

## **Project Title**

Effectiveness of a Community-delivered Pneumatic Machine Resistance Training Programme (Gym Tonic) For Older Adults at Neighbourhood Senior Centres – A Randomized Controlled Trial

## **Project Lead and Members**

Project lead: Wee Shiou Liang

Project members: Lee Shuen Yee, Alycia Goh, Ken Tan, Choo Pei Ling, Ong Peck Hoon, Wong Wai Pong

## **Organisation(s) Involved**

Singapore Institute of Technology, PulseSync Pte Ltd

## **Healthcare Family Group Involved in this Project**

Allied Health

## **Specialty or Discipline (if applicable)**

Rehabilitation

## **Project Period**

Start date: Oct 2018

Completed date: Jul 2019

## **Aims**

To evaluate the effects of the 12-week coach-led Gym Tonic pneumatic resistance training programme implemented at three neighbourhood senior centres on muscle strength and physical function of older adults.

## **Background**

See poster appended / below

## Methods

See poster appended / below

## Results

See poster appended / below

## Lessons Learnt

- a) Collaborations with industry and/or community partners are important to evaluate the effectiveness and improve community programs for older adults and ensure that the research work is grounded and relevant.
- b) Communication and coordination with stakeholders are essential for successful project completion, especially for processes such as cleaning and analysis of real-world data.
- c) Beyond small-scale controlled laboratory studies, pneumatic resistance training program (Gym Tonic) increases muscle strength and fast gait speed, and can be effectively scaled-up and delivered in the community.

## Conclusion

See poster appended / below

## Additional Information

Singapore Health & Biomedical Congress (SHBC) 2021 – Bronze (Category: Singapore Young Investigator Award, Clinical Research)

## Project Category

Applied Research, Quantitative Research, Technology, Digital Health, MedTech

## Keywords

Gym Tonic, Pneumatic Resistance Programme, Technology-Enabled Pneumatic Machines, Strength Training, Frailty, Retrospective Trial

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# Effectiveness of a community-delivered pneumatic resistance training programme (Gym Tonic) for older adults at neighbourhood senior centres – A pragmatic randomized controlled trial

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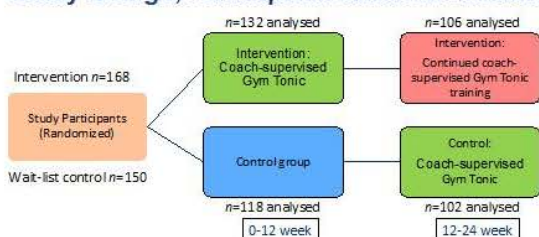
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## Background

- Resistance exercise attenuates the age-related loss in muscle mass, strength and function in older adults, which is associated with adverse health outcomes including frailty, falls, dependency and mortality.
- However, the effectiveness of a scaled-up community-delivered resistance training programme, using technology-enabled pneumatic machines, is not known.
- We evaluated the effectiveness of a multi-site community-delivered 12-week pneumatic-resistance programme, Gym Tonic (GT), on muscle strength and physical function in older adults.

## Methods

### Study Design, Participants and Intervention



Intervention consisted of twice/week progressive resistance training which target major muscle groups, using pneumatic machines (HUR, Kokkola, Finland).

### Outcomes

Fried frailty score, lower-extremity muscle strength and physical function (i.e., fast and habitual gait-speed, balance, repeated-chair-sit-to-stand, short physical performance battery (SPPB)), measured at baseline, 12 weeks and 24 weeks.

### Statistical analysis

- Participants with completed outcome measures at baseline and 12 weeks were included for analysis according to their randomised group allocation (modified intention-to-treat analysis), and maximum likelihood estimation was used to analyse missing data.
- Between-group differences for outcomes measured from baseline to 12 weeks were analysed using mixed-effect model, adjusted for age, sex and moderate-to-vigorous-physical activity levels.
- One-way ANOVA with Bonferroni adjustment was used for within-group differences in outcome measures from baseline, 12 and 24 weeks.

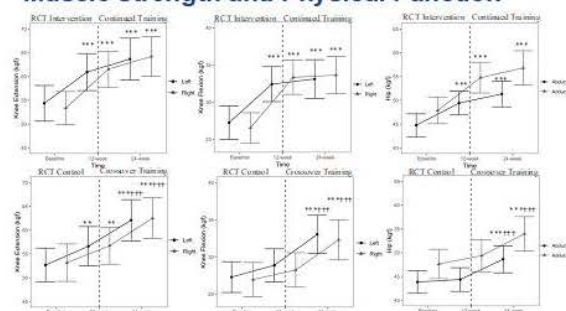
## Results

### Participants and adherence

- Programme adherence was high in intervention [0–12-weeks, 90% (SD,13%); 12–24-weeks, 89% (SD,17%)] and control [12–24-weeks, 90% (SD,19%)] groups.
- Frailty score improved by 0.5 in the intervention but not control group ( $p=0.004$ ).

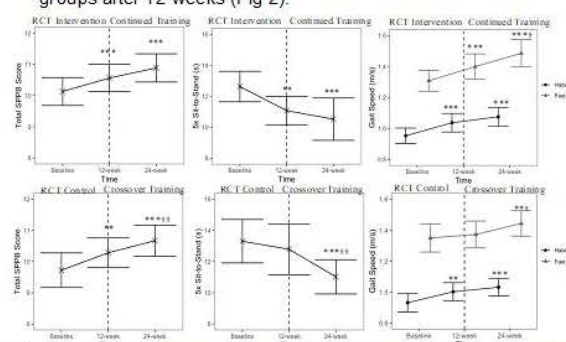
Reference: Lee, S.Y., Goh, A., Tan, K. et al. Effectiveness of a community-delivered pneumatic machine resistance training programme (Gym Tonic) for older adults at neighbourhood senior centres – a randomized controlled trial. *Eur Rev Aging Phys Act* 18, 21 (2021). <https://doi.org/10.1186/s11556-021-00273-x>

## Muscle strength and Physical Function



**Fig 1.** Muscle strength outcomes (mean and 95% CI). \*\* $p<0.01$ , \*\*\* $p<0.001$  compared to values at baseline; ††† $p<0.001$  compared to values at 12 weeks.

- After 12 weeks, lower-extremity muscle strength and fast gait speed improved by 11–26% and 7% respectively (all  $p<0.05$ ) in GT-intervention group than controls, regardless of frailty status (Fig 1&2).
- Repeated chair sit-to-stand time, balance, habitual gait speed and SPPB score did not differ between intervention and control groups after 12 weeks (Fig 2).



**Fig 2.** Physical function outcomes (mean and 95% CI). \*\* $p<0.01$ , \*\*\* $p<0.001$  compared to values at baseline; † $p<0.05$ , †† $p<0.01$  compared to values at 12 weeks.

- Within the intervention group, lower-extremity muscle strength and physical function outcomes improved at 24 weeks compared with baseline (all  $p<0.001$ , Fig 1&2).
- Within controls, lower-extremity muscle strength, SPPB, repeated chair sit-to-stand, and fast gait-speed improved post-GT (24-week) compared to both pre-GT (12-week) and baseline (Fig 1&2)

## Conclusion

- Extending upon earlier laboratory studies on the benefits of pneumatic resistance training on muscle strength and function, GT programme has high adherence, can be scaled-up, and be effectively delivered by community providers at neighbourhood senior centres.
- Future studies should investigate whether the addition of other multi-modal function-specific training may complement GT, and achieve better physical function, in other balance, endurance and power-related tasks.

