

Prompting dementia screening without labelling:
a 2×2 factorial RCT disentangling nudge and social-comparison effects via passive smartphone sensing(Seoul)

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No cut-off. No label.
Just how you compare.

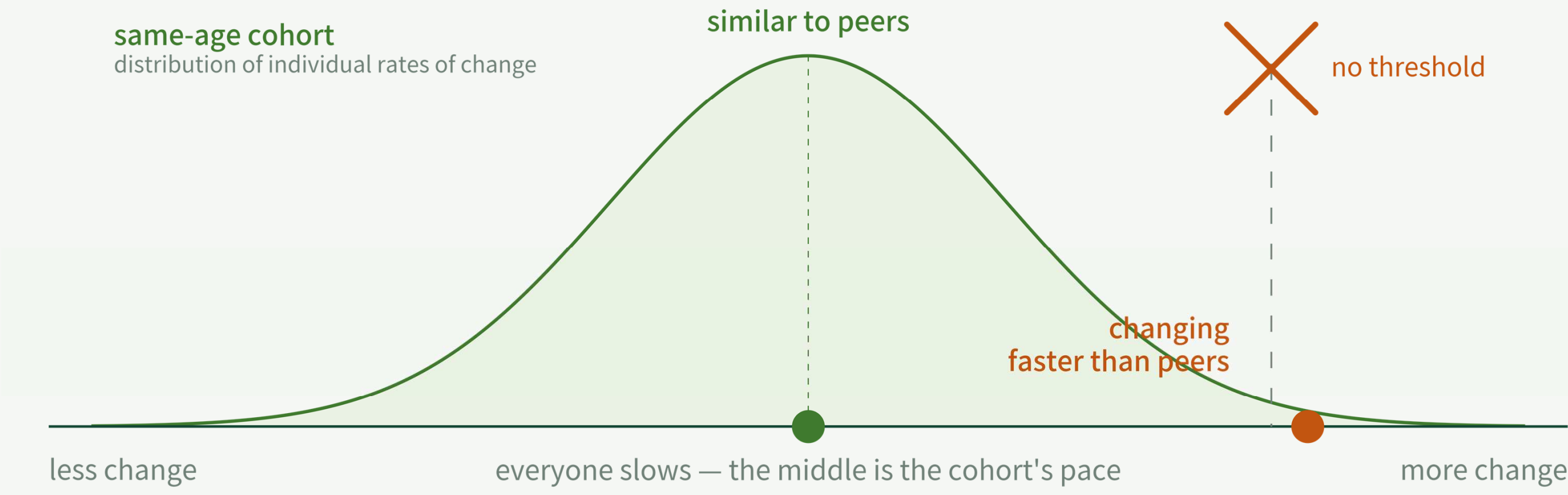
A wellness keyboard reads typing rhythm alone — hold time and flight time, nothing else. Being slow is fine. What comes back is your pace against your own age peers — a message, never a diagnosis.

BACKGROUND THE GAP IS UPSTREAM	SENSING STOPS AT DETECTION	NUDGES WORK, ONCE YOU HAVE FOUND PEOPLE
In 2023, an estimated 2,786,628 Koreans aged 60+ had MCI. That year 255,205 (9.2%) received a diagnosis and treatment. ^[1] District dementia-safety centres already offer free CIST screening, yet only 36.5% of Koreans aged 65–74 report screening in the past two years. ^[2] The constraint is not access or cost — nothing prompts anyone to go.	Passive keystroke sensing tracks cognitive change unobtrusively in older adults. ^[3] But it is built to classify on a cutoff ^[4] — to say who is impaired, and classification is exactly what carries the labelling risk that deters help-seeking. ^[5]	CULTIVAMENTE improved behaviours, cognition and provider practice across seven senior centres. ^[6] Prompting works. But its participants were already found — diagnosed and attending a centre. Targeting came from clinical selection, not a signal, and outcomes were self-reported, not attendance.

Intuition · Biogen + Apple, 2021–23 ^[3] 23,004 US adults, 24 months — one of the largest passive brain-health cohorts to date. Its stated objective is to classify MCI.	Descriptive norms & the boomerang^[7] Peer-average feedback reversed behaviour in households already doing well; an injunctive clause removed the reversal. This governs Arm 2’s wording.	Norms for voluntary risk detection^[8] A trending-norm message raised intention to test for an unseen hazard — the closest published analogue to screening uptake.
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The field is active at both ends — sensing that classifies, nudging that reaches people already in the system. We work the join: routing someone nobody has identified toward screening that already exists.

THE MOVE
Relative change, not absolute value



Baseline weeks 1–8, slope weeks 9–11, messaging from week 12. Slope is proportional change from each participant’s own baseline, so keyboard layout cancels by construction. Korean letter keys only; flight times across a language switch are discarded. Percentiles are computed within the cohort — no external norms. A message is sent only if both two-week windows — weeks 9–10 and 10–11 — depart from the participant’s own baseline and from the cohort distribution; one deviating window sends nothing.

THE DESIGN Two factors, crossed — so each one can be read on its own	SOCIAL COMPARISON — OFF	SOCIAL COMPARISON — ON
NUDGE — OFF	ARM 1 · CONTROL <i>No messages. Passive sensing only — the background uptake rate in a cohort measured but never told anything.</i>	ARM 2 · COMPARISON ONLY 최근 타이핑 패턴이 또래 연령대와 비슷한 흐름입니다. “Your recent typing pattern is moving similarly to others your age.” 최근 타이핑 패턴이 또래 연령대보다 빠르게 변화하고 있습니다. “Your recent typing pattern is changing faster than others your age.” content varies by relative slope · no call to action
NUDGE — ON	ARM 3 · NUDGE ONLY 주기적인 인지 확인은 건강에 도움이 됩니다. 치매안심센터에서 무료로 받으실 수 있습니다. “Checking your cognition regularly is good for your health. It is available free of charge at your district dementia-safety centre.” <i>Benefit plus cost cue, at a centre that already exists. Identical for everyone in the arm.</i>	ARM 4 · BOTH <i>Comparison then nudge, in one notification. Hypothesised highest uptake; the factorial isolates each component and their interaction, not the bundle.</i>

METHODS PARTICIPANT FLOW	ELIGIBILITY	OUTCOMES & ASCERTAINMENT
	Age 67–72 at consent, resident in Seoul Sole user of an Android smartphone Types Korean with the study keyboard (Chunjiin or QWERTY); analysis is restricted to Korean letter keys Uses the phone keyboard daily Able to consent independently Existing dementia or MCI diagnosis CIST within the preceding 12 months Condition affecting fine motor control As approved · SKKU IRB 2026-04-078	Primary CIST completed at a district centre within 8 weeks of first message. Binary; verified against centre records by consented linkage, not self-report. Secondary Time to attendance; notification open rate; keyboard retention to week 20. Exploratory MoCA-K at both extremes of the pre-intervention slope — an extreme-group check that the index relates to cognition, not an estimate of effect size.
	ALLOCATION & BLINDING Randomised at week 8 among participants averaging at least one valid session per day. Block randomisation, 1:1:1:1 to the four cells, stratified by caregiver-alert consent; sequence held server-side, concealed until enrolment closes. Outcomes extracted from centre records by staff blind to allocation; analysts blinded until the primary model is locked.	SAMPLE SIZE & ANALYSIS Each main effect is read across the full sample — every marginal comparison is 250 vs 250. 250/group · α=0.05 two-sided · 80% power detects 15% → 25% uptake (10 pp absolute). Baseline is an 8-week post-message rate, not the 2-year self-reported figure in [2]. Interactions detect only large departures from additivity — a limitation, not a hypothesis. Log-binomial regression on the ITT set, both factors plus interaction, unadjusted. Missing outcomes counted as non-attendance. Below the minimum keystroke volume no comparison message is sent — missing exposure, not outcome; these participants stay in the ITT set. A session enters analysis only at ≥ 40 keystrokes after outlier removal.

PARTICIPANTS 500 adults aged 67–72, Seoul	ALLOCATION Block-randomised 2×2 factorial, 1:1:1:1. 125 per cell.	PRIMARY OUTCOME CIST uptake at district centres within 8 weeks. Record-verified. ITT.	TIMELINE Recruitment opens 2026 · last outcome 2027 · reporting 2027	SIGNALS CAPTURED Hold time Flight time nothing else
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WHY IT IS BUILT THIS WAY Nudging moves prevention behaviour once people are identified. ^[6] Passive sensing supplies the identification — no clinic visit, no diagnosis, no self-testing. A threshold labels people. Within-cohort relative slope needs no cut-off, so habitually slow users are never flagged. The output is a message, not a classification — a wellness function, not a medical device. Recruitment runs through community senior digital-education programmes; referrals go to existing centres. No new facilities, no new staff.	COME AND ARGUE WITH US Recruitment opens 2026. We would rather find the weak points here than in peer review: Should the “similar to peers” message carry a normative clause, or does reassurance risk a boomerang effect? The nudge bundles a request with a cost cue. One factor or two? Would this transfer to a city without a centre network already in place? The presenting author is at this board all session. If you run screening programmes in another ageing city, come and talk.
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KNOWN LIMITS	Android only; slope precision depends on typing volume — sparse typists yield noisier estimates.	“Peers” means this single-city cohort, not a national norm.	The 15% baseline is an assumption; the observed Arm 1 rate may differ and will be reported as such.	Eight weeks captures prompted attendance, not sustained screening behaviour.
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