

Supplementary Information

Functional correlates of mobility across three regional samples of community-dwelling older adults

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Supplementary Methods

Sensitivity analyses reproduced the archived models, evaluated missingness by site, tested variance inflation, heteroscedasticity, residual distribution, functional form, influence and site interactions, and refitted models under seven alternative cleaning or tail-handling scenarios. Exact algorithms and hashes are provided in the accompanying Python audit and metadata files.

Supplementary Table S1 | Record exclusions by rule

Exclusion rule	Flagged records
Age missing or <60 years	18
Height <130 or >210 cm	0
BMI <14 or >45 kg/m²	0
Gait speed ≤0.2 or >2.0 m/s	12
TUG ≤1 or >60 s	13
Handgrip strength ≤0 or >80 kg	3
Ankle-flexion ROM <0 or >60°	36
Plantar contact area <4000 or >20,000 mm²	0
Any prespecified exclusion	79

Supplementary Table S2 | All pooled and handgrip-subcohort coefficients

Model	Outcome	Predictor	n	β (95% CI)	P	BH q
Three-site pooled	Gait speed	Age	713	-0.296 (-0.375, -0.217)	1.74e-13	1.39e-12
Three-site pooled	Gait speed	Male sex	713	0.117 (-0.040, 0.273)	0.145	0.267
Three-site pooled	Gait speed	BMI	713	-0.060 (-0.154, 0.034)	0.210	0.336
Three-site pooled	Gait speed	Ankle-flexion ROM	713	0.056 (-0.008, 0.119)	0.085	0.176
Three-site pooled	Gait speed	Beijing site	713	-0.118 (-0.359, 0.122)	0.336	NA
Three-site pooled	Gait speed	Taiyuan/Shanxi site	713	-0.169 (-0.361, 0.022)	0.083	NA
Three-site pooled	Cadence	Age	719	-0.273 (-0.351, -0.195)	5.43e-12	3.26e-11
Three-site pooled	Cadence	Male sex	719	-0.269 (-0.421, -0.116)	5.40e-04	0.002
Three-site pooled	Cadence	BMI	719	-0.037 (-0.124, 0.050)	0.409	0.546
Three-site pooled	Cadence	Ankle-flexion ROM	719	0.031 (-0.031, 0.093)	0.327	0.490
Three-site pooled	Cadence	Beijing site	719	0.338 (0.136, 0.541)	0.001	NA
Three-site pooled	Cadence	Taiyuan/Shanxi site	719	0.216 (0.037, 0.394)	0.018	NA
Three-site pooled	Harmonic ratio	Age	727	0.023 (-0.055, 0.101)	0.563	0.676
Three-site pooled	Harmonic ratio	Male sex	727	-0.143 (-0.307, 0.021)	0.088	0.176
Three-site pooled	Harmonic ratio	BMI	727	0.039 (-0.071, 0.148)	0.488	0.616
Three-site pooled	Harmonic ratio	Ankle-flexion ROM	727	0.016 (-0.055, 0.086)	0.663	0.757
Three-site pooled	Harmonic ratio	Beijing site	727	-0.219 (-0.432, -0.005)	0.045	NA
Three-site pooled	Harmonic ratio	Taiyuan/Shanxi site	727	-0.025 (-0.228, 0.177)	0.807	NA
Three-site pooled	TUG duration	Age	719	0.432 (0.345, 0.518)	1.18e-22	2.82e-21
Three-site pooled	TUG duration	Male sex	719	-0.023 (-0.163, 0.118)	0.752	0.820
Three-site pooled	TUG duration	BMI	719	0.067 (-0.006, 0.140)	0.073	0.175
Three-site pooled	TUG duration	Ankle-flexion ROM	719	-0.061 (-0.122, -0.001)	0.046	0.122
Three-site pooled	TUG duration	Beijing site	719	-0.212 (-0.408, -0.017)	0.033	NA
Three-site pooled	TUG duration	Taiyuan/Shanxi site	719	0.252 (0.095, 0.409)	0.002	NA
Three-site pooled	Plantar contact area	Age	702	-0.030 (-0.100, 0.040)	0.406	0.546
Three-site pooled	Plantar contact area	Male sex	702	0.670 (0.528, 0.812)	2.18e-20	2.61e-19
Three-site pooled	Plantar contact area	BMI	702	0.236 (0.150, 0.322)	6.95e-08	3.34e-07
Three-site pooled	Plantar contact area	Ankle-flexion ROM	702	0.044 (-0.018, 0.106)	0.160	0.274
Three-site pooled	Plantar contact area	Beijing site	702	0.063 (-0.143, 0.270)	0.548	NA
Three-site pooled	Plantar contact area	Taiyuan/Shanxi site	702	-0.135 (-0.315, 0.044)	0.140	NA
Three-site pooled	Single-leg balance index	Age	709	-0.216 (-0.304, -0.129)	1.18e-06	4.73e-06
Three-site pooled	Single-leg balance index	Male sex	709	0.010 (-0.133, 0.153)	0.889	0.889

Model	Outcome	Predictor	n	β (95% CI)	P	BH q
Three-site pooled	Single-leg balance index	BMI	709	-0.123 (-0.234, -0.011)	0.032	0.096
Three-site pooled	Single-leg balance index	Ankle-flexion ROM	709	-0.009 (-0.077, 0.059)	0.794	0.829
Three-site pooled	Single-leg balance index	Beijing site	709	-0.075 (-0.328, 0.179)	0.564	NA
Three-site pooled	Single-leg balance index	Taiyuan/Shanxi site	709	-0.361 (-0.557, -0.165)	3.14e-04	NA
Two-site grip	Gait speed	Age	434	-0.207 (-0.320, -0.094)	3.32e-04	0.001
Two-site grip	Gait speed	Male sex	434	-0.253 (-0.516, 0.011)	0.060	0.120
Two-site grip	Gait speed	BMI	434	-0.110 (-0.196, -0.025)	0.011	0.028
Two-site grip	Gait speed	Ankle-flexion ROM	434	0.014 (-0.075, 0.103)	0.758	0.842
Two-site grip	Gait speed	Handgrip strength	434	0.227 (0.102, 0.351)	3.46e-04	0.001
Two-site grip	Gait speed	Taiyuan/Shanxi site	434	-0.147 (-0.344, 0.051)	0.145	NA
Two-site grip	Cadence	Age	436	-0.217 (-0.324, -0.110)	6.85e-05	3.42e-04
Two-site grip	Cadence	Male sex	436	-0.486 (-0.718, -0.254)	4.03e-05	2.42e-04
Two-site grip	Cadence	BMI	436	-0.055 (-0.144, 0.034)	0.226	0.357
Two-site grip	Cadence	Ankle-flexion ROM	436	-0.015 (-0.095, 0.065)	0.712	0.821
Two-site grip	Cadence	Handgrip strength	436	0.194 (0.070, 0.317)	0.002	0.006
Two-site grip	Cadence	Taiyuan/Shanxi site	436	0.277 (0.082, 0.472)	0.005	NA
Two-site grip	Harmonic ratio	Age	436	0.063 (-0.045, 0.171)	0.253	0.380
Two-site grip	Harmonic ratio	Male sex	436	-0.047 (-0.289, 0.194)	0.702	0.821
Two-site grip	Harmonic ratio	BMI	436	0.012 (-0.087, 0.112)	0.811	0.869
Two-site grip	Harmonic ratio	Ankle-flexion ROM	436	-0.004 (-0.093, 0.086)	0.937	0.960
Two-site grip	Harmonic ratio	Handgrip strength	436	0.003 (-0.119, 0.126)	0.960	0.960
Two-site grip	Harmonic ratio	Taiyuan/Shanxi site	436	-0.040 (-0.243, 0.162)	0.697	NA
Two-site grip	TUG duration	Age	431	0.321 (0.209, 0.433)	1.79e-08	5.36e-07
Two-site grip	TUG duration	Male sex	431	0.433 (0.178, 0.688)	8.78e-04	0.003
Two-site grip	TUG duration	BMI	431	0.087 (0.013, 0.161)	0.021	0.048
Two-site grip	TUG duration	Ankle-flexion ROM	431	-0.025 (-0.111, 0.061)	0.568	0.711
Two-site grip	TUG duration	Handgrip strength	431	-0.309 (-0.430, -0.188)	5.92e-07	5.92e-06
Two-site grip	TUG duration	Taiyuan/Shanxi site	431	0.268 (0.093, 0.443)	0.003	NA
Two-site grip	Plantar contact area	Age	422	-0.051 (-0.156, 0.054)	0.341	0.487
Two-site grip	Plantar contact area	Male sex	422	0.570 (0.326, 0.815)	4.86e-06	3.65e-05
Two-site grip	Plantar contact area	BMI	422	0.251 (0.159, 0.344)	9.39e-08	1.41e-06
Two-site grip	Plantar contact area	Ankle-flexion ROM	422	0.031 (-0.058, 0.121)	0.492	0.671
Two-site grip	Plantar contact area	Handgrip strength	422	0.113 (-0.012, 0.238)	0.076	0.142
Two-site grip	Plantar contact area	Taiyuan/Shanxi site	422	-0.165 (-0.363, 0.033)	0.103	NA
Two-site grip	Single-leg balance index	Age	419	-0.039 (-0.163, 0.086)	0.543	0.709
Two-site grip	Single-leg balance index	Male sex	419	-0.268 (-0.514, -0.021)	0.033	0.072
Two-site grip	Single-leg balance index	BMI	419	-0.102 (-0.232, 0.029)	0.126	0.214
Two-site grip	Single-leg balance index	Ankle-flexion ROM	419	-0.073 (-0.166, 0.021)	0.129	0.214
Two-site grip	Single-leg balance index	Handgrip strength	419	0.218 (0.099, 0.336)	3.11e-04	0.001
Two-site grip	Single-leg balance index	Taiyuan/Shanxi site	419	-0.496 (-0.728, -0.263)	3.03e-05	NA

Supplementary Table S3 | Compact diagnostic summary

Analysis	Outcome	n	RMSE	Residual skew	BP P	White P	RESET P	Flags
Three-site pooled	Gait speed	713	0.948	-0.067	1.04e-07	4.10e-06	0.003	H; N; F
Three-site pooled	Cadence	719	0.944	-0.742	7.61e-04	0.023	0.659	H; N
Three-site pooled	Harmonic ratio	727	0.991	0.570	0.001	0.027	0.087	H; N
Three-site pooled	TUG duration	719	0.875	2.481	9.04e-05	0.008	7.00e-07	H; N; F
Three-site pooled	Plantar contact area	702	0.890	-0.171	0.010	0.013	0.339	H; N
Three-site pooled	Single-leg balance index	709	0.951	2.613	0.001	5.55e-04	1.78e-04	H; N; F
Two-site grip	Gait speed	434	0.928	-0.062	7.83e-07	1.60e-04	0.009	H; N; F
Two-site grip	Cadence	436	0.929	-0.804	0.089	0.394	0.533	N
Two-site grip	Harmonic ratio	436	0.998	0.591	0.707	0.310	0.662	N
Two-site grip	TUG duration	431	0.836	1.856	0.006	0.349	2.68e-08	H; N; F
Two-site grip	Plantar contact area	422	0.874	-0.244	6.66e-04	0.003	0.792	H; N
Two-site grip	Single-leg balance index	419	0.935	1.730	1.34e-05	2.38e-05	0.008	H; N; F

BP, Breusch-Pagan test. Flags: H, heteroscedasticity alert; N, non-normal residuals; F, functional-form alert. HC3 robust inference was used for all reported models. The complete diagnostic output is supplied as a separate machine-readable CSV file.

Supplementary Table S4 | Robustness of the six prespecified focal conclusions

Conclusion	n	Base β (95% CI)	Influence-re fit β	Leave-one-site-out β range	Threshold β range	Directional consistency	Site interaction P / q
Older age and slower gait	713	-0.296 (-0.375, -0.217)	-0.322	-0.368 to -0.221	-0.324 to -0.289	Influence Yes; site Yes; threshold Yes	0.036 / 0.109
Older age and longer TUG	719	0.432 (0.345, 0.518)	0.313	0.351 to 0.494	0.432 to 0.461	Influence Yes; site Yes; threshold Yes	1.04e-04 / 0.002
Higher BMI and larger plantar area	702	0.236 (0.150, 0.322)	0.249	0.174 to 0.247	0.230 to 0.244	Influence Yes; site Yes; threshold Yes	0.016 / 0.074
Ankle flexion and gait speed	713	0.056 (-0.008, 0.119)	0.048	0.034 to 0.076	0.046 to 0.073	Influence Yes; site Yes; threshold Yes	0.483 / 0.621
Grip strength and gait speed	434	0.227 (0.102, 0.351)	0.186	0.148 to 0.263	0.172 to 0.227	Influence Yes; site Yes; threshold Yes	0.032 / 0.104
Grip strength and TUG	431	-0.309 (-0.430, -0.188)	-0.230	-0.301 to -0.256	-0.311 to -0.267	Influence Yes; site Yes; threshold Yes	0.035 / 0.104

Ranges summarize all leave-one-site-out or threshold variants. The complete robustness output, including exact P values and comparison counts, is supplied as a separate machine-readable CSV file.

Supplementary Table S5 | Joint tests of predictor-by-site interactions

Analysis	Outcome	Predictor	n	Joint Wald statistic	P	BH q
Three-site pooled	Gait speed	Age	713	6.622	0.036	0.109
Three-site pooled	Gait speed	BMI	713	11.741	0.003	0.025
Three-site pooled	Gait speed	Ankle-flexion ROM	713	1.457	0.483	0.621
Two-site grip	Gait speed	Handgrip strength	434	4.613	0.032	0.104
Three-site pooled	Cadence	Age	719	2.811	0.245	0.488
Three-site pooled	Cadence	BMI	719	1.570	0.456	0.621
Three-site pooled	Cadence	Ankle-flexion ROM	719	3.774	0.152	0.341
Two-site grip	Cadence	Handgrip strength	436	2.707	0.100	0.164
Three-site pooled	Harmonic ratio	Age	727	9.598	0.008	0.049
Three-site pooled	Harmonic ratio	BMI	727	1.740	0.419	0.621
Three-site pooled	Harmonic ratio	Ankle-flexion ROM	727	2.611	0.271	0.488
Two-site grip	Harmonic ratio	Handgrip strength	436	2.560	0.110	0.164
Three-site pooled	TUG duration	Age	719	18.337	1.04e-04	0.002
Three-site pooled	TUG duration	BMI	719	0.850	0.654	0.735
Three-site pooled	TUG duration	Ankle-flexion ROM	719	1.930	0.381	0.621
Two-site grip	TUG duration	Handgrip strength	431	4.466	0.035	0.104
Three-site pooled	Plantar contact area	Age	702	6.943	0.031	0.109
Three-site pooled	Plantar contact area	BMI	702	8.223	0.016	0.074
Three-site pooled	Plantar contact area	Ankle-flexion ROM	702	0.298	0.862	0.862
Two-site grip	Plantar contact area	Handgrip strength	422	0.132	0.716	0.733
Three-site pooled	Single-leg balance index	Age	709	5.883	0.053	0.136
Three-site pooled	Single-leg balance index	BMI	709	1.021	0.600	0.720
Three-site pooled	Single-leg balance index	Ankle-flexion ROM	709	0.383	0.826	0.862
Two-site grip	Single-leg balance index	Handgrip strength	419	0.117	0.733	0.733

The complete table, including the tested interaction terms, is supplied as a separate machine-readable CSV file.

Supplementary Table S6 | Leave-one-site-out estimates for the six focal conclusions

Analysis	Outcome	Predictor	Site excluded	n	β (95% CI)	P	Direction stable
Three-site pooled	Gait speed	Age	Beijing	461	-0.289 (-0.390, -0.188)	2.23e-08	Yes
Three-site pooled	Gait speed	Ankle-flexion ROM	Beijing	461	0.034 (-0.050, 0.118)	0.425	Yes
Three-site pooled	TUG duration	Age	Beijing	458	0.440 (0.336, 0.543)	7.40e-17	Yes
Three-site pooled	Plantar contact area	BMI	Beijing	449	0.247 (0.160, 0.334)	2.51e-08	Yes
Three-site pooled	Gait speed	Age	Taiyuan/Shanxi	434	-0.221 (-0.320, -0.121)	1.42e-05	Yes
Three-site pooled	Gait speed	Ankle-flexion ROM	Taiyuan/Shanxi	434	0.076 (-0.006, 0.158)	0.069	Yes
Three-site pooled	TUG duration	Age	Taiyuan/Shanxi	439	0.351 (0.236, 0.467)	2.76e-09	Yes
Three-site pooled	Plantar contact area	BMI	Taiyuan/Shanxi	419	0.231 (0.127, 0.336)	1.45e-05	Yes
Three-site pooled	Gait speed	Age	Zhengzhou	531	-0.368 (-0.457, -0.279)	5.02e-16	Yes
Three-site pooled	Gait speed	Ankle-flexion ROM	Zhengzhou	531	0.048 (-0.019, 0.116)	0.160	Yes
Three-site pooled	TUG duration	Age	Zhengzhou	541	0.494 (0.397, 0.591)	2.52e-23	Yes
Three-site pooled	Plantar contact area	BMI	Zhengzhou	536	0.174 (0.063, 0.284)	0.002	Yes
Two-site grip	Gait speed	Handgrip strength	Taiyuan/Shanxi	182	0.148 (-0.014, 0.309)	0.073	Yes
Two-site grip	TUG duration	Handgrip strength	Taiyuan/Shanxi	178	-0.256 (-0.413, -0.099)	0.001	Yes
Two-site grip	Gait speed	Handgrip strength	Zhengzhou	252	0.263 (0.059, 0.466)	0.012	Yes
Two-site grip	TUG duration	Handgrip strength	Zhengzhou	253	-0.301 (-0.514, -0.087)	0.006	Yes

All predictor-level leave-one-site-out results are supplied in the complete machine-readable CSV file.

Supplementary Table S7 | Focal estimates under seven cleaning and tail-handling scenarios

Conclusion	Scenario	n	β (95% CI)	P	Direction stable	$ \Delta\beta $
Older age and slower gait	Primary recordwise screening	713	-0.296 (-0.375, -0.217)	1.74e-13	Yes	0.000
Older age and longer TUG	Primary recordwise screening	719	0.432 (0.345, 0.518)	1.18e-22	Yes	0.000
Higher BMI and larger plantar area	Primary recordwise screening	702	0.236 (0.150, 0.322)	6.95e-08	Yes	0.000
Ankle flexion and gait speed	Primary recordwise screening	713	0.056 (-0.008, 0.119)	0.085	Yes	0.000
Grip strength and gait speed	Primary recordwise screening	434	0.227 (0.102, 0.351)	3.46e-04	Yes	0.000
Grip strength and TUG	Primary recordwise screening	431	-0.309 (-0.430, -0.188)	5.92e-07	Yes	0.000
Older age and slower gait	Valuewise invalid-to-missing	728	-0.305 (-0.383, -0.228)	9.22e-15	Yes	0.009
Older age and longer TUG	Valuewise invalid-to-missing	730	0.449 (0.362, 0.535)	3.81e-24	Yes	0.017
Higher BMI and larger plantar area	Valuewise invalid-to-missing	724	0.230 (0.145, 0.316)	1.32e-07	Yes	0.006
Ankle flexion and gait speed	Valuewise invalid-to-missing	728	0.061 (-0.001, 0.124)	0.055	Yes	0.005
Grip strength and gait speed	Valuewise invalid-to-missing	440	0.216 (0.092, 0.339)	6.20e-04	Yes	0.011
Grip strength and TUG	Valuewise invalid-to-missing	436	-0.311 (-0.434, -0.188)	6.95e-07	Yes	0.002
Older age and slower gait	Ankle ROM lower bound -20°	739	-0.304 (-0.381, -0.227)	8.38e-15	Yes	0.008
Older age and longer TUG	Ankle ROM lower bound -20°	745	0.436 (0.349, 0.522)	7.96e-23	Yes	0.004
Higher BMI and larger plantar area	Ankle ROM lower bound -20°	722	0.241 (0.158, 0.325)	1.46e-08	Yes	0.005
Ankle flexion and gait speed	Ankle ROM lower bound -20°	739	0.068 (0.004, 0.133)	0.039	Yes	0.012
Grip strength and gait speed	Ankle ROM lower bound -20°	447	0.211 (0.089, 0.333)	6.82e-04	Yes	0.015
Grip strength and TUG	Ankle ROM lower bound -20°	444	-0.298 (-0.419, -0.178)	1.19e-06	Yes	0.010
Older age and slower gait	Gait-speed range 0.1-2.5 m/s	718	-0.309 (-0.391, -0.228)	8.40e-14	Yes	0.013
Older age and longer TUG	Gait-speed range 0.1-2.5 m/s	724	0.445 (0.356, 0.533)	4.73e-23	Yes	0.013
Higher BMI and larger plantar area	Gait-speed range 0.1-2.5 m/s	707	0.239 (0.154, 0.324)	3.83e-08	Yes	0.003
Ankle flexion and gait speed	Gait-speed range 0.1-2.5 m/s	718	0.046 (-0.017, 0.109)	0.150	Yes	0.010
Grip strength and gait speed	Gait-speed range 0.1-2.5 m/s	438	0.224 (0.103, 0.346)	2.99e-04	Yes	0.002
Grip strength and TUG	Gait-speed range 0.1-2.5 m/s	435	-0.311 (-0.434, -0.188)	6.85e-07	Yes	0.003
Older age and slower gait	Relaxed joint recordwise	746	-0.324 (-0.404, -0.244)	1.75e-15	Yes	0.028
Older age and longer TUG	Relaxed joint recordwise	752	0.445 (0.356, 0.534)	1.12e-22	Yes	0.013
Higher BMI and larger plantar area	Relaxed joint recordwise	729	0.244 (0.162, 0.326)	5.91e-09	Yes	0.008
Ankle flexion and gait speed	Relaxed joint recordwise	746	0.073 (0.012, 0.135)	0.020	Yes	0.017
Grip strength and gait speed	Relaxed joint recordwise	452	0.201 (0.081, 0.320)	9.79e-04	Yes	0.026
Grip strength and TUG	Relaxed joint recordwise	449	-0.307 (-0.430, -0.185)	9.39e-07	Yes	0.001
Older age and slower gait	Strict joint recordwise	692	-0.289 (-0.367, -0.210)	4.67e-13	Yes	0.008
Older age and longer TUG	Strict joint recordwise	701	0.461 (0.371, 0.551)	7.21e-24	Yes	0.030
Higher BMI and larger plantar area	Strict joint recordwise	681	0.235 (0.144, 0.326)	4.35e-07	Yes	0.001
Ankle flexion and gait speed	Strict joint recordwise	692	0.049 (-0.017, 0.116)	0.145	Yes	0.007
Grip strength and gait speed	Strict joint recordwise	420	0.172 (0.035, 0.309)	0.014	Yes	0.055

Conclusion	Scenario	n	β (95% CI)	P	Direction stable	$ \Delta\beta $
Grip strength and TUG	Strict joint recordwise	419	-0.267 (-0.377, -0.156)	2.08e-06	Yes	0.042
Older age and slower gait	Within-site 1st-99th percentile winsorisation	713	-0.298 (-0.377, -0.219)	1.49e-13	Yes	0.001
Older age and longer TUG	Within-site 1st-99th percentile winsorisation	719	0.449 (0.364, 0.534)	4.99e-25	Yes	0.017
Higher BMI and larger plantar area	Within-site 1st-99th percentile winsorisation	702	0.239 (0.149, 0.328)	1.65e-07	Yes	0.002
Ankle flexion and gait speed	Within-site 1st-99th percentile winsorisation	713	0.059 (-0.007, 0.125)	0.078	Yes	0.003
Grip strength and gait speed	Within-site 1st-99th percentile winsorisation	434	0.226 (0.100, 0.353)	4.63e-04	Yes	0.000
Grip strength and TUG	Within-site 1st-99th percentile winsorisation	431	-0.311 (-0.430, -0.191)	3.41e-07	Yes	0.002

Scenario definitions and the complete numeric output are supplied in the machine-readable CSV file and reproducibility code.

Supplementary Table S8 | Influence-refit estimates for the six focal conclusions

Analysis	Association	n full / refit	Removed	β full	β refit (95% CI)	Refit P	Direction changed
Three-site pooled	Age → Gait speed	713 / 673	40	-0.296	-0.322 (-0.388, -0.255)	4.06e-21	No
Three-site pooled	Ankle-flexion ROM → Gait speed	713 / 673	40	0.056	0.048 (-0.009, 0.105)	0.100	No
Three-site pooled	Age → TUG duration	719 / 683	36	0.432	0.313 (0.260, 0.365)	2.08e-31	No
Three-site pooled	BMI → Plantar contact area	702 / 665	37	0.236	0.249 (0.177, 0.322)	1.52e-11	No
Two-site grip	Handgrip strength → Gait speed	434 / 402	32	0.227	0.186 (0.087, 0.285)	2.23e-04	No
Two-site grip	Handgrip strength → TUG duration	431 / 406	25	-0.309	-0.230 (-0.302, -0.157)	4.83e-10	No

The complete predictor-level influence-refit table is supplied as a separate machine-readable CSV file.

Supplementary Table S9 | Cross-site measurement and harmonisation matrix

Domain	Beijing	Taiyuan/Shanxi	Zhengzhou	Analytic definition	Boundary
Gait and TUG	iGAIT 400 Hz; Baibit 200 Hz; 3 m TUG	iGAIT 400 Hz; Baibit 200 Hz; 3 m TUG	Corresponding harmonised exports; 3 m TUG	Device-exported gait speed, cadence and harmonic ratio; total TUG duration	Common definitions do not prove identical calibration or measurement error
Plantar contact area	Left/right values averaged when available	Left/right values averaged when available	Supplied bilateral summary	Bilateral summary contact area (mm ²)	Aggregation route differed by source workbook
Single-leg balance	Left/right indices averaged when available	Left/right indices averaged when available	Supplied bilateral summary	Device-derived bilateral summary index	Device-specific index; no external validation for the present use
Ankle-flexion ROM	Mean of available left/right values	Mean of available left/right values	Supplied bilateral summary	Mean available bilateral ankle-flexion ROM (degrees)	Field summary is not equivalent to strength, propulsion or weight-bearing dorsiflexion
Handgrip strength	Not collected	Two trials per hand; mean of valid trials	Three trials per hand; supplied mean summary	Mean valid recorded grip strength (kg)	Structurally missing in Beijing; trial count differed between measured sites

The table distinguishes a shared analytic definition from identical acquisition and error structures. Structural absence of handgrip data in Beijing was preserved rather than imputed.

Supplementary Table S10 | Site-specific slopes for interaction tests surviving FDR correction

Outcome	Predictor	Site	Interaction-model n	Site-specific β (95% CI)	Slope P	Joint interaction P / q
Gait speed	BMI	Zhengzhou	713	-0.248 (-0.401, -0.094)	0.002	0.003 / 0.025
Gait speed	BMI	Beijing	713	0.135 (-0.047, 0.317)	0.147	0.003 / 0.025
Gait speed	BMI	Taiyuan/Shanxi	713	0.001 (-0.119, 0.121)	0.984	0.003 / 0.025
Harmonic ratio	Age	Zhengzhou	727	0.254 (0.083, 0.424)	0.003	0.008 / 0.049
Harmonic ratio	Age	Beijing	727	-0.043 (-0.143, 0.057)	0.397	0.008 / 0.049
Harmonic ratio	Age	Taiyuan/Shanxi	727	-0.039 (-0.182, 0.104)	0.594	0.008 / 0.049
TUG duration	Age	Zhengzhou	719	0.176 (0.029, 0.322)	0.019	1.04e-04 / 0.002
TUG duration	Age	Beijing	719	0.440 (0.288, 0.591)	1.21e-08	1.04e-04 / 0.002
TUG duration	Age	Taiyuan/Shanxi	719	0.579 (0.463, 0.695)	1.25e-22	1.04e-04 / 0.002

Site-specific slopes are linear combinations from the HC3 interaction models and use pooled, outcome-specific standardisation. The joint interaction test, not a within-site P value, addresses whether slopes differ across sites. Complete slopes for every tested predictor-outcome combination are supplied as a machine-readable CSV file.