

Seated Sensorimotor Exercise for Functional Mobility in Older Adults With and Without Diagnosed Dementia: A Six-Month Non-Randomised Controlled Study

Erzsébet Stephens-Sarlós

sarlos.erszebet@gmail.com

Széchenyi István University <https://orcid.org/0000-0001-7723-0128>

Attila Szabo

Széchenyi István University <https://orcid.org/0000-0003-2788-4304>

Fanni Küplen

Széchenyi István University <https://orcid.org/0009-0002-4733-9813>

Patrick Stephens

Széchenyi István University <https://orcid.org/0009-0007-9211-0512>

Angéla Somogyi

Széchenyi István University <https://orcid.org/0000-0001-7966-1159>

Edmond Girasek

Széchenyi István University <https://orcid.org/0000-0002-0579-6592>

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Abstract

Background

Accessible exercise approaches are needed to support mobility in older adults with cognitive or physical limitations. We examined primitive reflex burden (PRB), functional mobility and their changes during a seated sensorimotor programme designed to counter persistent reflex-associated movement patterns.

Methods

This prospective, institution-allocated, non-randomised controlled study included 90 older adults with and without diagnosed dementia across six centres. Participants received supervised seated exercise for 30 minutes five times weekly over six months ($n = 47$) or usual activities ($n = 43$). PRB and Timed Up and Go (TUG) were assessed before and after the programme. Analyses comprised robust baseline regression, participant-clustered generalised estimating equations (GEE), and exploratory centre-clustered ANCOVA with small-sample correction.

Results

Higher baseline PRB was associated with slower TUG after adjustment ($n = 83$; $B = 0.235$ s/point, 95% CI 0.096–0.373). GEE estimates favoured intervention for PRB (-13.60 points, 95% CI -17.48 to -9.71) and TUG (-5.40 s, 95% CI -8.57 to -2.24). Centre-clustered adjusted follow-up differences were -11.66 PRB points ($n = 66$; 95% CI -16.82 to -6.49 ; $p = 0.010$) and -5.07 s for TUG ($n = 67$; 95% CI -11.15 to 1.00 ; $p = 0.070$). All three intervention centres showed mean improvements. Adjusted individual PRB and TUG changes were not independently associated. Attendance was 81%; no exercise-session incidents were reported.

Conclusions

Seated sensorimotor exercise was associated with favourable mobility and reflex-burden changes. The centre-clustered mobility estimate remained uncertain. This accessible approach merits cluster-randomised evaluation; the findings do not establish causality, reduced falls, or equivalent effects across dementia groups.

Trial registration:

Retrospectively registered on the Open Science Framework (OSF), acb4t, 11 October 2026.

1 Background

Maintaining functional mobility supports independence and participation in later life. Exercise is recommended, but standing or more demanding programmes may be difficult for older adults with mobility limitations or cognitive impairment [1, 2]. Chair-based exercise offers an accessible approach, although its effects vary across programmes and populations [3]. Supervised seated activity may therefore extend opportunities for regular exercise within routine older-adult services.

The Timed Up and Go (TUG) test measures the time required to stand, walk, turn and sit [4]. These actions integrate strength, balance, sensory processing, attention and movement planning. TUG is a functional mobility measure, not a stand-alone predictor of falls; fall prevention requires broader assessment [5, 6]. Distributed cortical, subcortical, brainstem and spinal systems contribute to mobility, including the suppression of context-inappropriate motor responses [7].

Primitive reflexes are automatic responses prominent in infancy that become attenuated as motor control develops [8]. Several persistent or re-emergent responses in adulthood are termed frontal release signs. They occur in ageing and neurodegenerative disease but are not disease-specific [9, 10, 11]. Their prevalence is higher in dementia, with variation by reflex type [12]. Primitive reflex burden (PRB), an aggregate score from a standardised assessment [13], may describe sensorimotor variation relevant to mobility, without directly measuring cortical inhibition or establishing a clinical biomarker.

A previous controlled study found reduced primitive reflex expression after sensorimotor exercise [14]. The present programme uses seated, low-load movements to reproduce and deliberately dissociate reflex-associated synergies, aiming to support voluntary movement and functional mobility. The primary aim was to examine the baseline PRB–TUG association adjusted for age, sex, dementia status and allocation. Secondary aims were to compare six-month PRB and TUG changes and explore modification by dementia status. We hypothesised higher PRB would accompany slower TUG and intervention participants would show more favourable changes. Individual change-score coupling was exploratory; parallel changes would not establish mediation.

2 Methods

2.1 Design and participants

This prospective, institution-allocated, controlled non-randomised study followed the TREND reporting framework [15]. Ninety participants were recruited during October–November 2025 from six older-adult day-care centres in Hungary. Baseline assessment occurred in November 2025. The programme ran from 3 December 2025 to 11 June 2026, with follow-up assessment in June 2026.

Institutions able to provide five supervised sessions weekly received the programme: centres A (n = 27), B (n = 12) and C (n = 8). Centres D (n = 17), E (n = 14) and F (n = 12) continued usual activities. Allocation depended on staff delivery capacity, not randomisation or participants' baseline scores. There were 47 intervention and 43 control participants. Dementia status was constant within centres: B, C and F served participants with diagnosed dementia. Centre identities are provided confidentially to the editors.

All attendees meeting eligibility criteria were invited. Inclusion required age ≥ 60 years, regular attendance, ability to understand simple instructions and ability to complete TUG safely, with a habitual walking aid if needed. Exclusions comprised acute illness preventing activity, unstable cardiovascular disease, severe musculoskeletal disease or recent fracture, severe non-dementia neurological impairment affecting movement, or visual/vestibular impairment preventing assessment. Dementia was a pre-existing documented medical diagnosis, not assigned by the researchers. No a priori sample-size calculation was performed; the sample comprised eligible consenting attendees. Numbers screened, ineligible or declining participation are not reported.

The study followed the Declaration of Helsinki and received university ethics approval on 12 May 2025. Committee identity and approval number are withheld for anonymous review and supplied to the editors. Written consent was obtained from participants without diagnosed dementia and from legal guardians for those with diagnosed dementia. Data were pseudonymised.

2.2 Seated sensorimotor programme and usual activities

Trained social care workers led small-group sessions lasting 30 minutes, scheduled five times weekly. Participants remained seated on stable chairs at tables in familiar surroundings. The programme used slow, controlled movements without externally applied resistance, vigorous exertion, standing balance tasks or floor exercises. This format was chosen to support safe participation among people with physical or cognitive limitations.

A bottom-up component involved deliberate reproduction of movements associated with persistent primitive reflexes. A complementary top-down component required voluntary movements that dissociated, counteracted or reversed these synergies. Tasks included head rotation and flexion–extension with defined arm positions; coordinated limb flexion–extension; reciprocal leg movements; crossing and uncrossing limbs; alternate grasping and release with contralateral hand opening; oral-motor and hand-opening coordination; and gentle tactile-motor stimulation of the hands, legs, soles and glabellar region. These tasks addressed tonic neck, tonic labyrinthine, Moro, Galant, grasp-related, oral, plantar and glabellar response patterns. Their rationale was repeated sensorimotor practice, not demonstrated restoration of a specific neural inhibitory mechanism.

Programme leaders received standardised training in starting positions, sequences, repetitions and safe execution, supported by a written manual and instructional video. The exercise protocol is deposited in Mendeley Data [16]; identifying repository details are supplied confidentially for review. Leaders recorded attendance, and make-up sessions were available. The colleague leading each session was responsible for monitoring and reporting incidents during exercise. Treatment fidelity was not formally quantified.

Control participants continued usual physical exercise, cognitive stimulation, recreational and social activities. They did not receive the study-specific programme, and control staff did not receive its training or materials during the study. Routine medical care was unchanged in both arms. Outcome assessors did not deliver the intervention. Participants and programme leaders could not be blinded; participants were not told the hypotheses. Complete assessor masking to allocation was not assured, and assessors knew dementia status.

2.3 Outcomes and data completeness

PRB summarised 17 primitive and transitional reflexes from an 18-reflex protocol, excluding the diving reflex. Twelve bilateral reflexes and five midline responses yielded 29 components, each scored 0 (absent), 1 (partially elicitable) or 2 (fully elicitable). Scores summed to 0–58; higher values indicated greater reflex burden. The protocol preprint reports weighted Cohen's κ of 0.912–0.983 for intra-rater and 0.912–1.000 for inter-rater reliability [13]. A total was valid only if every component was available; stored totals were checked against component sums.

For TUG, participants started in an armchair approximately 45 cm high, stood at the verbal instruction, walked 3 m at their usual safe speed, turned, returned and sat. Timing ended when fully seated. One recorded trial was performed without practice. Habitual walking aids and usual safe footwear were allowed. An examiner

accompanied the walking task on a level, unobstructed surface without assisting or setting the pace unless safety required intervention. Identical procedures were used at follow-up.

Improvement was baseline minus follow-up for both outcomes; positive values therefore represented lower PRB or faster TUG. Missing data were not imputed. Available cases informed descriptive summaries; paired analyses required both assessments, and regression required complete covariates. GEE used all available repeated outcomes with complete covariates. Completeness comparisons examined baseline characteristics in participants with and without paired PRB and TUG data.

2.4 Statistical analysis

Data management used SPSS 21.0; statistical analyses used Python with SciPy, statsmodels and NumPy. Continuous variables are mean $\pm$ SD and categorical variables counts/percentages. Distribution checks used Shapiro–Wilk tests and graphical inspection. Baseline comparisons used Welch or Mann–Whitney tests, Kruskal–Wallis tests across four groups, and chi-square or Fisher–Freeman–Halton tests for categorical variables.

Baseline PRB–TUG associations used Spearman/Pearson correlations and linear regression with HC3 heteroskedasticity-robust standard errors, adjusting for age, sex, dementia and allocation. Separate Gaussian identity-link GEE models used exchangeable correlation and participant-level clustering. Terms were time, intervention, dementia, time $\times$ intervention, time $\times$ dementia, age and sex. The time $\times$ intervention coefficient estimated the between-arm difference in change; these models did not account for clustering within centres.

Paired *t* and Wilcoxon tests assessed within-arm changes; Welch and Mann–Whitney tests compared changes between arms. Hedges' *g* intervals used 5,000 participant-level bootstrap resamples. HC3 change-score models included baseline outcome, age, sex, allocation, dementia and allocation $\times$ dementia. The adjusted Δ TUG– Δ PRB model included both baseline outcomes and demographic/allocation covariates; a separate interaction model tested Δ PRB $\times$ allocation. Dementia and change-coupling analyses were exploratory.

Additional, non-prespecified ANCOVA regressed follow-up outcome on allocation, baseline outcome, age, sex and dementia in outcome-specific complete cases. Centre-clustered CR2 covariance correction under identity working covariance and coefficient-specific Satterthwaite inference addressed institutional dependence [17]. No allocation $\times$ dementia term was included. These models estimate adjusted follow-up differences, unlike GEE change contrasts, and use different samples; inference differences cannot be attributed solely to clustering correction. With six centres and approximately two effective degrees of freedom, intervals and tests remain approximate. Centre-specific paired changes and unadjusted leave-one-centre-out contrasts assessed descriptive directional stability.

All tests were two-sided with $p < 0.05$, without multiplicity adjustment. Secondary estimates were interpreted cautiously. OpenAI Codex assisted language editing, structuring, statistical-code development/execution and figure rendering. Independent code implementations cross-checked centre-clustered calculations; the authors reviewed the analyses and retain responsibility for the manuscript.

3 Results

3.1 Participants and intervention delivery

The four groups comprised 31 non-dementia controls, 27 non-dementia intervention participants, 12 dementia controls and 20 dementia intervention participants. Overall, 69 (76.7%) were women; age was available for 84 (77.26 ± 7.10 years). Table 1 describes baseline characteristics. Baseline PRB was higher in intervention than control participants (22.35 ± 10.03 versus 16.86 ± 7.35; $p = 0.005$). Baseline TUG means were 17.12 ± 6.68 versus 15.07 ± 9.05 s (Welch $p = 0.238$; Mann–Whitney $p = 0.016$). Sex distribution differed ($p = 0.048$), underscoring non-comparability despite adjustment.

Table 1
Baseline characteristics across the four study groups

Characteristic	Non-dementia control	Non-dementia intervention	Dementia control	Dementia intervention	p value
Participants, n	31	27	12	20	—
Women, n (%)	24 (77.4)	24 (88.9)	5 (41.7)	16 (80.0)	.021
Age, years	75.81 ± 6.70	81.57 ± 6.38 (n = 21)	82.92 ± 4.62	71.60 ± 4.04	< .001
PRB score	14.48 ± 6.53	18.35 ± 8.80 (n = 23)	23.00 ± 5.72	26.95 ± 9.53	< .001
TUG time, s	11.12 ± 2.79	13.99 ± 4.95 (n = 22)	25.28 ± 11.57	20.57 ± 6.74	< .001
Values are mean ± SD unless indicated. Available-case n is shown when different from group totals. p values: Kruskal–Wallis (continuous variables) and Fisher–Freeman–Halton (sex). PRB, primitive reflex burden; TUG, Timed Up and Go.					

Baseline PRB and TUG were available for 86 and 85 participants; follow-up values were available for 70 each. Paired PRB, paired TUG and both paired outcomes were available for 66, 67 and 65, respectively. Seventy-two participants had at least one follow-up PRB/TUG outcome (Fig. 1). One dementia control participant died. Other follow-up nonattendance reflected illness or inability to travel from residential care; numerical separation of these reasons was unavailable. Baseline characteristics did not differ significantly between participants with and without both paired outcomes (all $p > 0.05$), although this does not exclude attrition bias. Intervention attendance was 81% of scheduled sessions. No incidents during exercise sessions were reported.

3.2 Baseline association and outcome changes

In 83 complete cases, higher PRB accompanied slower TUG (Spearman's $\rho = 0.589$; Pearson's $r = 0.506$; both $p < 0.001$). The adjusted association was $B = 0.235$ s/point (95% CI 0.096–0.373; $p < 0.001$; model $R^2 = 0.470$). Age and dementia were also associated with slower TUG. The PRB × dementia interaction was not significant ($p = 0.140$).

Among paired cases, TUG improved by 2.75 s in the intervention arm and worsened by 1.87 s in controls (Table 2). The unadjusted between-arm improvement difference was 4.62 s (Hedges' $g = 0.92$, 95% CI 0.73–1.66). PRB improved by 9.62 points with intervention and worsened by 4.41 points in controls; the difference was 14.02 points ($g = 1.56$, 95% CI 1.12–2.20). Participant-clustered GEE estimates favoured intervention for TUG (− 5.40 s, 95% CI − 8.57 to − 2.24) and PRB (− 13.60 points, 95% CI − 17.48 to − 9.71), both $p < 0.001$ (Table 3; Fig. 2).

Table 2
Paired outcomes and within-arm changes

Outcome	Arm	n	Baseline, mean $\pm$ SD	Post- intervention, mean $\pm$ SD	Mean improvement [95% CI]	Paired t-test p	Wilcoxon p	Cohen's d _z
PRB	Intervention	34	22.32 $\pm$ 10.58	12.71 $\pm$ 7.43	9.62 [5.97, 13.27]	< .001	< .001	0.92
PRB	Control	32	16.38 $\pm$ 7.25	20.78 $\pm$ 7.82	-4.41 [- 6.83, - 1.98]	< .001	.001	-0.65
TUG	Intervention	34	16.84 $\pm$ 6.54	14.10 $\pm$ 6.65	2.75 s [1.81, 3.68]	< .001	< .001	1.03
TUG	Control	33	14.40 $\pm$ 8.98	16.27 $\pm$ 11.65	-1.87 s [- 4.17, 0.43]	.108	.062	-0.29

Improvement = baseline minus follow-up; positive values indicate improvement. Between-arm differences: PRB 14.02 points, Hedges' g 1.56 (95% CI 1.12–2.20); TUG 4.62 s, g 0.92 (0.73–1.66). Both Welch p < 0.001. Tests and bootstrap intervals are participant-level, without centre correction.

Table 3
Association, longitudinal, change-score and centre-clustered models

Analysis	Effect/predictor	Analysis sample	B	95% CI	p value	Model R ²
Baseline TUG (HC3)	Baseline PRB	83	0.235	0.096 to 0.373	< .001	.470
Baseline TUG (HC3)	PRB × dementia	83	0.220	−0.072 to 0.512	.140	.481
Longitudinal PRB (GEE)	Time × intervention	84 participants / 150 observations	−13.599	−17.484 to − 9.713	< .001	—
Longitudinal TUG (GEE)	Time × intervention	83 participants / 150 observations	−5.403	−8.570 to − 2.236	< .001	—
PRB improvement (HC3)	Intervention	66	10.556	6.694 to 14.418	< .001	.729
PRB improvement (HC3)	Intervention × dementia	66	3.485	−4.211 to 11.181	.375	.729
TUG improvement (HC3)	Intervention	67	3.709	1.615 to 5.803	< .001	.302
TUG improvement (HC3)	Intervention × dementia	67	4.254	−7.913 to 16.420	.493	.302
ΔTUG, unadjusted (HC3)	ΔPRB	65	0.140	0.024 to 0.256	.018	.079
ΔTUG, fully adjusted (HC3)	ΔPRB	65	−0.077	−0.221 to 0.068	.297	.300
ΔTUG, fully adjusted (HC3)	Intervention	65	5.857	2.261 to 9.452	.001	.300
ΔTUG interaction (HC3)	ΔPRB × intervention	65	−0.159	−0.507 to 0.188	.369	.310
Follow-up PRB (ANCOVA, CR2)	Intervention	66 participants / 6 centres	−11.656	−16.822 to − 6.489	.010	—
Follow-up TUG (ANCOVA, CR2)	Intervention	67 participants / 6 centres	−5.074	−11.151 to 1.003	.070	—
HC3 models adjust for age, sex, dementia and allocation; change models include baseline outcome and allocation × dementia. The fully adjusted ΔTUG model includes both baseline outcomes and ΔPRB; the interaction model adds ΔPRB × allocation. GEE terms: time, allocation, dementia, time × allocation, time × dementia, age and sex. ANCOVA adjusts follow-up for baseline outcome, age, sex, dementia and allocation; CR2/Satterthwaite inference clusters by centre (PRB df 2.094; TUG df 2.020). Negative GEE/ANCOVA allocation contrasts favour intervention. HC3/GEE and bootstrap inference do not incorporate centre dependence. p values are unadjusted for multiplicity.						

Centre-clustered ANCOVA supported lower follow-up PRB with intervention (n = 66; −11.66 points, 95% CI − 16.82 to − 6.49; p = 0.010; df = 2.094). The TUG estimate favoured intervention but remained uncertain (n = 67; −5.07 s,

95% CI – 11.15 to 1.00; $p = 0.070$; $df = 2.020$). All three intervention centres showed mean improvement in both outcomes (Table 4). Omitting each centre in turn retained favourable unadjusted contrasts, ranging from 13.30–15.52 PRB points and 3.63–6.27 s for TUG; these descriptive checks do not establish significance or remove confounding.

Table 4
Paired changes by institution

Centre	Arm	Enrolled n	PRB paired n	PRB mean improvement	TUG paired n	TUG mean improvement (s)
Centre A	Intervention	27	17	8.53	17	3.41
Centre B	Intervention	12	11	10.82	11	2.09
Centre C	Intervention	8	6	10.50	6	2.09
Centre D	Control	17	13	–5.31	13	–2.44
Centre E	Control	14	12	–1.92	13	0.68
Centre F	Control	12	7	–7.00	7	–5.54
Unadjusted paired changes = baseline minus follow-up. Positive values indicate improvement. Codes mask institutional identities for review. Outcome-specific paired counts differ from enrolled counts; centre means are descriptive, not causal effects.						

Greater individual PRB reduction accompanied TUG improvement before adjustment ($n = 65$; Spearman's $\rho = 0.436$; $p < 0.001$). After adjustment, Δ PRB was not independently associated with Δ TUG ($B = -0.077$, 95% CI – 0.221 to 0.068; $p = 0.297$). Allocation $\times$ dementia interactions were not significant in PRB ($p = 0.375$) or TUG ($p = 0.493$) change models. The dementia control subgroup had only seven paired cases; these results do not demonstrate equivalent responses by dementia status.

4 Discussion

This study addresses a practical question: can exercise performed entirely while seated support mobility in older adults with and without diagnosed dementia? Participants receiving the programme showed favourable PRB and TUG changes, with mean improvements at all intervention centres. The centre-clustered mobility estimate remained imprecise, so the findings support further evaluation rather than definitive efficacy. The primary baseline association also indicated that greater reflex burden accompanied poorer mobility after measured covariate adjustment.

The programme's distinctive feature is its use of low-load voluntary movements that reproduce and counter reflex-associated synergies while avoiding standing balance tasks. This provides an accessible format for repeated practice in people who may struggle with conventional exercise. An 81% attendance rate and no reported exercise-session incidents support practical delivery within these centres. They do not establish comprehensive safety: incident reporting depended on programme leaders, and the study was not designed to

compare adverse-event rates. The death occurred in the control arm and is reported separately from exercise-session incidents.

TUG improved despite the absence of direct practice of standing, walking and turning. This raises the possibility that seated coordination, reciprocal movements and sensory input may transfer to broader functional tasks. Staff attention, motivation, confidence and general engagement may also contribute. An attention- and intensity-matched comparison is needed to distinguish programme-specific effects from structured participation. Findings complement chair-based exercise research [3] and earlier sensorimotor work on reflex expression [14].

Persistent primitive reflexes and frontal release signs are heterogeneous; they differ in elicitation, neural organisation and sensitivity to examination conditions. Summed PRB may capture distributed sensorimotor variation, but it cannot identify a specific inhibitory deficit. Age-related cortical GABA changes offer biological context [18, 19], not evidence that these exercises restore GABAergic function. The loss of an independent change-score association after adjustment also argues against claiming that reflex reduction mediated mobility improvement. PRB remains a candidate complementary measure requiring external validation and clinically meaningful thresholds.

The main limitation is non-random allocation across only six institutions based on delivery capacity. Baseline differences, staff resources, usual activities and unmeasured centre characteristics could influence outcomes. Dementia was constant within centres, limiting separation of cognitive status from institution. Participant-level GEE, HC3 and bootstrap analyses omitted centre dependence; exploratory CR2 analyses addressed dependence but could not remove confounding. Their small effective degrees of freedom, different estimand and complete-case samples limit inference. Consistent descriptive directions do not resolve these limitations.

Additional limitations include incomplete follow-up, unavailable reason-specific attrition counts, imperfect assessor masking, no active matched control, no formal fidelity assessment and no analysis of individual exercise dose. Baseline completeness comparisons cannot rule out selective loss related to illness or residential-care access. A single TUG trial without practice may increase measurement variability. Falls, daily physical activity, strength and daily living were not measured prospectively; improved TUG cannot establish fewer falls or improved real-world independence. Clinical importance relative to a prespecified TUG threshold was not evaluated, and longer-term follow-up was not available. The reflex protocol remains a preprint, and the predominantly female Hungarian service-based sample limits generalisability.

Future multicentre cluster-randomised studies should prespecify centre-level inference, adequate sample size, dementia subgroup analyses, adherence and fidelity measures, incident surveillance and longer-term functional outcomes. The present results justify evaluating this seated approach as an accessible contribution to mobility-oriented activity, with reflex burden as a complementary outcome.

5 Conclusions

Higher PRB was associated with slower functional mobility. A six-month seated sensorimotor programme designed to counter persistent reflex-associated movement patterns was associated with favourable PRB and TUG changes in older adults with and without diagnosed dementia. Centre-clustered analysis supported lower PRB, while the mobility contrast remained uncertain. Supervised seated delivery and the absence of reported

exercise-session incidents support further investigation, but do not establish causality, fall prevention, comprehensive safety or equal efficacy across dementia groups.

Abbreviations

ANCOVA
analysis of covariance
CI
confidence interval
CR2
bias-reduced cluster-robust covariance correction
df
degrees of freedom
GABA
γ-aminobutyric acid
GEE
generalised estimating equations
HC3
heteroskedasticity-consistent covariance estimator type 3
MMSE
Mini-Mental State Examination
PRB
primitive reflex burden
SD
standard deviation
TREND
Transparent Reporting of Evaluations with Nonrandomized Designs
TUG
Timed Up and Go.

Declarations

Ethics approval and consent to participate

University ethics approval was granted on 12 May 2025; identifying details are supplied to the editors. Written informed consent was obtained from participants without diagnosed dementia and legal guardians of participants with diagnosed dementia.

Study registration

The study was retrospectively registered on the Open Science Framework (OSF) on 11 October 2026, after completion of data collection (registration ID: acb4t; view-only link for peer review: https://osf.io/acb4t/overview?view_only=feb51ec019ab49769a88ba123cbb24cf).

Consent for publication

Not applicable. No identifiable individual information or images are presented.

Competing interests

The complete declaration is supplied confidentially with the covering letter.

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Authors' contributions

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Provided with the covering letter for anonymous review.

Availability of data and materials

Selected de-identified participant-level data are available from the corresponding author on reasonable request, subject to ethical and data-protection requirements. The exercise protocol is publicly deposited [16]; identifying details are withheld for anonymous review and supplied to the editors.

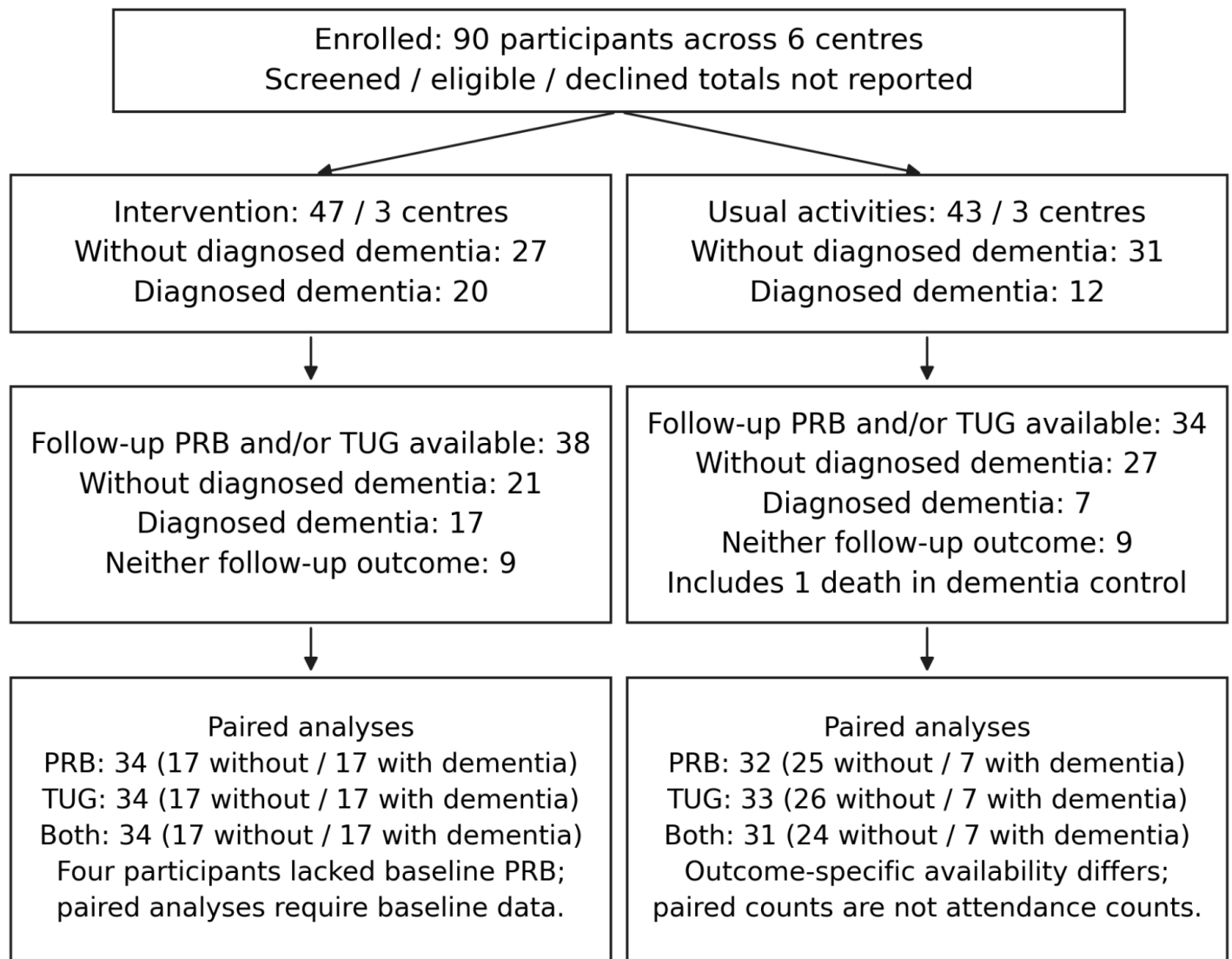
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Figures



Other nonattendance reasons: illness or inability to travel from residential care.
Counts by reason unavailable. One participant had MMSE follow-up only.

Figure 1

Participant flow and outcome-specific analysis samples

Follow-up availability refers to PRB and/or TUG, not attendance. One additional participant had only a Mini-Mental State Examination (MMSE) follow-up value. Paired samples require both time points; missing baseline data also reduce these samples. Screening and reason-specific loss counts are not reported.

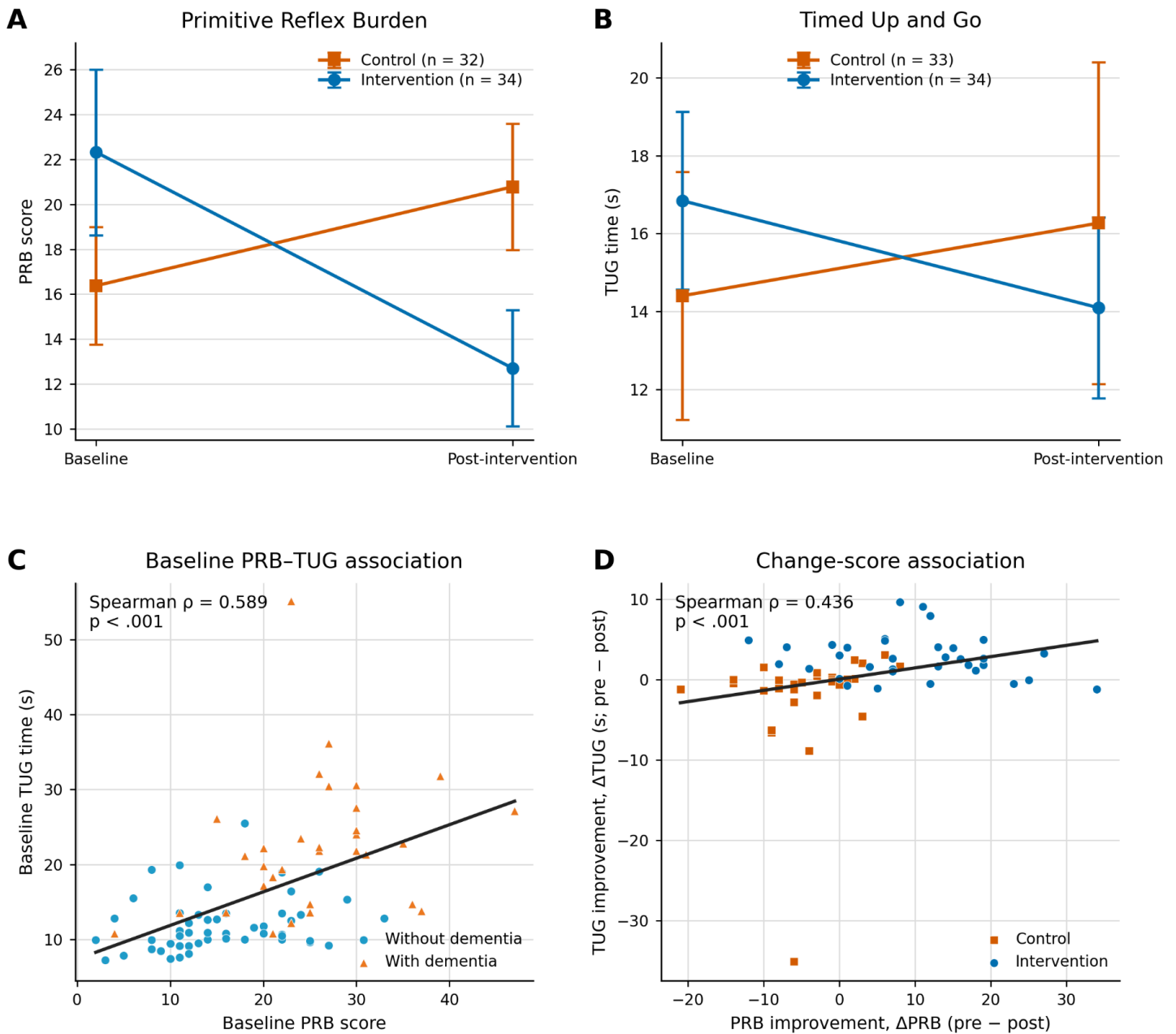


Figure 2

Reflex burden and functional mobility changes and associations

(A–B) Paired PRB and TUG means with 95% CIs: PRB control/intervention $n = 32/34$; TUG $n = 33/34$. (C) Baseline association, $n = 83$, Spearman's $\rho = 0.589$. (D) Individual improvement association, $n = 65$, $\rho = 0.436$. Both correlations $p < 0.001$. Improvement = baseline minus follow-up. The adjusted Δ PRB– Δ TUG association was not significant ($B = -0.077$; $p = 0.297$). Intervals and fits are participant-level; centre-clustered results appear in Table 3.