

The Impact of Intervention Order on Physical and Daily Functions A Crossover Study of ICT and Exercise Programs in Older Adults

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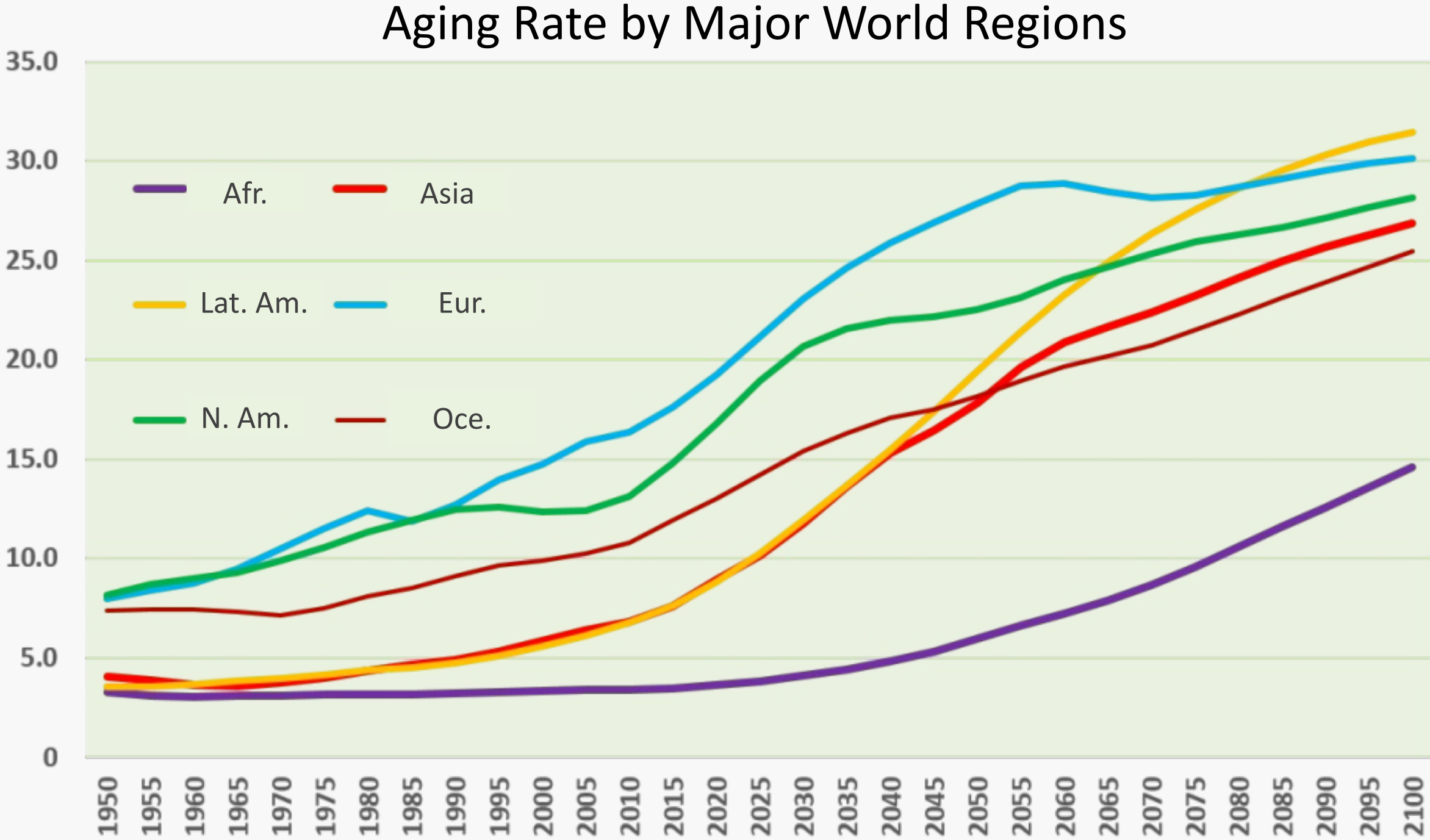
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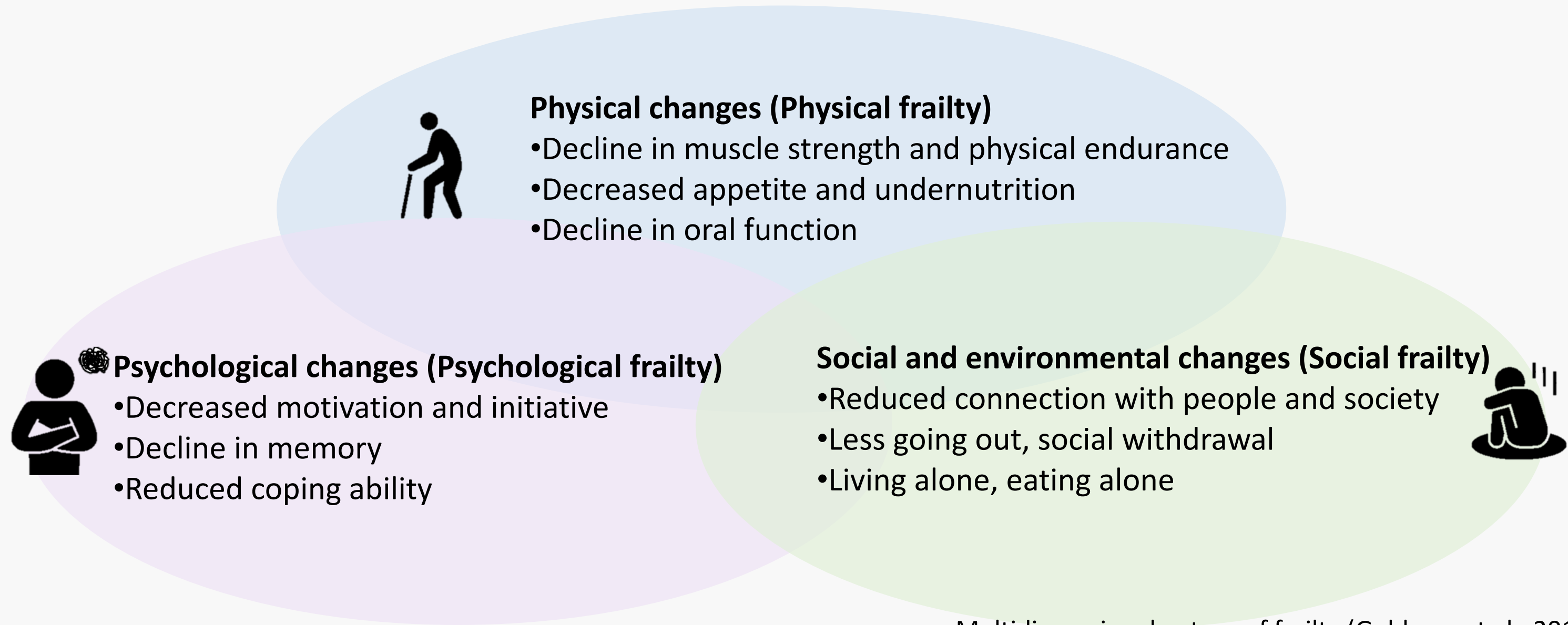
4)Tokyo University of Technology

Global Population Aging and Emerging Support Needs



Population aging is expected to increase frailty and care needs.

Why combine Exercise and ICT?



Multidimensional nature of frailty (Gobbens et al., 2010)

Exercise programs improve physical function and can also influence QOL and social participation, although effects vary across studies

(Netz et al., 2005; Windle et al., 2010)

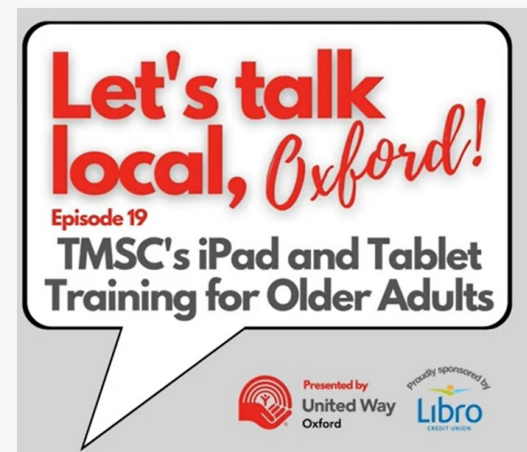
Why combine Exercise and ICT?



Technology and Aging Project

Training for adults aged 60 years and older

→ Increased frequency of ICT use and improved self-efficacy (Woodward, 2011)



AGE-ON Tablet Training Program

Evaluated the effects of tablet training classes on social isolation, loneliness, and quality of life

→ Some participants showed improvements in social connectedness and self-efficacy (Neil-Sztramko et al., 2020)

ICT use has been associated with improved QOL, autonomy, and social connectedness in older adults (Czaja et al., 2015; Chen & Schulz, 2016)

**ICT and exercise are often studied *separately*,
and how to integrate them in practice remains unclear.**

Research Gap & Question

Parallel-group RCT

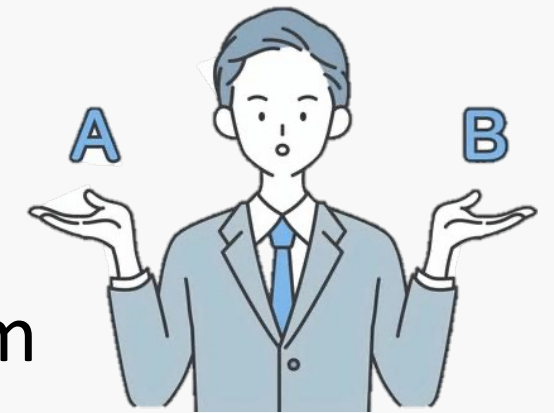
→ Focuses on superiority (ICT vs. exercise)

However, the research question of this study is not superiority, but **interaction effects**

Community-based setting

Difficult to recruit large sample sizes

Ethical concerns arise when participants cannot receive their preferred program



Crossover design

Each participant experiences **both ICT and exercise interventions**

→ Enables within-person comparison of sequence effects

Advantages of crossover trials

Enables **within-participant comparisons**, reducing confounding

Minimizes imbalance between groups

Provides high-precision comparisons with smaller sample sizes

(Lim CY et al., 2021)

Research Gap & Question

What remains unclear:

- How should exercise and ICT interventions be combined?
- Does the order of interventions influence outcomes?

Research Question:

Does intervention sequencing (ICT→exercise vs exercise→ICT) lead to different improvements in physical function, QOL, daily activities, and frailty?

Method

Outcome

Frenchay Activities Index (FAI)

(daily activities & social participation)

WHOQOL-BREF

(health-related quality of life)

Kaigo-Yobo Checklist

(frailty risk)

Grip strength

(muscle strength)

5-meter walking speed

(gait performance)

Five-time sit-to-stand test

(lower limb function)

Method

Measure

Baseline (T1)

After first intervention period (T2)

After second intervention period (T3)

Analytics

- Descriptive statistics
- Two-way repeated-measures ANOVA (group × time)
- Non-parametric tests when appropriate
- Significance level: $p < .05$



Theme of the Classes

- Part 1
Initial evaluation and ICT equipment
Touch and feel
- Part 2
Get health information
- Part 3
Let's redesign your interests
- Part 4
Reflection on Life
- Part 5
Travel all over the World in ICT
- Part 6
Crisis Management
- Part 7
Environment and ICT
- Part 8
Final evaluation and program review

Lecture



Session

1 time 80 min

Total 8 times (4 months)

1 Group about 10 people

Theme of the Classes



Lecture



Exercise

1 time 80 min

Total 8 times (4 months)

1 Group about 10 people

Part 1

Initial evaluation and program introduction

Part 2

Knee Pain Prevention Program

Part 3

Back Pain Prevention Program

Part 4

Falls and Fractures Prevention Program

Part 5

Shoulder Pain Prevention Program

Part 6

Eye strain prevention program

Part 7

Fall Prevention Program

Part 8

Final evaluation and program review

Results / Practice Implications

	ICT-first group (n = 27)	Exercise-first group (n = 27)
Age (years)	77.37 [95%CI: 75.45–79.29]	79.41 [95%CI: 76.56–82.26]
Sex (Male / Female)	8 / 19	8 / 19
Long-term care insurance certification (Yes / No)	2 / 25	2 / 25
Comorbidities (Yes / No)	11 / 16	10 / 17
Cohabitation (Yes / No)	10 / 17	11 / 16
Frequency of outings		
Daily	9	8
5–6 times per week	8	8
3–4 times per week	5	6
1–2 times per week	5	5
Prior tablet experience (Yes / No)	3 / 24	2 / 25

Results / Practice Implications

	ICT-first group T1		ICT-first group T2		ICT-first group T3		ICT-first group p value		Exercise-first group T1		Exercise-first group T2		Exercise-first group T3		Exercise-first group p value		Group × Time	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	T1 v.s. T2	T2 v.s. T3	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	T1 v.s. T2	T2 v.s. T3	F	p ^c		
Grip Strength ^a	22.67 4.85	22.27 4.92	23.23 5.40	0.33	<0.01 ^{**}	21.79 5.50	21.98 5.52	23.13 5.90	0.68	<0.01 ^{**}	0.88	0.40						
5-meter walking time ^a	4.67 1.60	4.26 1.09	4.00 1.03	<0.01 ^{**}	<0.01 ^{**}	5.09 1.48	4.30 0.94	4.08 0.94	<0.01 ^{**}	<0.01 ^{**}	0.99	0.37						
Five-time sit-to-stand ^a	8.81 2.71	8.90 3.29	8.02 2.36	0.76	<0.01 ^{**}	9.78 3.27	8.05 1.96	7.60 2.13	<0.01 ^{**}	<0.01 ^{**}	6.09	<0.01 ^{**}						
WHOQOL-BREF																		
• Physical health ^b	23.55 4.28	24.41 4.54	23.74 4.43	0.21	0.21	25.26 3.13	25.48 2.91	26.37 2.90	0.66	0.06	2.16	0.12						
• Psychological ^b	18.11 2.58	20.52 2.74	20.52 2.53	<0.01 ^{**}	1.00	18.52 3.01	20.63 3.28	21.85 2.99	<0.01 ^{**}	<0.01 ^{**}	1.76	0.18						
• Social relationships ^b	10.37 2.34	11.56 2.26	11.52 2.24	<0.01 ^{**}	0.88	10.37 2.19	10.74 1.53	11.33 1.36	0.31	<0.01 ^{**}	1.43	0.24						
• Environment ^b	25.04 4.30	28.48 5.03	27.89 4.68	<0.01 ^{**}	0.38	25.81 2.82	27.81 2.99	29.33 2.56	<0.01 ^{**}	<0.01 ^{**}	2.02	0.15						
FAI ^b	28.52 6.96	31.81 6.50	34.78 5.27	<0.01 ^{**}	<0.01 ^{**}	30.26 6.65	33.78 5.05	33.00 5.29	<0.01 ^{**}	0.16	5.71	<0.01 ^{**}						
Kaigo-Yobo Checklist ^b	3.30 2.46	1.70 1.90	1.63 1.78	<0.01 ^{**}	0.62	2.93 1.71	2.48 2.01	1.67 1.41	0.12	<0.01 ^{**}	4.07	0.03 [*]						

FAI: Frenchay Activity Index

a: Wilcoxon signed-rank test between the two time points (T1 v.s. T2, T2 v.s. T3).

b: Mann-Whitney U test between the two time points (T1 v.s. T2, T2 v.s. T3).

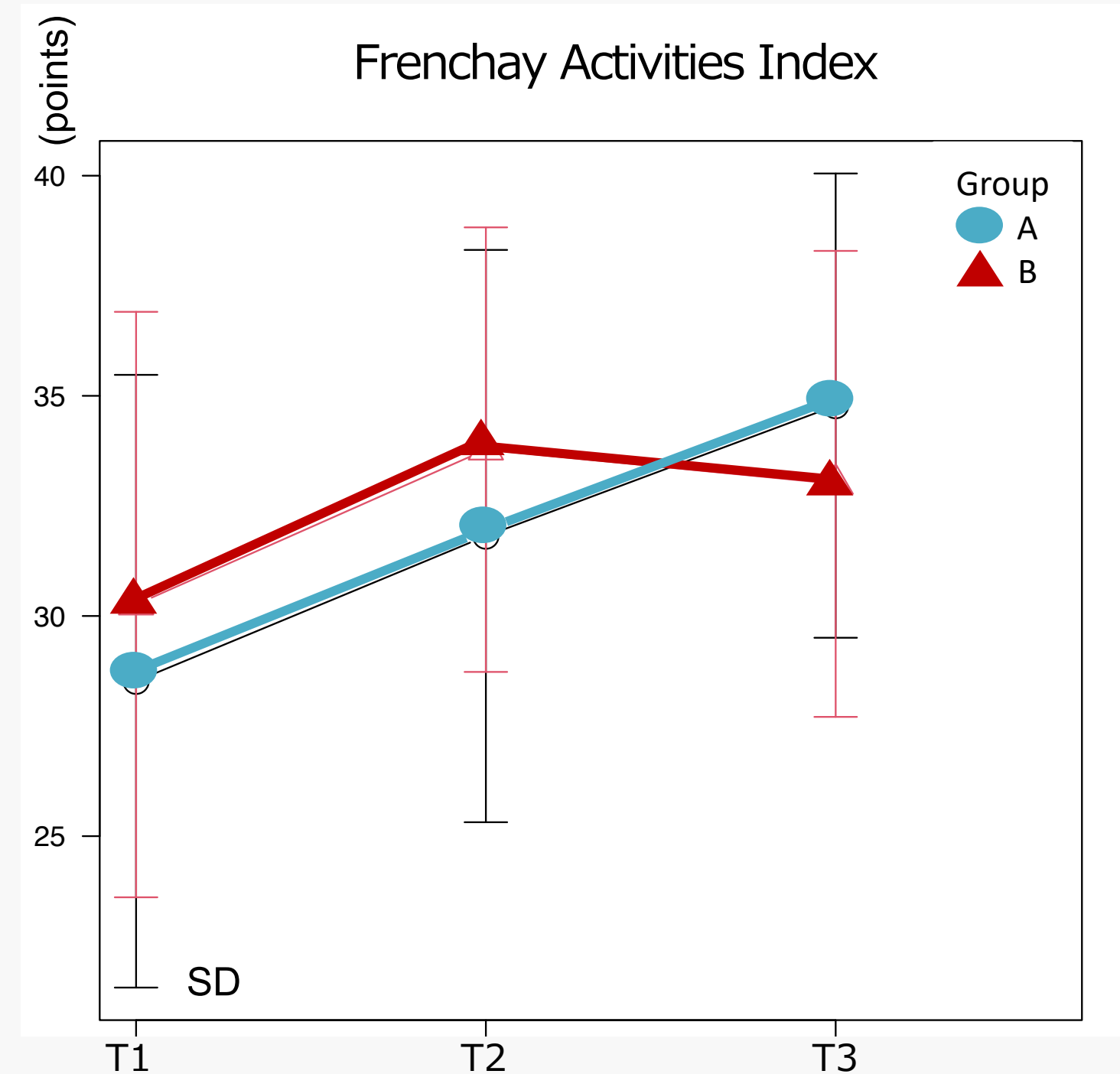
c: Two-way repeated measures ANOVA evaluated Group × Time interaction.

* : p<.05 ** : p<.01

Results / Practice Implications

ICT-first group (Group A)

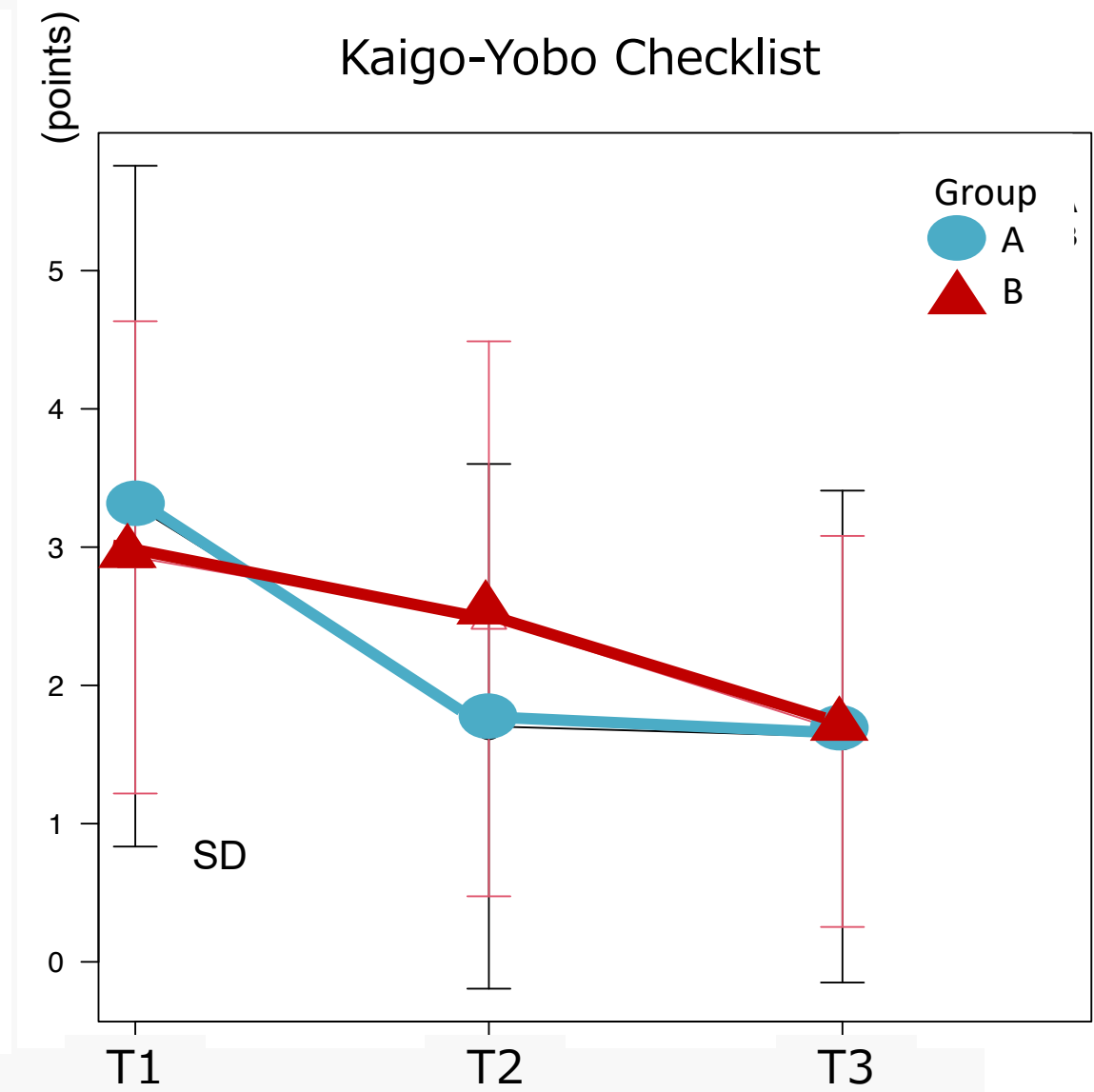
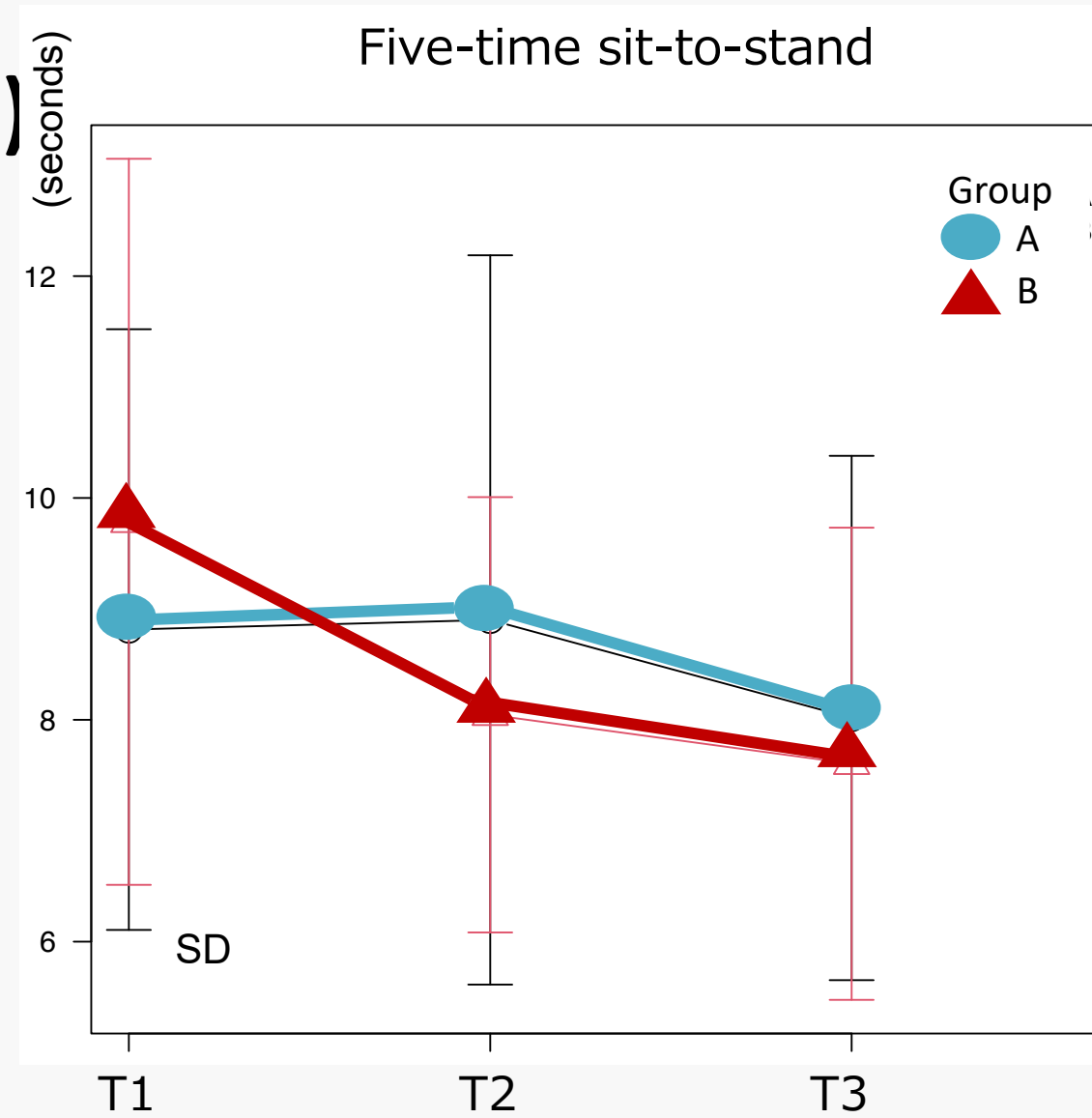
- Significant group \times time interaction for Frenchay Activities Index (FAI) ($p = 0.010$)
- No significant interaction for physical function or QOL



Results / Practice Implications

Exercise-first group (Group B)

- Significant group \times time interaction for Five-time sit-to-stand test ($p = 0.005$)
- Kaigo-Yobo Checklist ($p = 0.033$)



Discussion: Why does sequence matter?

The effects differed depending on the order of the interventions.

In **the ICT-first group**, improvements were observed in daily activities and participation, whereas in **the exercise-first group**, physical function and frailty-related outcomes improved.

One possible explanation is that

ICT interventions may enhance motivation for participation, autonomy, and readiness for activity (Chen & Schulz, 2016).

Exercise interventions may function more effectively once a certain level of physical capacity has been established (Cadore & Izquierdo, 2015).

These findings suggest that the domains in which improvements are most likely to occur differ according to the sequence of interventions.

Discussion: Why does sequence matter?



By introducing ICT first, older adults may enhance their sense of agency in daily life.

Subsequently introducing exercise may allow improvements in physical function to translate into more meaningful behavioral changes.



By improving physical function through exercise first, a foundation for going out and engaging in activities may be established.

Subsequent introduction of ICT may then further promote continued exercise and activity.

Limitations

- ✓ Participants were relatively healthy and motivated, which may limit generalizability.
- ✓ We did not control for activities outside the program, such as informal exercise or community participation.

Future studies should include more diverse populations and longer follow-up periods.

Conclusion

- ✓ Combining ICT and exercise is promising for frailty prevention.
- ✓ The **order of interventions matters**.
- ✓ **Exercise-first strategies** may enhance physical performance.
- ✓ **ICT-first strategies** may support daily functioning and participation.

Implication for Occupational Therapy

Tailoring intervention sequences based on individual goals may optimize outcomes

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Thank you for listening.

If you have any questions, I'm more than happy to answer them.