)	Using transportation	using transportation
		Continence		Responsibility for own medications	Responsibility for own medications
				Ability to handle finances	Ability to handle finances
				Outgoing for a short distance	
				Decorating	
Total score	5 scores	7 scores	6 scores	10 scores	8 scores

Abbreviations: ADL, Activities of daily living; IADL, Instrumental activities of daily living; PSMS, Physical Self-Maintenance Scale.
Notes: 1 score for each component; 1=dependent, 0=independent.

Table S3 Sensitivity comparative analysis of pre- and post-imputation data

Variables	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	P
Albumin, g/dL	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	3.8 ± 0.5	1.000
Creatine, mg/dL	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	0.9 ± 0.6	1.000
MNA-SF	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	10.7 ± 3.2	1.000
MMSE	25.3 ± 5.0	25.1 ± 5.1	25.0 ± 5.2	25.0 ± 5.3	25.0 ± 5.2	25.0 ± 5.2	25.0 ± 5.2	25.0 ± 5.3	24.9 ± 5.3	25.0 ± 5.1	25.1 ± 5.1	25.1 ± 5.2	25.0 ± 5.3	25.0 ± 5.2	24.9 ± 5.3	25.0 ± 5.2	25.0 ± 5.3	24.9 ± 5.3	25.0 ± 5.2	25.0 ± 5.2	25.0 ± 5.2	1.000
GDS-15	3.6 ± 3.1	3.8 ± 3.2	3.7 ± 3.1	3.8 ± 3.1	3.7 ± 3.2	3.7 ± 3.2	3.7 ± 3.2	3.7 ± 3.2	3.8 ± 3.2	3.7 ± 3.1	3.7 ± 3.1	3.7 ± 3.2	3.8 ± 3.2	3.7 ± 3.1	3.7 ± 3.2	3.8 ± 3.2	3.8 ± 3.3	3.8 ± 3.2	3.8 ± 3.2	3.8 ± 3.2	3.7 ± 3.2	1.000
SPPB	7.3 ± 4.4	7.4 ± 4.3	7.4 ± 4.3	7.4 ± 4.3	7.4 ± 4.3	7.4 ± 4.3	7.3 ± 4.3	7.3 ± 4.3	7.3 ± 4.3	7.3 ± 4.3	7.3 ± 4.4	7.4 ± 4.3	7.3 ± 4.3	7.3 ± 4.3	7.3 ± 4.3	7.4 ± 4.3	7.3 ± 4.3	7.4 ± 4.3	7.4 ± 4.3	7.4 ± 4.3	7.3 ± 4.3	1.000
Handgrip strength	23.5 ± 8.4	22.6 ± 8.5	22.8 ± 8.4	22.8 ± 8.5	22.7 ± 8.5	22.8 ± 8.4	22.7 ± 8.4	22.8 ± 8.6	22.8 ± 8.6	22.8 ± 8.4	22.7 ± 8.4	22.9 ± 8.5	22.6 ± 8.5	22.6 ± 8.5	22.8 ± 8.5	22.6 ± 8.6	22.6 ± 8.5	22.8 ± 8.5	22.8 ± 8.7	22.9 ± 8.4	22.7 ± 8.5	0.988
Walter Index	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	2.8 ± 2.9	1.000
GPI	2.9 ± 1.6	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	3.1 ± 1.8	0.985
FRAIL Scale	1.6 ± 1.5	1.6 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.6 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.6 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.7 ± 1.5	1.6 ± 1.5	1.6 ± 1.5	1.6 ± 1.5	1.000

Abbreviations: MNA-SF, Mini-Nutritional Assessment Short Form; MMSE, Mini-Mental State Examination; GDS-15, Geriatric depression scale with 15 items; SPPB, Short Physical Performance Battery; GPI, Geriatric prognostic Index

Values are mean ±Standard Deviation; 0, Pre-imputation; 1-20, 20 datasets for post-imputation

Table S4 Results of multivariate logistic regression of pre- and post-imputation data pooled by Rubin's rule

	Non-adjusted		Adjustment I		Adjustment II	
	Pre-imputation OR (95% CI)	Pooled by Rubin's rule OR (95% CI)	Pre-imputation OR (95% CI)	Pooled by Rubin's rule OR (95% CI)	Pre-imputation OR (95% CI)	Pooled by Rubin's rule OR (95% CI)
Walter Index						
0-1	Reference	Reference	Reference	Reference	Reference	Reference
2-3	5.58 (1.54, 20.23)	5.56 (1.53, 20.17)	5.21 (1.42, 19.06)	5.16 (1.41, 18.89)	3.89 (1.03, 14.68	3.90 (1.04,14.68)
4-6	31.85 (9.63, 105.39)	31.85 (9.63, 105.36)	23.86 (7.02, 81.07)	23.58 (6.94, 80.11)	17.36 (4.96, 60.84	17.12 (4.88, 60.03)
>6	163.81 (48.56, 552.54)	166.93 (49.52, 562.74	111.02 (31.73, 388.39)	112.09 (32.06, 391.85)	81.43 (22.54, 294.18	84.80 (23.70, 303.39)
CCI						
0	Reference	Reference	Reference	Reference	Reference	Reference
1-2	2.58 (1.11, 5.99)	2.58 (1.11, 5.99)	2.52 (1.07, 5.96)	2.52 (1.07, 5.95)	2.22 (0.93, 5.32)	2.30 (0.96,5.53)
3-4	6.28 (2.59, 15.21)	6.28 (2.59, 15.22)	5.43 (2.14, 13.74)	5.43 (2.14, 13.76)	3.89 (1.50, 10.08)	4.54 (1.75, 11.76)
>4	48.30 (19.88, 117.30)	48.30 (19.8, 117.32)	31.23 (12.24, 79.67)	31.23 (12.24, 79.68)	27.06 (10.35, 70.76)	30.97 (11.76, 81.56)
FRAIL Scale						
0	Reference	Reference	Reference	Reference	Reference	Reference
1-2	3.47 (1.41, 8.51)	3.49 (1.42, 8.58)	3.34 (1.33, 8.42)	3.35 (1.33,8.43)	2.76 (1.07, 7.15)	2.92 (1.14, 7.53)
3-5	14.06 (5.96, 33.18)	14.06 (5.96, 33.14)	10.76 (4.33, 26.70)	10.53 (4.24, 26.14)	7.97 (2.82, 22.56)	7.93 (2.83, 22.21)
GPI						
	1.73 (1.48, 2.03)	1.82 (1.59, 2.09)	1.66 (1.38, 1.98)	1.70 (1.46, 1.99)	1.63 (1.30, 2.04	1.68 (1.37, 2.05)

Abbreviations: OR, Odds Ratio; CI, Confidence Interval; CCI, Charlson Comorbidity index; GPI, Geriatric Prognostic Index.
Adjust I covariates: marital; social support network, cigarette, length of stay, number of medications, hemoglobin.
Adjust II covariates: Adjust I covariates+ Frail, handgrip strength, Short Physical Performance Battery.

Table S5 Pairwise comparison of the receiver operating characteristic curves using the Delong method

	Walter Index	GPI	CCI	FRAIL
Walter Index	x	<.001	<.001	<.001
GPI	<.001	x	.104	.210
CCI	<.001	.104	x	.211
FRAIL Scale	<.001	.210	.211	x

Abbreviations: CCI, Charlson Comorbidity index; GPI, Geriatric Prognostic Index

Table S6 Brier Scores of pre- and post-imputation data

Models	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Walter Index	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
GPI	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
FRAIL Scale	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Abbreviations: GPI, Geriatric Prognostic Index
Notes: 0, Pre-imputation; 1-20, 20 datasets for post-imputation

Table S7 C-statistics of pre- and post-imputation data

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Walter Index																					
C-statistic	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
95% CI down	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
95% CI up	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Geriatric Prognostic Index																					
C-statistic	0.75	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
95% CI down	0.69	0.74	0.73	0.73	0.74	0.73	0.74	0.74	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
95% CI up	0.80	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
FRAIL Scale																					
C-statistic	0.74	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.73	0.74	0.74	0.74	0.74	0.74	0.73	0.74
95% CI down	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
95% CI up	0.80	0.80	0.80	0.80	0.79	0.80	0.80	0.79	0.79	0.80	0.79	0.79	0.80	0.80	0.79	0.80	0.80	0.80	0.80	0.80	0.80

Notes: 0, Pre-imputation data; 1-20, 20 datasets of post-imputation

Table S8 Observed and predicted 1-year mortality based on four models

Models	No. Who Died/ No. at Risk	Observed mortality, % (95% CI)	Predicted mortality, %
Walter Index			
0-1	3/347	0.9 (0.2–2.5)	0.9
2-3	11/237	4.6 (2.3–8.2)	4.7
4-6	35/161	21.7 (15.6–28.9)	21.2
>6	50/85	58.8 (47.6–69.4)	59.4
Geriatric Prognostic Index			
0	0/21	0 (0.0-16.1)	1.6
0.5	0/34	0 (0.0-10.3)	2.1
1	0/63	0 (0.0-5.7)	2.7
1.5	5/89	5.6 (1.8–12.6)	3.5
2	3/76	3.9 (0.8–11.1)	4.6
2.5	8/98	8.2 (3.6–15.4)	5.9
3	4/73	5.5 (1.5–13.4)	7.6
3.5	7/55	12.7 (5.3–24.5)	9.8
4	6/50	12.0 (4.5–24.3)	12.5
4.5	6/46	13.0 (4.9–26.3)	15.8
5	11/45	24.4 (12.9–39.5)	19.8
5.5	8/40	20.0 (9.1–35.6)	24.6
6	10/24	41.7 (22.1–63.4)	30.0
6.5	4/14	28.6 (8.4–58.1)	36.0
7	0/2	0 (0.0-84.2)	42.6
7.5	0/1	0 (0.0-97.5)	49.3
8.0	0/0	-	-
Charlson Comorbidity Index			
0	7/235	3.0 (1.2–6.0)	2.0
1-2	29/395	7.3 (5.0–10.4)	7.2
3-4	21/130	16.2 (10.3–23.6)	22.5
≥5	43/72	59.7 (47.5–71.1)	52.4
Frail Scale			
0	6/237	2.5 (0.5-4.5)	2.3
1-2	28/339	8.3 (5.3-11.2)	8.5
3-5	65/243	26.7 (21.2-32.3)	26.6

Table S9 Baseline characteristics of participants in the development and validation cohorts

	Development cohort N=1495	Validation cohort N=832
Age, mean (SD)/mean (IQR)	81 (7)	77.0 (74.0–82.0)
Male, n (%)	491(33)	380 (45.7)
ADL, n (%)		
Independent in all ADLs	604 (41)	463 (55.6)
Dependent in 1-4 ADLs	601(40)	325 (39.1)
Dependent in all ADLs	520 (35)	44 (5.3)
ALB, n (%)		
>3.4	1089 (73)	668 (80.4)
3.0-3.4	255 (17)	117 (14.1)
<3.0	151 (10)	46 (5.5)
Creatine, n (%)		
≤3.0	1344 (90)	821(98.8)
>3.0	151 (10)	2 (1.2)
Comorbid conditions, n (%)		
Myocardial infarction	208 (14)	37 (4.4)
Congestive heart failure	400 (27)	57 (6.9)
Dementia	271 (18)	43 (5.2)
Chronic pulmonary disease	256 (17)	98 (11.8)
Diabetes	265 (18)	231 (27.8)
Solitary cancer	111 (7)	95 (11.4)
Metastatic cancer	47 (3)	53 (6.4)
Cerebrovascular disease	250 (17)	135 (16.2)
Married, n (%)	520 (35)	642 (77.2)
Length of stay >7d, n (%)	458 (31)	761 (91.5)
Walter index, n (%)		
0-1	356 (23.8)	347 (41.8)
2-3	382 (25.6)	237 (28.6)
4-6	475 (31.8)	161 (19.4)
>6	282 (18.9)	85 (10.2)
1-year mortality, n (%)	492 (32.9)	100 (12.0)

Abbreviations: SD, Standard Deviation; IQR, Interquartile Range
Notes: The development cohort refers to the development cohort of the original study of Walter Index; The validation cohort refers to our study population
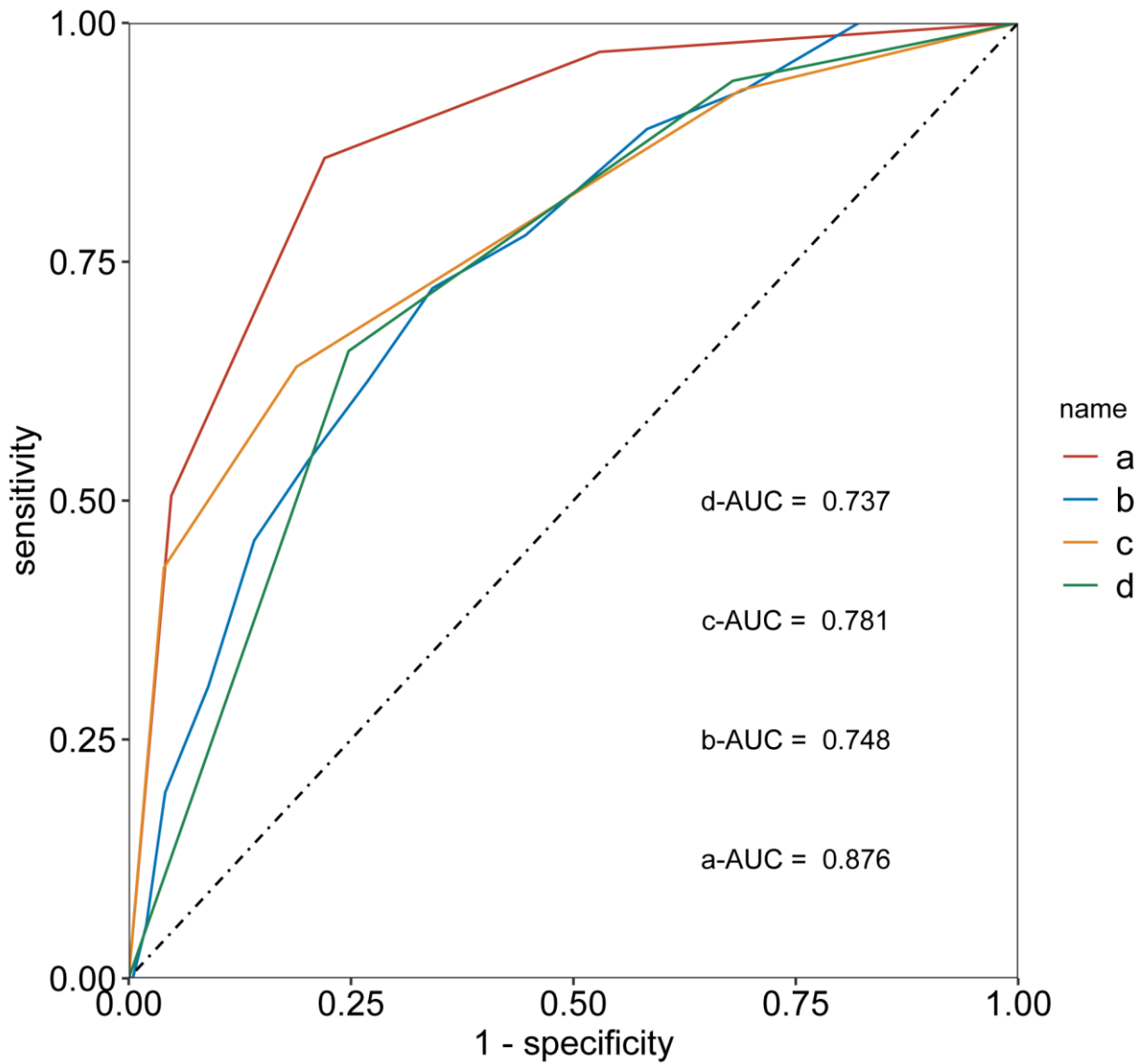
Supplementary Figures

d-AUC = 0.737

c-AUC = 0.781

b-AUC = 0.748

a-AUC = 0.876

name
a
b
c
d

Figure S1 Area under the receiver operating characteristic curves for 1-year mortality

Notes: Area under the receiver operating characteristic curves of four models were Walter Index (Model a): 0.88 (95% CI 0.84-0.91), Geriatric Prognostic Index (Model b): 0.75 (95% CI 0.69-0.80), Charlson Comorbidity Index (Model c): 0.78 (95% CI 0.73-0.83), and FRAIL Scale (Model d): 0.74 (95% CI 0.69-0.78), respectively.
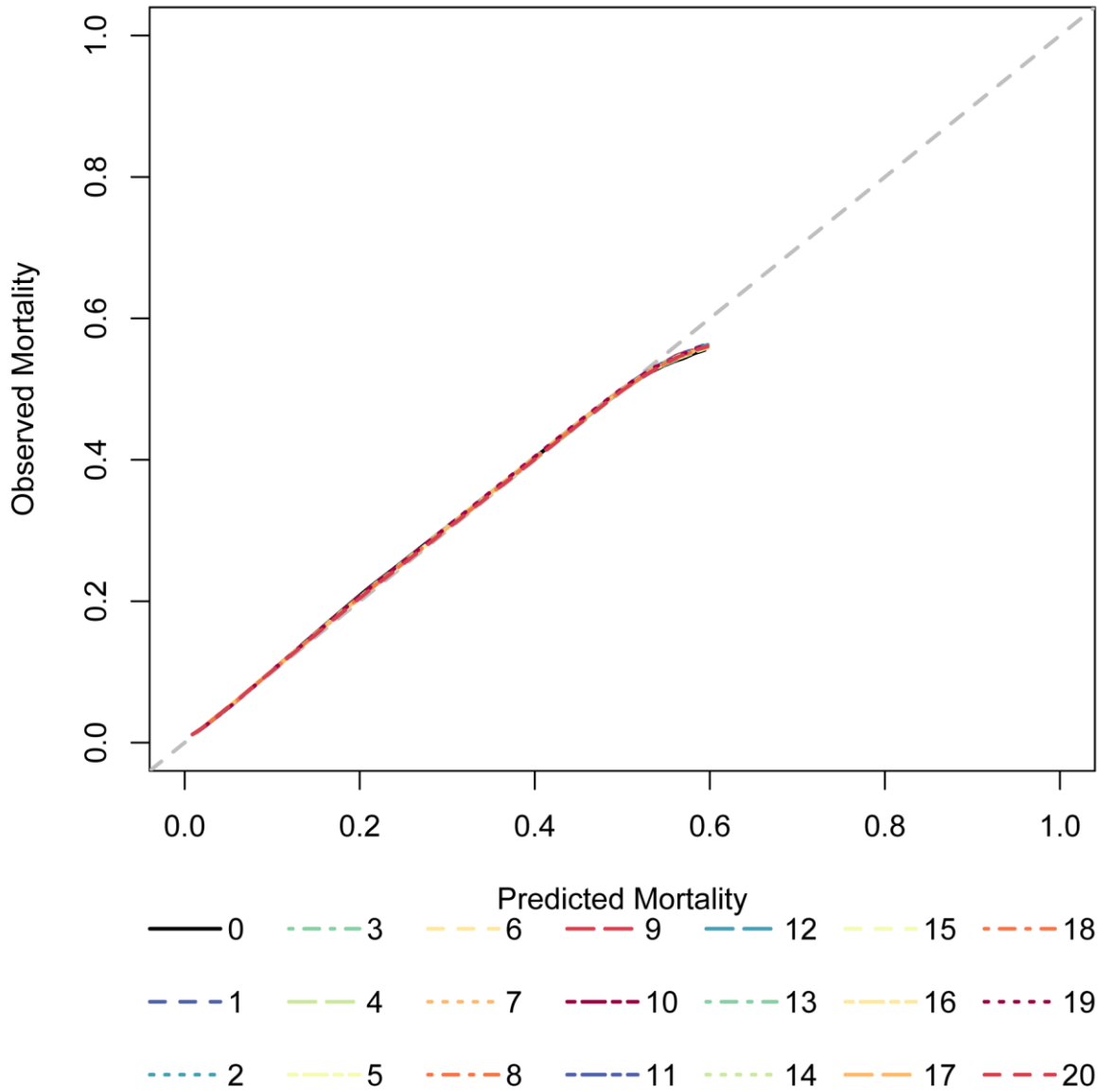
Figure S2 Walter Index calibration curves of pre- and post-imputation data

Notes: Calibration plot with predicted mortality on the x-axis and observed mortality on the y-axis. A perfect prediction corresponds to the 45°dotted line (ideal calibration line). Calibration curves were bias-corrected using bootstrapping (B=1000 repetitions), indicating the performance of the observed models.

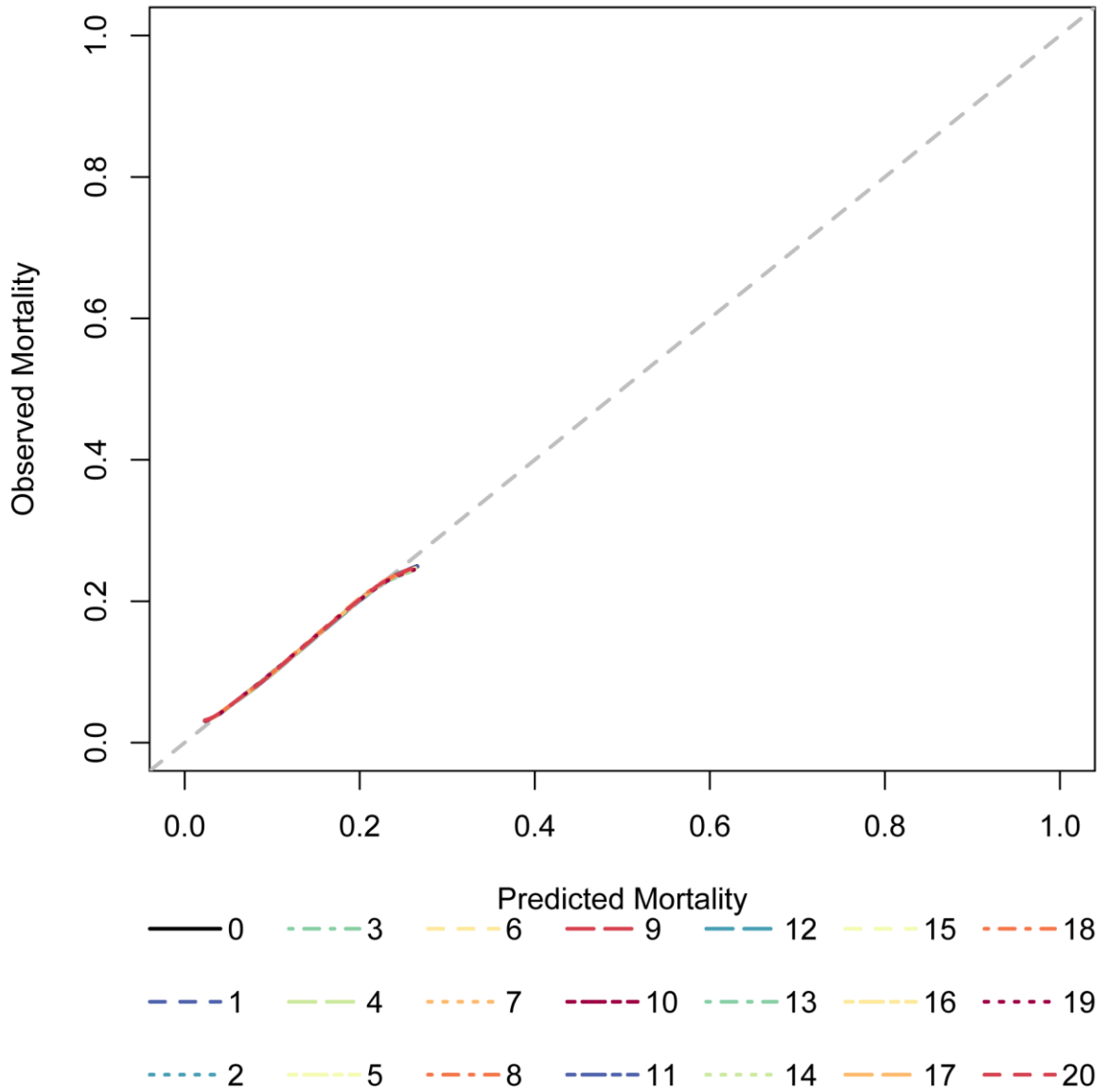0, Pre-imputation data; 1-20, 20 datasets for post-imputation
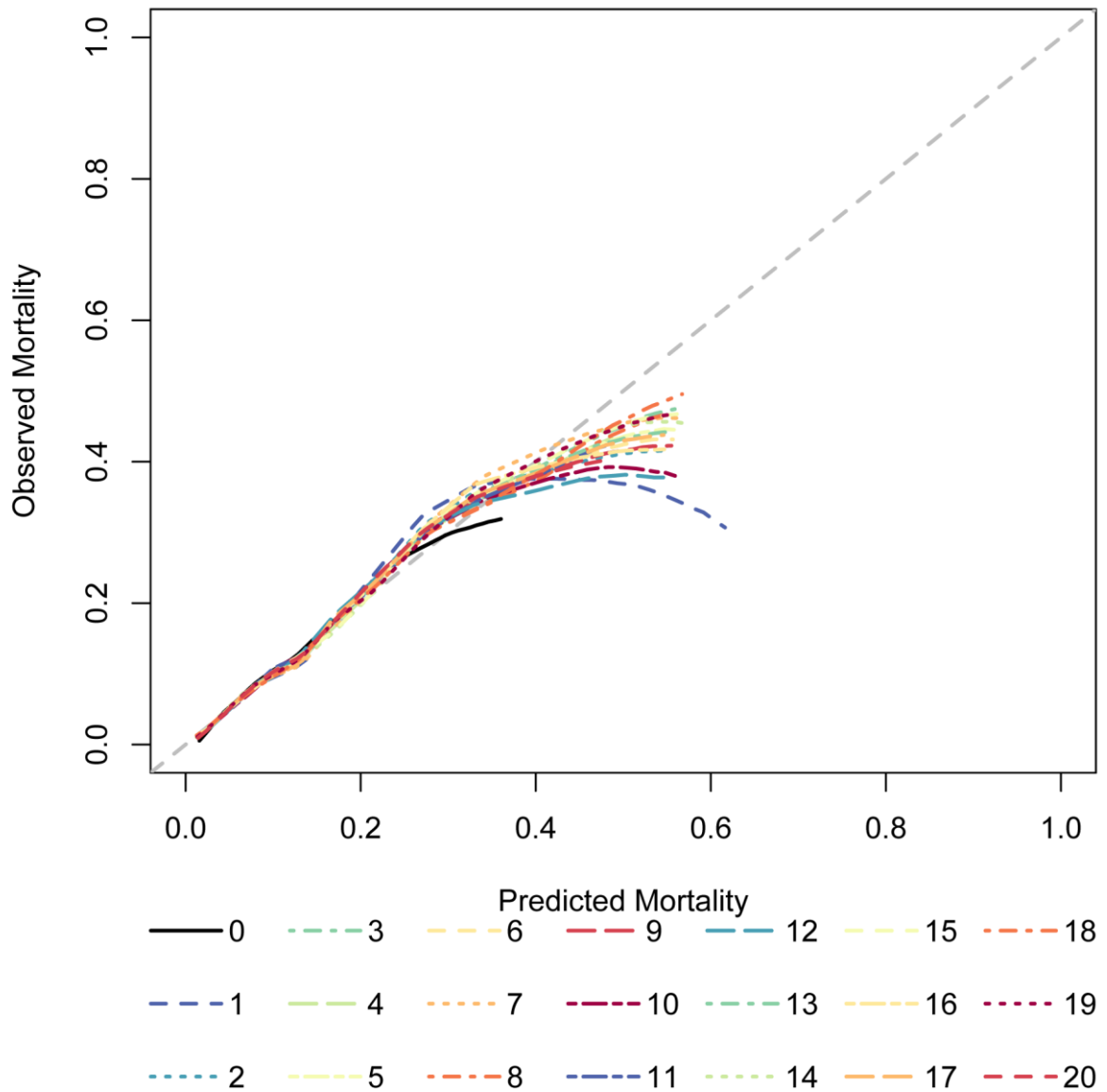
Figure S3 Geriatric Prognostic Index calibration curves of pre- and post-imputation data

Notes: Calibration plot with predicted mortality on the x-axis and observed mortality on the y-axis. A perfect prediction corresponds to the 45°dotted line (ideal calibration line). Calibration curves were bias-corrected using bootstrapping (B=1000 repetitions), indicating the performance of the observed models.

0, Pre-imputation data; 1-20, 20 datasets for post-imputation

Figure S4 FRAIL calibration curves of pre- and post-imputation data

Notes: Calibration plot with predicted mortality on the x-axis and observed mortality on the y-axis. A perfect prediction corresponds to the 45°dotted line (ideal calibration line). Calibration curves were bias-corrected using bootstrapping (B=1000 repetitions), indicating the performance of the observed models.

0, Pre-imputation data; 1-20, 20 datasets for post-imputation
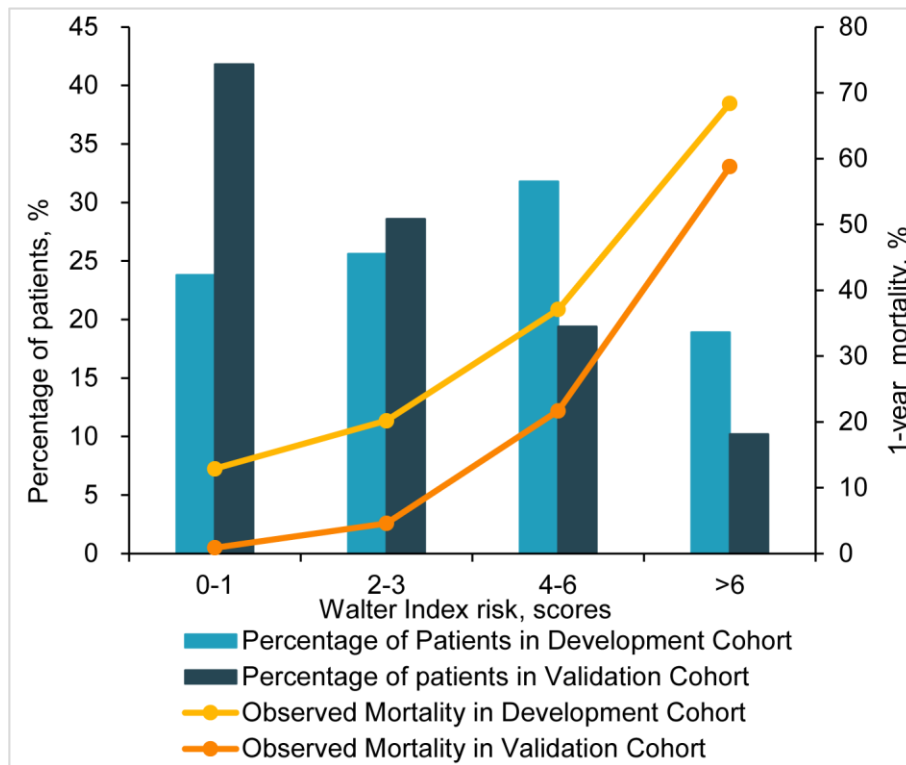
Figure S5 The distribution of calculated risk scores and observed 1-year mortality in the development cohort of the Walter Index and validation cohort of this study

Notes: The columns show the percentage of people in different subgroups, and the lines show the observed 1-year mortality. The development cohort refers to the development cohort of the original study of Walter Index; The validation cohort refers to our study population.
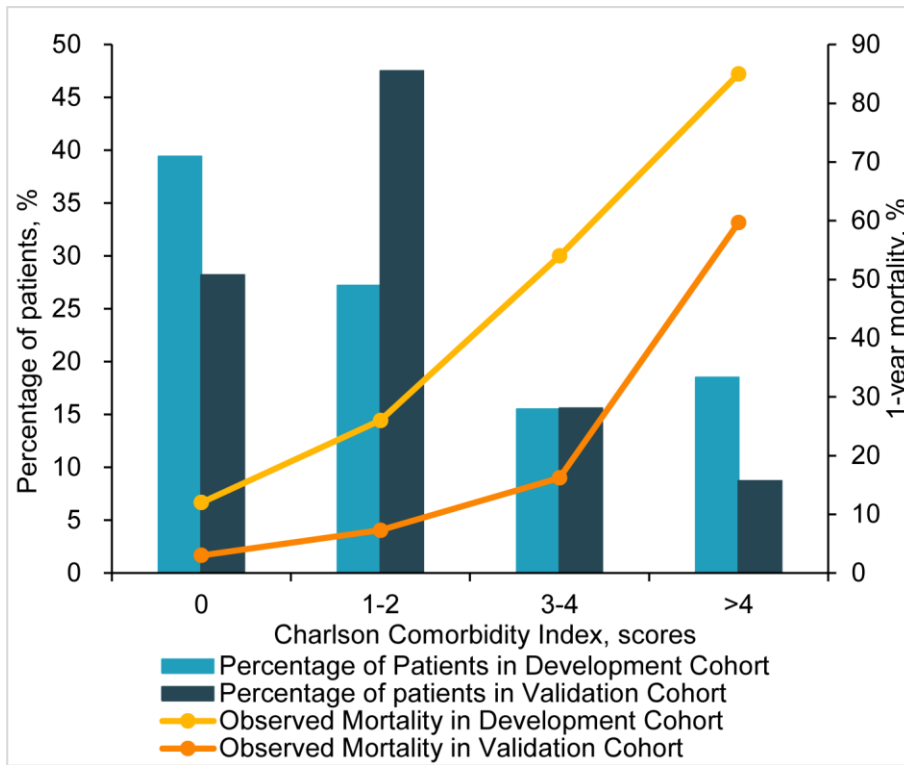
Figure S6 The distribution of calculated risk scores and observed 1-year mortality in the development cohort of the CCI and validation cohort of this study

Notes: The columns show the percentage of people in different subgroups, and the lines show the observed 1-year mortality. The development cohort refers to the development cohort of the original study of CCI; The validation cohort refers to our study population.

References

1.   Walter L, Brand R, Counsell S, et al. Development and validation of a prognostic index for 1-year mortality in older adults after hospitalization. *JAMA.* 2001;285(23):2987-2994.

2.   Charlson M, Pompei P, Ales K, MacKenzie C. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of chronic diseases.* 1987;40(5):373-383.

3.   Jung H, Kim J, Han J, et al. Multidimensional Geriatric Prognostic Index, Based on a Geriatric Assessment, for Long-Term Survival in Older Adults in Korea. *PloS one.* 2016;11(1):e0147032.

4.   Rubenstein L, Harker J, Salvà A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). *J Gerontol A Biol Sci Med Sci.* 2001;56(6):M366-372.

5.   KATZ S, FORD A, MOSKOWITZ R, JACKSON B, JAFFE M. STUDIES OF ILLNESS IN THE AGED. THE INDEX OF ADL: A STANDARDIZED MEASURE OF BIOLOGICAL AND PSYCHOSOCIAL FUNCTION. *JAMA.* 1963;185:914-919.

6.   Won CW YK, Rho YG, Kim SY, Lee EJ, Yoon JL, et al. The Development of Korean Activities of Daily Living(K-ADL) and Korean Instrumental Activities of Daily Living(K-IADL) Scale. *Korean Geriatr Soc.* 2002:6.

7.   Lawton M, Brody E. Assessment of older people: self-maintaining and instrumental activities of daily living. *The Gerontologist.* 1969;9(3):179-186.