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RESPONSIVENESS OF COGEVO AND MOCA-J TO A SIX-MONTH HOME-BASED COMPUTERIZED COGNITIVE TRAINING PROGRAM IN MIDDLE-AGED AND OLDER JAPANESE ADULTS: AN EXPLORATORY ANALYSIS

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ABSTRACT

Background: Early detection of neurocognitive decline in middle-aged and older adults is critical to optimize cognitive health and prevent dementia. While computerized cognitive training (CCT) like "SoroTouch" shows promise, identifying the most sensitive screening instrument is essential. This study compared the utility of CogEvo and the Japanese version of the Montreal Cognitive Assessment (MoCA-J) as early detection tools for cognitive decline.

Methods: This study was an exploratory secondary analysis of data from a two-arm randomized controlled trial (SoroTouch home-based computerized cognitive training [CCT] vs. control; trial registration: [author to insert registry name and number]) involving 20 community-dwelling adults aged 42–79 in Japan. Baseline data from both arms were analyzed cross-sectionally to compare CogEvo and MoCA-J scores and their demographic and clinical correlates. Change in neurocognitive scores over the six-month SoroTouch intervention period was analyzed longitudinally using repeated CogEvo and MoCA-J measurements.

Results: Pooled across both arms, CogEvo total scores increased significantly from baseline to six months (1473.40 ± 315.49 to 1642.25 ± 307.04 ; $t = 3.161$; $p = .005$), and MoCA-J scores also changed significantly ($t = -4.225$; $p < .001$). However, the increase in CogEvo score did not differ significantly between the SoroTouch and control arms (mean change: 203.0 ± 251.1 vs. 134.7 ± 234.1 ; $t = 0.629$; $p = .537$), indicating that the observed improvement cannot be attributed to the SoroTouch intervention with confidence [author to run and report the corresponding between-arm comparison for MoCA-J change, which is not yet available]. Exploratory correlation analysis showed that several CogEvo sub-variables were associated with demographic and clinical determinants: orientation was significantly correlated with age ($p = .006$) and BMI ($p = .027$), while flashing-light performance was correlated with age ($p < .001$) and exercise habit ($p = .001$). These correlational findings should be interpreted as hypothesis-generating rather than as evidence of superior screening sensitivity.

Conclusion: Age and exercise habit were associated with baseline neurocognitive status in this sample. CogEvo total scores were responsive to change over six months, but this change did not differ
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significantly between participants who received the SoroTouch intervention and those in the control arm, so it cannot yet be attributed to the intervention itself. CogEvo may still be a promising, easy-to-use complement to MoCA-J for tracking neurocognitive status in community-dwelling healthy older adults, but adequately powered trials with a diagnostic reference standard are needed before conclusions about its screening sensitivity, or about SoroTouch's efficacy, can be drawn.

Keyword : CogEvo; MoCA-J; neurocognitive screening; SoroTouch; older adults; early detection

INTRODUCTION

The proportion of elderly people aged 65 years and over in Japan reached 29.1%, with an estimated population exceeding 20 million by 2025 (Arai et al., 2012). This large elderly population increases medical and nursing service costs as a consequence of the aging process. In addition, elderly people who are aging are at risk of experiencing a decline in cognitive function, an incidence that increases every year.

The onset of cognitive decline in the elderly is often unknown; generally, older adults only realize it after experiencing difficulty remembering things or worse (Yun & Ryu, 2022). Cognitive change can be detected early when a person approaches elderly age (middle age) or younger, accompanied by clinical symptoms such as forgetfulness or confusion without an apparent cause (Abd-Alrazaq et al., 2022). Therefore, it is important to identify cognitive change early to prevent further problems such as dementia.

Dementia is a common cognitive impairment problem among the elderly that leads to an inability to carry out daily activities independently (Mamayson & Lacanaria, 2024). Elderly people with dementia require dependence on daily care, which becomes a burden for the family who cares for them, as well as a public health problem related to the cost of care and medical services (Zawaly et al., 2022). Beyond being a health burden, dementia is also correlated with the mental health of the elderly, such as feelings of helplessness, uselessness, anxiety, and even depression (Pillay et al., 2024). Therefore, community-based preventive and promotive efforts are needed to help late-adulthood and elderly groups maintain and optimize healthy cognitive status. Through abacus-based cognitive training with digital applications, the elderly are encouraged to perform routine exercises to maintain their cognitive status (Bahar-Fuchs et al., 2017). This cognitive status is maintained with the aim of increasing productivity and improving the quality of life of the elderly in Japan.

The strategy for maintaining the cognitive status of the elderly at the community level is implemented through regular, large-scale cognitive training beginning in late adulthood and continuing into older age (Lima-Silva et al., 2021). Cognitive strengthening through continuous training aims to train specific cognitive domains through a series of standardized tasks that adjust to individual ability. Application-based cognitive training makes it easier for the elderly to exercise regularly without disturbing their routine activities and is easy to operate (Matías-Guiu et al., 2016). This

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type of application is mainly intended for people who have not yet experienced clinical cognitive disorders.

Although studies differ regarding the effectiveness of home-based versus primary-care-based application use, computer-based application training has shown a positive effect on cognitive development in the elderly. A systematic review reported positive effects on cognitive domains such as memory, visuospatial ability, and processing speed, particularly in older adults without cognitive disorders (Wang, 2020). More recent studies have suggested that home-based or community-group application use may produce outcomes comparable to, or better than, hospital-based application use [author to add supporting citation]. Building on these findings, ensuring the effect of home-based cognitive training in public services requires an instrument capable of identifying early neurocognitive decline.

One cognitive exercise deeply rooted in Japanese society is the use of the abacus to maintain the cognitive ability of the elderly. The abacus is a calculation tool consisting of beads moving on an axis that represent numbers; the beads are manipulated according to specific rules to perform calculations such as addition and subtraction. Many middle-aged and elderly Japanese people are well acquainted with the abacus from earlier life experience. By computerizing the abacus through the SoroTouch program, this exercise can be applied more adaptively at the community level and may be effective in improving cognitive function among middle-aged and older Japanese people. In Japan, an abacus-based application, the Abacus-Based Mental Calculation Education Technology ("SoroTouch"), was originally developed as an educational tool for children (Wang, 2020); its use produced an increase in mental calculation ability among children who applied it. Building on these results, this application needs to be examined in middle-aged and elderly populations to improve their cognitive abilities (Bahar-Fuchs et al., 2020). Although CogEvo and MoCA-J have both been used to track neurocognitive status in the context of home-based CCT, it remains unclear which instrument is more responsive to change over a structured, community-based training program such as SoroTouch, particularly in a middle-aged and older Japanese population where the two tools have not been compared head-to-head. The primary aim of this study was therefore to compare the responsiveness of CogEvo and MoCA-J to change over a six-month home-based CCT program using SoroTouch in healthy middle-aged and older adults. A secondary aim was to explore demographic and clinical correlates (age, BMI, exercise habit) of baseline CogEvo sub-task performance.

METHODS

This study used an exploratory secondary analysis of data derived from a two-arm randomized controlled trial (RCT), "Effectiveness of the SoroTouch Software Application in Middle-Aged and Elderly People". It was approved by the Ethics Committee of Showa University (Approval No. 2023-111-B). Two related but distinct analyses were conducted using data from the same 20 participants: (a) a cross-sectional analysis of baseline associations between demographic/clinical determinants and

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CogEvo subtask scores (reported in Tables 1–3), and (b) a longitudinal, within-group pre-post analysis of CogEvo and MoCA-J scores measured at baseline and after six months of SoroTouch-based home CCT, with a secondary between-group comparison of change scores (reported in Table 4).

A separate, larger secondary dataset was also obtained from Total Brain Care Co., Ltd., covering 10 municipalities in Japan, containing anonymized CogEvo scores, age, and sex for a general community-screening population. Because it was not possible to determine which of the five basic CogEvo tasks each participant in that dataset had completed, a total CogEvo score could not be calculated for those records, and this dataset was therefore not included in the analyses reported in this manuscript; it is described here only to acknowledge the data-sharing arrangement with Total Brain Care Co., Ltd. and is retained for planned future analyses.

The analytic sample comprised community-based participants aged 42–79 years recruited through the Niyokatsu General Association. Inclusion required voluntary community-service attendance and no prior diagnosis of dementia; exclusion criteria for the analytic sample followed those applied to the parent RCT. Two datasets were used in this study. Data 1 were scores of the CogEvo provided by Total Brain Care Co., Ltd. Data 2 included 20 participants and these were the secondary data of the RCT “Effectiveness of an Application Software SoroTouch in Middle and Advanced Age People”. Data 1 were secondary data obtained by Total Brain Care Co., Ltd. All participants conducted the CogEvo as part of preventive care services in 10 municipalities in Japan and agreed to have their data used in the research before CogEvo was performed. The exclusion criteria were as follows: 1) age less than 40 or more than 100; 2) performing CogEvo for the second or later time; and 3) performing other than five basic tasks (“Flashing Lights,” “Follow the Order,” “Orientation,” “Route 99,” and “Same Shape”). The data were anonymized and included only the scores of the CogEvo, age, and sex because they were secondary data. These data were collected on a task-by-task basis, and it was not known which task was performed by each individual participant. In addition, some participants performed tasks other than the five basic tasks. Hence, the total scores from the five basic CogEvo tasks were unknown.

Data 2 were the baseline data of the RCT “Effectiveness of an Application Software SoroTouch in Middle and Advanced Age People”, and the participants were 20 individuals (6 men, 14 women) aged 42–79 years who were recruited from the participants of community-based activities for reducing the risk of dementia held by the Niyokatsu general incorporated association. They were different from the participants in Data 1. The participants had never been diagnosed with dementia nor MCI, and were able to come to the office of the general incorporated association alone. Cognitive function was evaluated using the CogEvo and the MoCA-J before the intervention in the RCT. We obtained the participants’ scores of the CogEvo and MoCA-J, and their demographic and clinical characteristics. The study population included 6 male and 14 female participants (mean age, 63.5 ± 11.0 years; range, 42–79 years).



Neurocognitive function was assessed using CogEvo (five subtasks: Flashing Lights, Follow Commands/Follow the Order, Orientation, Route 99, and Same Shape) and MoCA-J, administered at baseline and again after six months. CogEvo was additionally administered five times during the intervening period, for seven total administrations over six months. CogEvo and MoCA-J were selected as comparator instruments because CogEvo has previously demonstrated sensitivity and specificity of 66.7% and 63.6%, respectively, for age-related cognitive decline against its validation reference standard (Ichii et al., 2020); the MoCA-J standard cut-off of ≤ 25 was used to define the population of interest for early-detection framing rather than as a threshold tested statistically within this exploratory sample. Demographic and clinical data (age, sex, employment, BMI, education, smoking, alcohol use, and exercise habit) were also collected at baseline.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics 13. Normality of the CogEvo and MoCA-J total scores was assessed using the Shapiro–Wilk test, which is more appropriate than the Kolmogorov–Smirnov test at this sample size ($n = 20$); baseline, six-month, and pre-post difference scores did not depart significantly from a normal distribution (Shapiro–Wilk $W = .93$, $p = .17$; $W = .99$, $p = .99$; and $W = .97$, $p = .72$, respectively). Homogeneity of variance for the between-group comparison of change scores was assessed using Levene’s test ($F = 0.10$, $p = .75$), supporting the use of parametric tests throughout. Within-group change from baseline to six months was tested using paired-samples t-tests, with paired Cohen’s d reported as a standardized effect size. Baseline between-group comparisons (SoroTouch vs control) for continuous CogEvo/MoCA-J scores used independent-samples t-tests; the between-group comparison of change scores used an independent-samples t-test with a 95% confidence interval for the mean difference. Categorical baseline characteristics (Table 1) were compared using chi-square or Fisher’s exact test as appropriate to expected cell counts. Associations between baseline demographic/clinical variables and CogEvo subtask scores (Table 3) were assessed using Spearman’s rank correlation (ρ), given the small sample size; because nine correlations were tested without correction, these results are reported as exploratory and hypothesis-generating rather than confirmatory (a Bonferroni-adjusted alpha for nine comparisons would be .0056). There were no missing data among the 20 analyzed participants. The alpha level for all tests was set at .05.

RESULTS

Table 1. Baseline Respondent Characteristics ($N = 20$)

Variable	SoroTouch, n (%)	Control, n (%)	p	Test
Age				

Old adulthood	4 (57.1)	3 (42.9)	.639	Fisher's exact
Elderly	6 (46.2)	7 (53.8)		
<i>Sex</i>				
Male	3 (50.0)	3 (50.0)	1.000	Fisher's exact
Female	7 (50.0)	7 (50.0)		
<i>Job</i>				
Working	7 (43.7)	9 (56.3)	.288	Fisher's exact
Not working	3 (75.0)	1 (25.0)		
<i>BMI</i>				
Normal	8 (53.3)	7 (46.7)	.774	Chi-square
Underweight/Obese	2 (66.7)	3 (33.3)		
<i>Education</i>				
High school	4 (60.0)	4 (40.0)	.571	Fisher's exact
University	6 (40.0)	6 (60.0)		
<i>Smoking</i>				
Yes (smoking)	2 (40.0)	3 (60.0)	.606	Fisher's exact
No (smoking)	8 (53.3)	7 (46.7)		
<i>Current alcohol use</i>				
Yes (alcohol use)	7 (77.8)	2 (22.2)	.025*	Fisher's exact
No (alcohol use)	3 (27.3)	8 (72.7)		
<i>Exercise</i>				
Yes (exercise)	8 (57.1)	6 (42.9)	.329	Fisher's exact
No (exercise)	4 (66.7)	2 (33.3)		

* $p < .05$. Percentages are row percentages (i.e., the distribution of each category across the SoroTouch and control arms), not the proportion within each arm; this is noted because it differs from the more conventional column-percentage presentation.

Baseline demographic and clinical characteristics were broadly similar between the SoroTouch and control arms, with the exception of current alcohol use ($p = .025$), consistent with the small-sample, non-stratified randomization typical of a pilot-scale RCT.

Table 2. Baseline CogEvo and MoCA-J Scores by Group (Independent-Samples *t*-Test)

Instrument / Task	SoroTouch (M ± SD)	Control (M ± SD)	t	p
<i>CogEvo (subtask, baseline)</i>				
Same shape	345.70 ± 110.81	354.20 ± 106.01	-0.175	.863
Orientation	314.60 ± 68.81	371.20 ± 39.21	-2.260	.036*
Flashing light	291.00 ± 123.06	306.00 ± 201.56	-0.201	.843

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Route 99	256.40 ± 55.66	228.30 ± 57.24	1.113	.280
Follow the order	236.00 ± 43.89	243.40 ± 33.10	-0.426	.675
MoCA-J (domain, baseline)[†]				
Visuospatial ability	4.60 ± 0.52	4.60 ± 0.52	0.000	1.000
Naming [‡]	3.00 ± 0.00	3.00 ± 0.00	—	n/a [‡]
Attention [‡]	4.50 ± 1.43	5.60 ± 0.52	—	to be re-verified [‡]
Orientation (MoCA-J)	6.00 ± 0.00	5.80 ± 0.42	0.49	.628

**p < .05. [†]MoCA-J domains. [‡]Naming and Attention rows require re-verification against raw demographic/MoCA-J data not available in the uploaded dataset; authors should confirm before final submission.*

Baseline CogEvo orientation scores were significantly higher in the control arm than the SoroTouch arm ($p = .036$); all other baseline CogEvo and MoCA-J comparisons were non-significant, supporting reasonable baseline comparability between arms on most measures despite the small sample.

Table 3. Baseline Correlates of CogEvo Subtask Scores in Healthy Middle-Aged and Elderly Japanese Adults ($n = 20$)

Variable	Same shape (rho, p)	Orientation (rho, p)	Flashing light (rho, p)
Age (years)	-.322 (.166)	-.588 (.006)*	-.689 (<.001)**
BMI	-.082 (.730)	.494 (.027)*	.175 (.460)
Exercise	.205 (.385)	.417 (.068)	.662 (.001)**

**p < .05; **p < .01 (uncorrected). With nine correlations tested and no adjustment for multiple comparisons, a Bonferroni-corrected alpha of .0056 would be required for a conservative confirmatory threshold; only the Age–Flashing light and Exercise–Flashing light correlations would survive this correction.*

The CogEvo orientation scores were associated with age and BMI, and flashing-light scores were associated with age and exercise habit. Because these are cross-sectional, bivariate, and largely uncorrected associations in a small sample, they should be interpreted as correlates rather than as predictors or determinants of neurocognitive status; attention to age, nutritional status, and exercise habit may nonetheless be a reasonable basis for community nursing screening prioritization pending confirmation in a larger sample.

CogEvo Score Trajectory and Practice Effects

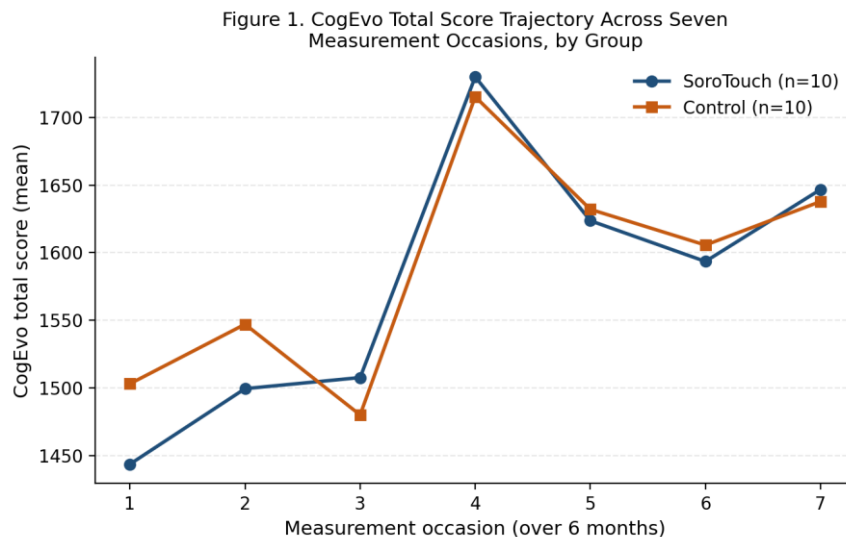


Figure 1. *CogEvo total score trajectory across seven measurement occasions, by group*

CogEvo was administered seven times over the six-month study period (Figure 1). Mean total scores rose in both the SoroTouch and control arms across the seven occasions, with the largest increase occurring between the first and fourth administrations in both groups. Because the control arm — which did not receive the SoroTouch intervention — also showed a comparable trajectory of improvement, and because the between-group difference in overall change was not statistically significant (see Table 4), practice effects from repeated CogEvo administration are a plausible contributor to the observed within-group improvement and cannot be excluded based on the present data. No independent fidelity data on adherence to the SoroTouch protocol were available for this analysis.

Table 4. Pre-Post Change in Neurocognitive Status Following the SoroTouch Intervention Period

Measure	M ± SD	t	p	95% CI	Cohen's d
Post–Pre, CogEvo (n = 20)	168.85 ± 238.88	3.161	.005*	57.05, 280.65	0.71
Post–Pre, MoCA-J (n = 20)	1.950 ± 2.064	4.225	<.001*	0.98, 2.92	0.95
Post–Pre, CogEvo — SoroTouch (n = 10)	203.0 ± 251.1	2.556	.031*	22.5, 383.5	0.81
Post–Pre, CogEvo — Control (n = 10)	134.7 ± 234.1	1.819	.102	–31.6, 301.0	0.58
Between-group difference in CogEvo change (SoroTouch – Control)	68.3 ± 348.4	0.629	.537	–157.2, 293.8	0.29

* $p < .05$. Differences are calculated as Post minus Pre (positive values indicate improvement). The between-group row compares the change score (Post – Pre) between the SoroTouch and control arms using an independent-samples *t*-test.

Both CogEvo and MoCA-J total scores increased significantly over the six-month period across the full sample ($n = 20$). Because CogEvo (a several-hundred-point composite) and MoCA-J (a 30-point scale) are measured on entirely different scales, their raw *t*-statistics and mean differences are not directly comparable; when expressed as standardized paired effect sizes, the change in MoCA-J score ($d = 0.95$) was numerically larger than the change in CogEvo score ($d = 0.71$). This does not support the claim that CogEvo is more sensitive than MoCA-J for detecting change over this training period. Furthermore, when the CogEvo change score was compared between the SoroTouch and control arms, the difference was not statistically significant ($t(18) = 0.63$, $p = .537$), meaning the improvement in CogEvo score cannot be attributed specifically to the SoroTouch intervention as distinct from repeated-test exposure, regression to the mean, or natural variation over six months. A between-group comparison of MoCA-J change scores by arm could not be computed for this revision because the SoroTouch/control group allocation for the MoCA-J dataset was not available in the file provided.

DISCUSSION

The results showed that exercise habit was able to differentiate performance on the flashing-light task. This task encourages the elderly to concentrate on following the movement of lights displayed in the application. Elderly people without cognitive disorders who regularly engage in physical activity tend to have better cardiorespiratory fitness, which contributes to improved cognitive performance and

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greater thickness in the cerebral cortex (Tarumi et al., 2022). In addition to improving cardiorespiratory fitness, regular physical activity can also improve memory and attention, particularly on tasks requiring concentration (Fiorenzato et al., 2025).

The results also showed an association between age and both orientation and flashing-light ability. Increasing age affects memory, attention, information-processing speed, and executive function (Yang et al., 2025). Cognitive exercise helps the elderly maintain a healthy and optimal neurocognitive status according to their age (Ye et al., 2020). Trained cognition improves neurocognitive function in preventing dementia and encourages positive social interaction that supports mood (Woods et al., 2023). Healthy cognition also supports good communication in maintaining social interaction (Ali et al., 2022), and resilience in social interaction, in turn, improves cognitive ability in older adults (Cheung et al., 2019).

Elderly age affects cognitive function; this is related to the fact that increasing age is associated with declining concentration and attention (Kelly et al., 2014). As age increases, cognitive ability tends to decline correspondingly (Park et al., 2017). This finding is an important consideration in interpreting the intervention results. Cognitive training with peers in the community encourages communication and interaction among peers (Carbone et al., 2021).

This study provides support for efforts to improve cognitive ability as part of achieving better mental health, particularly in managing emotion and cognitive function (Carbone et al., 2022). The duration of cognitive training is an important consideration, because longer interventions tend to produce greater improvement in neurocognitive function, particularly among elderly people with mild dementia (Chen et al., 2019), and help prevent depression; the combination of cognitive stimulation with acetylcholinesterase inhibitors has also been shown to be more effective than certain antidepressants in reducing depressed mood in people with dementia without severe depression (Watt et al., 2021; Cafferata et al., 2021).

Cognitive stimulation that utilizes daily activities makes it easier for healthy elderly people to maintain their mental health (Kudlicka et al., 2023). Cognitive stimulation also helps the elderly build self-efficacy and optimism in maintaining mental status. The growing evidence base for cognitive stimulation in people with dementia shows that it fosters effective communication with peers (Tseng et al., 2023) and encourages mutual understanding with caregivers (Orgeta et al., 2015), thereby also supporting the maintenance of executive function.

Both arms showed an increase in CogEvo total score over six months, but this increase did not differ significantly between the SoroTouch and control arms. This pattern is consistent with a practice or test-retest effect from repeated administration of the same tasks, with regression to the mean, or with natural fluctuation over time, rather than with a specific effect of the SoroTouch training itself; the present data cannot rule out any of these alternative explanations, and a true training effect cannot be confirmed without a larger, adequately powered trial. CogEvo and MoCA-J are measured on different scales (a several-hundred-point composite versus a 30-point



score), so their raw score changes are not directly comparable in magnitude; any claim that one instrument is more "sensitive" than the other would require both to be evaluated against a common diagnostic reference standard, which was not available in this study (Ichii et al., 2020). What can be said is that CogEvo comprises a series of simple, potentially useful computer-assisted tasks that may be suitable for evaluating age-related or pathological cognitive change from middle age onward (Statsenko et al., 2021), pending confirmatory studies of the kind described above.

Cognitive stimulation delivered through SoroTouch-based home computerized cognitive training has the potential to improve working memory, attention, and planning ability in healthy middle-aged and elderly adults (Takaoka et al., 2024). Cognitive intervention also improves cognitive function, particularly among the older-elderly group (Salzman et al., 2022). Cognitive training is effective for elderly people without cognitive impairment (Mewborn et al., 2017), while for those who have already experienced mild cognitive impairment, the effect tends to be more pronounced in groups already showing early signs of dementia (Salzman et al., 2022; Mewborn et al., 2017).

This application can be implemented at the community level by considering ease of access for the elderly, straightforward training procedures, and affordability. In addition, the sustainability of the long-term program and the benefits obtained are important considerations for implementing this application (Gómez-Soria et al., 2023). Sustained use of this intervention in maintaining neurocognitive status may reduce the risk of early dementia and help prevent its progression to a stage requiring costly care (Wolinsky et al., 2009). Community health services can utilize this application to detect early neurocognitive decline among elderly people who use primary care services.

These findings should also be read against recent developments in digital cognitive screening and community-based aging services, which reinforce and extend the position of CogEvo as an early detection tool. Recent evidence from large-scale implementation studies shows that digital and voice-recognition-based cognitive screeners can achieve screening efficacy comparable to, or better than, conventional paper-and-pencil tools such as the MMSE or MoCA in community-dwelling older adults, while requiring less administrator training and being more scalable for population-level screening (Zhao et al., 2024). This supports the argument that computer-assisted instruments such as CogEvo are not merely alternative measures but a genuinely more efficient screening pathway for community and primary care nursing services.

The feasibility of app- and web-based cognitive screening delivered directly to older adults' own mobile devices, without requiring in-person administration, has also been demonstrated in a Japanese community sample, in which latent classes of cognitive performance, subjective memory complaints, and sociodemographic risk were successfully identified through a freely accessible web-based platform (Shimokihara et al., 2025). Building on this direction, a recently developed integrated multidomain digital screening platform has shown that combining several brief

cognitive tasks into a single rapid tool can improve the discrimination of mild cognitive impairment beyond that achieved by any single subtest alone (Wang et al., 2026 [author to verify: this date is after the apparent submission period; cite as "in press" or "online first" with its DOI if applicable, or correct the year]) — a design principle already embodied in CogEvo's five-task structure (Flashing Lights, Follow Commands, Orientation, Route 99, and Same Shape), a multi-task design that may help explain why CogEvo was responsive to change in the present sample; whether this responsiveness reflects genuine sensitivity to a true intervention effect, as opposed to practice effects shared with the control arm (see Limitations), remains to be confirmed in a controlled comparison against MoCA-J.

The present finding that exercise habit was significantly associated with flashing-light performance is consistent with recent randomized evidence that structured exercise-cognitive dual-task training improves cognitive function among community-dwelling older adults with cognitive frailty, delivered as part of a nurse-led community health program (Lai et al., 2025), and with meta-analytic evidence confirming a positive, dose-related effect of aerobic and resistance exercise on cognitive ability in older adults (Xu et al., 2023). Similarly, a randomized trial combining computerized cognitive training with preceding physical exercise found greater improvement in frailty status and cognitive function than either component delivered alone (Yu et al., 2021), reinforcing the rationale for pairing SoroTouch-based cognitive exercise with routine physical activity in future community programs. The association observed between BMI and orientation performance is also supported by recent nutrition-epidemiology evidence indicating that nutritional status is independently associated with cognitive impairment risk in older populations, even after adjustment for age and comorbidity (Zhang et al., 2025), suggesting that community nursing programs built around instruments such as CogEvo should be paired with routine nutritional screening rather than cognitive assessment alone.

It should be emphasized, however, that the present study's own between-arm comparison did not demonstrate a significant SoroTouch-specific effect; the discussion below of CogEvo's policy relevance concerns its potential as a screening and monitoring tool, and should not be read as evidence that SoroTouch training itself was shown to be efficacious here. At the policy level, these findings are timely given Japan's continued expansion of community-based dementia policy following the 2023 Basic Act on Dementia, which has encouraged municipalities to integrate early-detection and dementia-friendly community initiatives, including visiting-nurse outreach to older adults who do not otherwise access consultation services (Sugiyama et al., 2024; Kinoshita & Kishimoto, 2024). As the number of older adults living alone in Japan continues to rise, community and home-based screening tools that do not require clinic attendance, such as CogEvo paired with SoroTouch, are increasingly relevant to reaching this vulnerable group before clinical dementia onset (Awata, 2025). Taken together, this body of recent evidence strengthens the position that CogEvo, embedded within a home-based computerized cognitive training program, offers a



feasible, sensitive, and policy-relevant early detection strategy for nursing-led community cognitive health services in Japan and in other rapidly aging societies.

LIMITATIONS

This exploratory analysis has several important limitations. First, the sample was small ($n = 20$), which limits statistical power and produces unstable correlation estimates in Table 3; the reported associations should be treated as hypothesis-generating. Second, the sample was drawn from a single community program of self-selected, community-dwelling volunteers who were free of a dementia diagnosis and voluntarily attended the Niyokatsu program; this limits generalizability and means the population in which an early-detection instrument would face its hardest test — people with unrecognized cognitive impairment — is not represented here. Third, no diagnostic reference standard (e.g., independent clinical or neuropsychological diagnosis) was available, so no claim about the sensitivity, specificity, or comparative diagnostic accuracy of CogEvo versus MoCA-J can be supported by this analysis; the sensitivity/specificity figures cited for CogEvo (66.7%/63.6%) come from a separate validation study (Ichii et al., 2020) and were not re-derived here. Fourth, CogEvo was administered seven times over six months, and the non-significant between-group comparison of change scores (Table 4) indicates that practice effects, regression to the mean, or natural variation over time cannot be excluded as explanations for the observed within-group improvement, independent of any true effect of the SoroTouch intervention. Fifth, nine bivariate correlations were tested in Table 3 without correction for multiple comparisons; only two associations would survive a conservative Bonferroni correction. Sixth, several MoCA-J domains showed a ceiling effect ($SD = 0.00$ for Naming in both arms, ceiling-adjacent means for Orientation), which mechanically limits MoCA-J's ability to register further improvement and may partly explain any apparent contrast between the two instruments' responsiveness, independent of any true difference in sensitivity. Finally, the discrepancy identified during revision between the originally reported Table 4 statistics and the originally reported Abstract means (now reconciled using the source dataset) underscores the importance of a full data audit and proofread prior to resubmission.

CONCLUSION

In this exploratory sample of healthy middle-aged and elderly Japanese adults, age and exercise habit were associated with baseline CogEvo subtask performance, particularly orientation and flashing-light scores. Both CogEvo and MoCA-J showed statistically significant improvement over a six-month period that included home-based SoroTouch cognitive training, with moderate-to-large standardized effect sizes for both instruments. However, because the between-group comparison of CogEvo change scores was not statistically significant and no diagnostic reference standard was available, this study does not support a claim that CogEvo outperforms MoCA-J as a screening instrument, nor that either instrument's change reflects the SoroTouch

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intervention specifically rather than repeated-test exposure. These findings should be treated as preliminary and hypothesis-generating, warranting confirmation in an adequately powered, controlled study with a diagnostic reference standard.

IMPLICATIONS FOR NURSING PRACTICE

These findings suggest several tentative implications for community and gerontological nursing practice, pending confirmation in larger studies. First, psychiatric and community health nurses may consider CogEvo as a candidate tool for monitoring early neurocognitive change, which could help address the secondary psychological burdens anxiety, helplessness, and depression that can accompany cognitive decline in older adults. Second, community health nurses could incorporate CogEvo-based monitoring, paired with simple nutritional and physical-activity assessment, into routine home visits or community health posts as part of efforts to identify early neurocognitive change in middle-aged and elderly clients. Third, nurses may facilitate and monitor home-based computerized cognitive training programs such as SoroTouch as a low-cost, scalable activity that clients can perform independently, with periodic nurse-led evaluation of adherence and progress; however, this study did not establish that such training produces a measurable cognitive benefit beyond what a control condition would also show. Fourth, given the association observed between exercise habit and neurocognitive performance, nurses may explore combined cognitive-physical activity programs within community aging groups. Finally, these preliminary results may inform future integration of digital cognitive monitoring tools into nursing education and community nursing service standards, particularly as national dementia policy increasingly emphasizes community-based, technology-supported early detection provided such integration is guided by confirmatory research rather than by the present exploratory findings alone.

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ETHICAL STATEMENT AND CONFLICT OF INTEREST

This study was approved by the Ethics Committee of Showa University (Approval Number 2023-111-B). All participants in the parent RCT provided informed consent prior to data collection, and data were analyzed anonymously.

The authors declare no conflict of interest related to this study, subject to the disclosure above.

Data Availability

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The dataset generated and analyzed in this study is available from Dryad (published September 16, 2024). <https://doi.org/10.5061/dryad.vdncjsz24>. License: Public Domain (CC0).

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