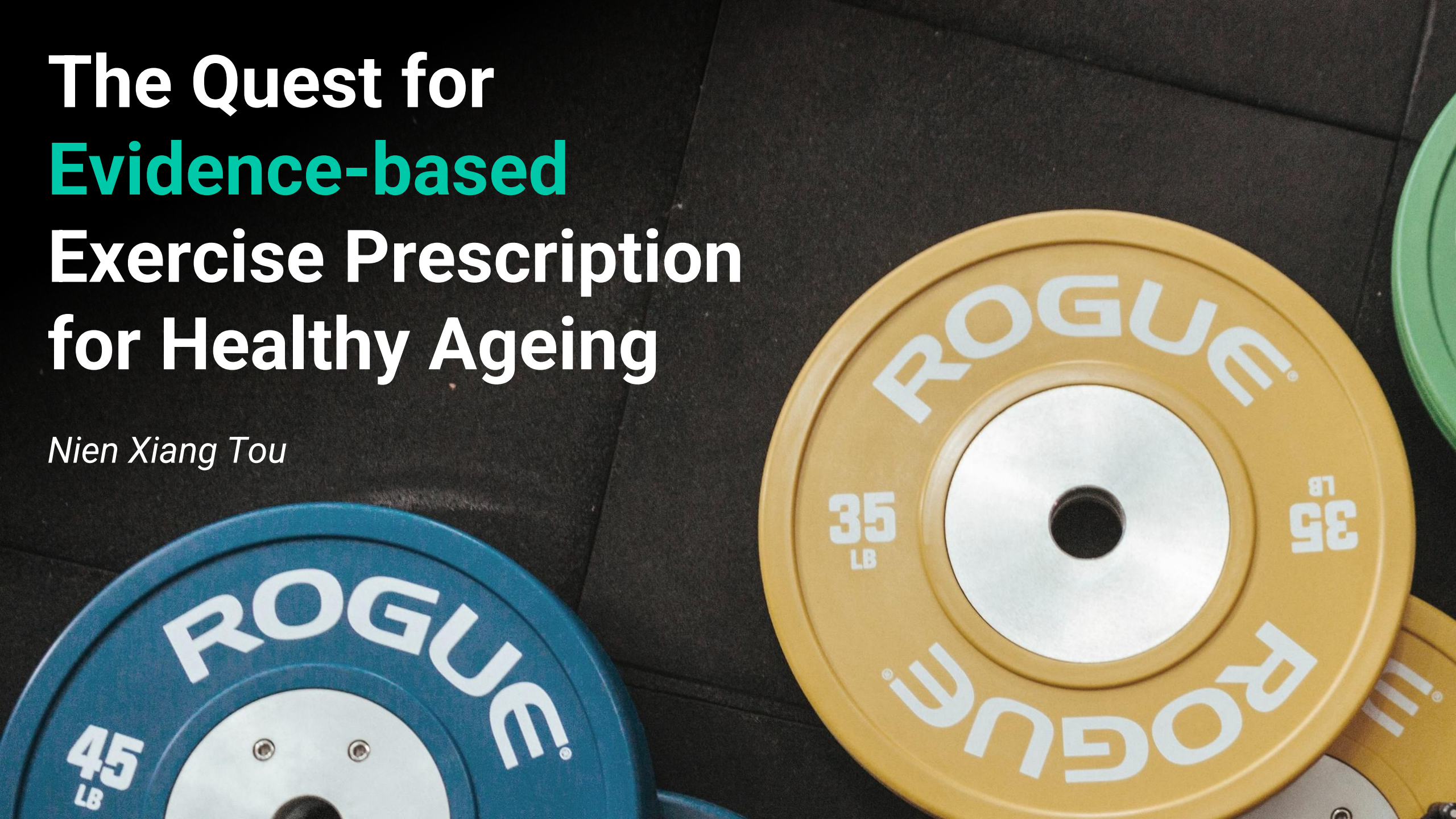
The Quest for Evidence-based Exercise Prescription for Healthy Ageing

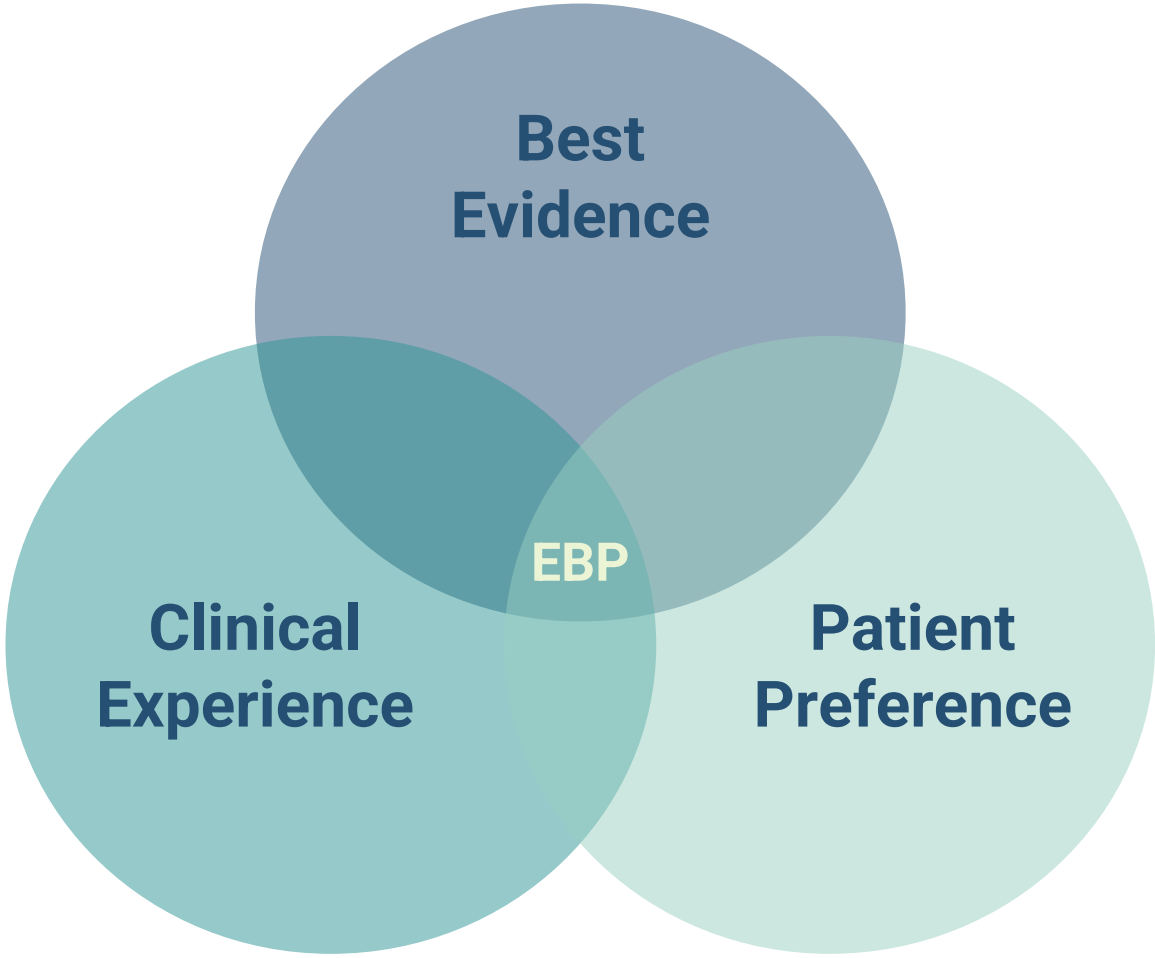
Nien Xiang Tou



When an older adult visit a **doctor** for an illness, would you expect the treatment to be **well-supported by evidence**, **safe**, and **effective**?

The Evidence Movement

Evidence based medicine is the ***conscientious, explicit,*** *and* ***judicious*** *use of* ***current best evidence*** *in making decisions about the care of individual patients.*



Sackett, D. L., Rosenberg, W. M., Gray, J. M., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: what it is and what it isn't. *BMJ*, *312*(7023), 71-72.

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When an older adult attend a **physical activity programme**, would you expect the programme to be **well-supported by evidence**, **safe**, and **effective**?

01 | WHY

02 | WHAT

03 | HOW

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WHY

is evidence-based exercise important for healthy ageing?

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Mind the Gap!

JAMA Network | Open

Original Investigation | Global Health

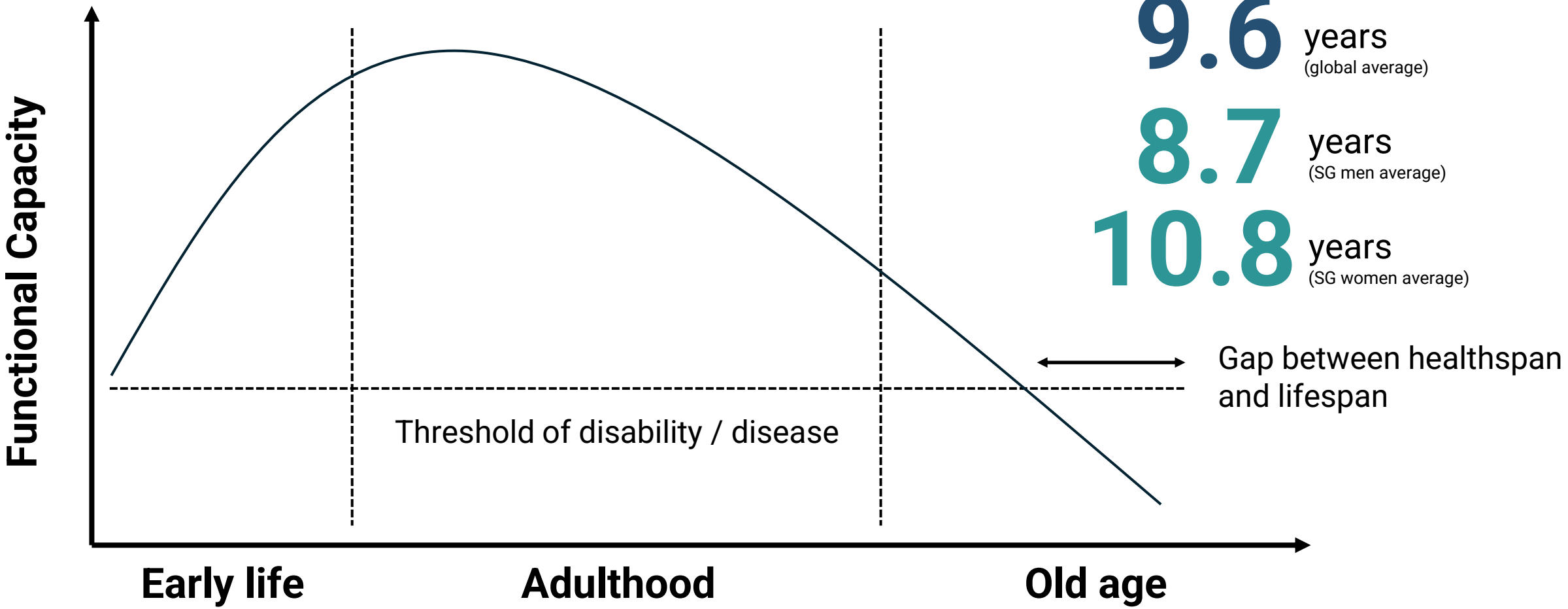
Global Healthspan-Lifespan Gaps Among 183 World Health Organization Member States

Armin Garmany, BS; Andre Terzic, MD, PhD

9.6 years (global average)

8.7 years (SG men average)

10.8 years (SG women average)



Garmany, A., & Terzic, A. (2024). Global healthspan-lifespan gaps among 183 World Health Organization member states. *JAMA Network Open, 7*(12), e2450241.

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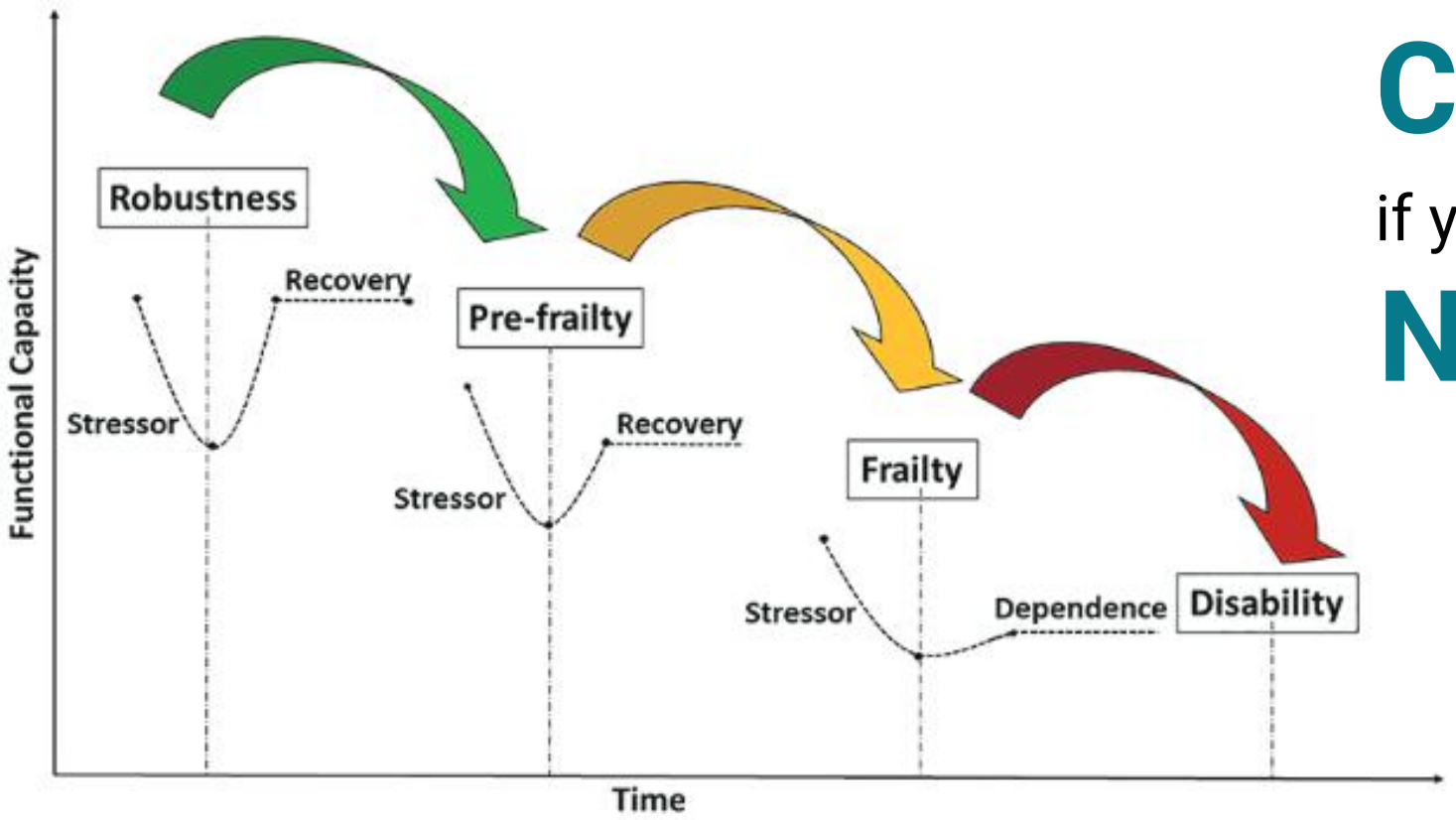
Cascade of Functional Decline



Age will

CATCH UP

if you choose to do

NOTHING.

Dent, E., Morley, J. E., Cruz-Jentoft, A. J., Woodhouse, L., Rodríguez-Mañas, L., Fried, L. P., ... & Vellas, B. (2019). Physical frailty: ICFSR international clinical practice guidelines for identification and management. *The Journal of Nutrition, Health & Aging, 23*, 771-787..

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Hallmark of Ageing: Musculoskeletal Decline

0.47%
per year

2-4%
per year

Mitchell, W. K., Williams, J., Atherton, P., Larvin, M., Lund, J., & Narici, M. (2012). Sarcopenia, dynapenia, and the impact of advancing age on human skeletal muscle size and strength; a quantitative review. *Frontiers in Physiology, 3*, 260.

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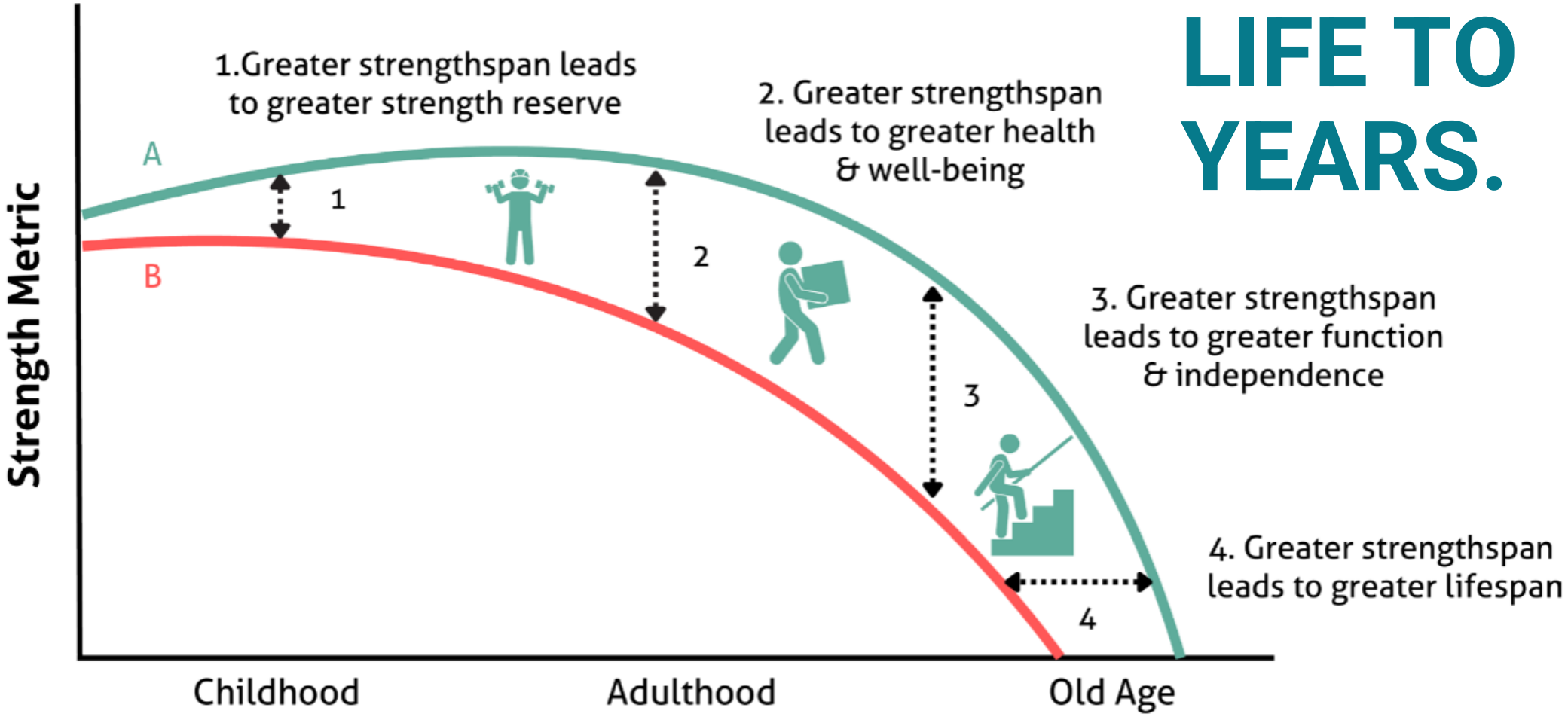
Greater muscle strength adds **LIFE TO YEARS.**



Faigenbaum, A. D., Garcia-Hermoso, A., MacDonald, J. P., Mortatti, A., & Rebullido, T. R. (2024). Bridging the gap between strengthspan and lifespan. *British Journal of Sports Medicine*, *58*(14), 758-760.

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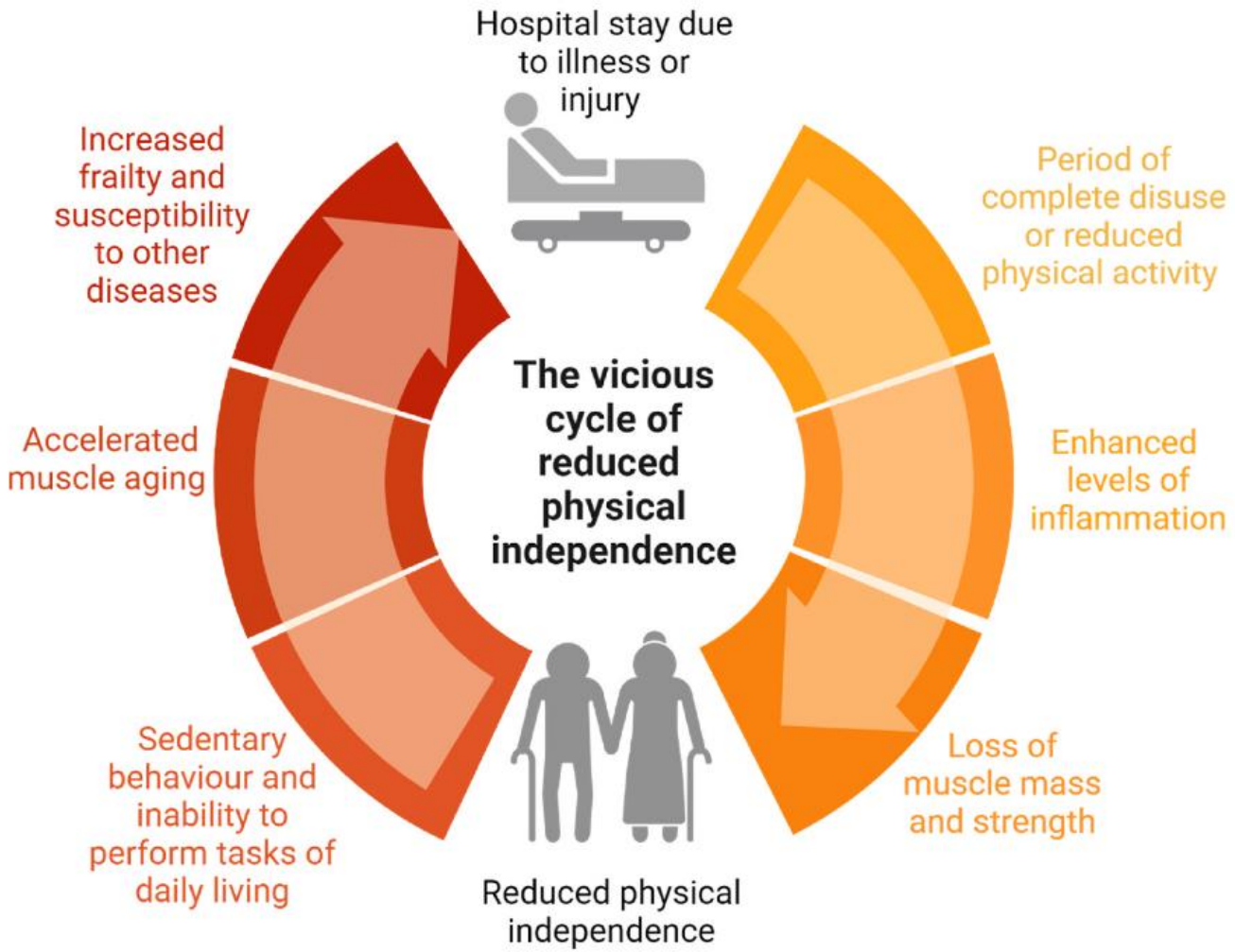
Sedentarism-Vulnerability Vicious Cycle



Janssen, T. A., Lowisz, C. V., & Phillips, S. (2024). From molecular to physical function: the aging trajectory. *Current Research in Physiology, 8*, 100138.

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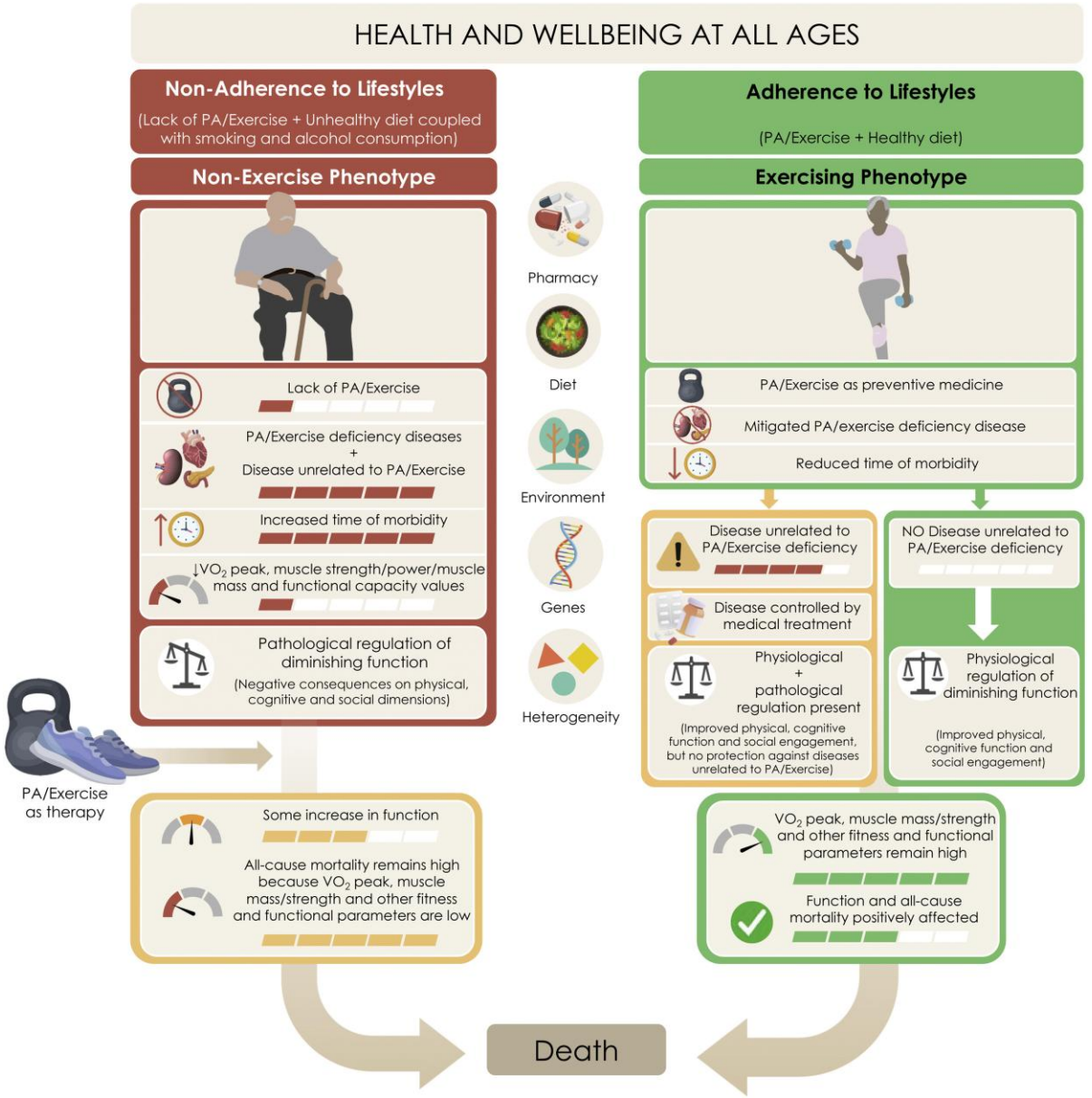
Phenotypes of Ageing:

Exercising

versus

Non-Exercise



Izquierdo, M., de Souto Barreto, P., Arai, H., Bischoff-Ferrari, H. A., Cadore, E. L., Cesari, M., ... & Singh, M. A. F. (2025). Global consensus on optimal exercise recommendations for enhancing healthy longevity in older adults (ICFSR). *The Journal of Nutrition, Health and Aging, 29(1)*, 100401.

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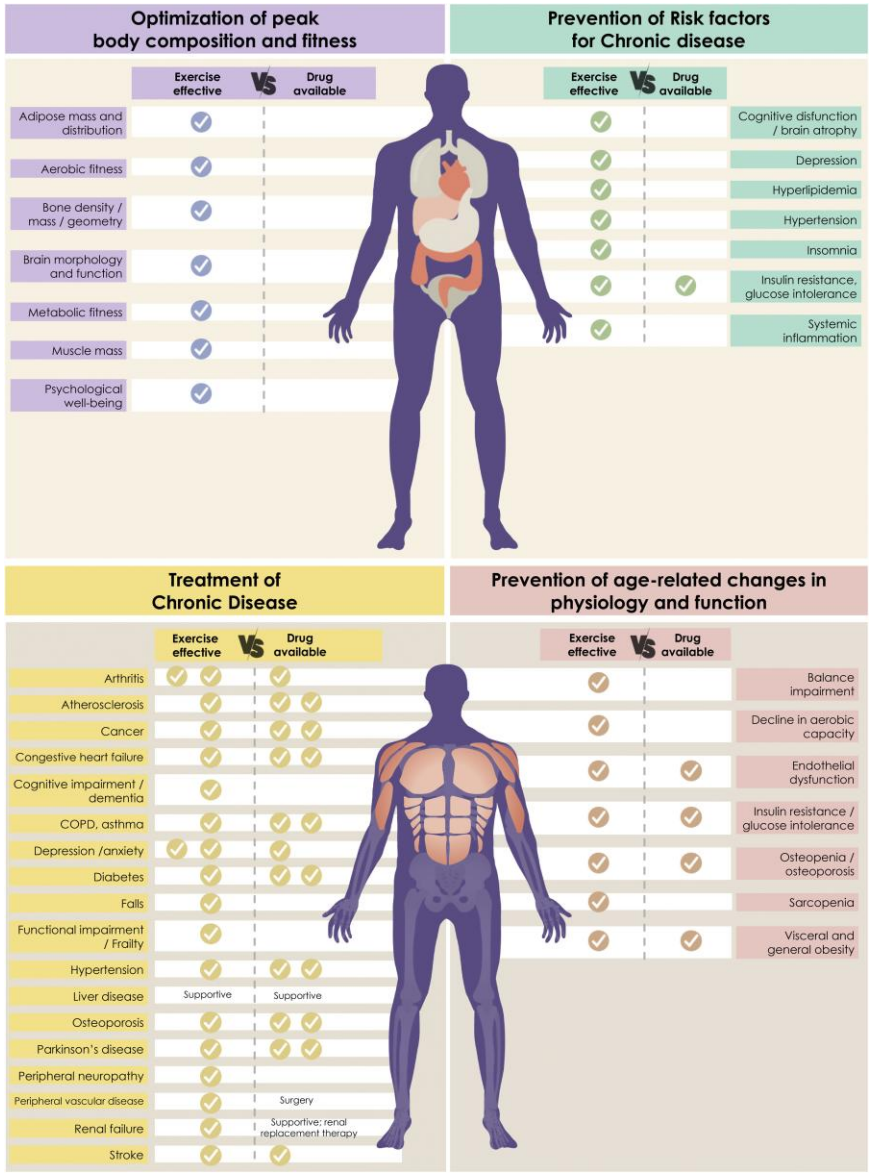

Exercise as Medicine

1 | **Primary prevention** for conditions for which treatments are available

2 | **Supplementing** clinical interventions and **substitution** for unsafe treatments

3 | Management of conditions that has **no other effective treatments**

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Overwhelming Empirical Evidence

Review Article

The Effectiveness of Exercise Interventions for the

ACRM AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2014;95:753-69

de Labra *et al. BMC Geriatrics* (2015) 15:154
DOI 10.1186/s12877-015-0155-4

RESEARCH ARTICLE

Journal of Cachexia, Sarcopenia and Muscle 2023; **14**: 1199–1211
Published online 14 April 2023 in Wiley Online Library (wileyonlinelibrary.com) **DOI:** 10.1002/jcsm.13225

Exercise for sarcopenia in older people: A sys review and network meta-analysis

Yanjiao Shen[1,3], Qingyang Shi[2], Kailei Nong[2], Sheyu Li[2], Jirong Yue[3], Jin Huang[1], Birong Dong[3], Mar Qiukui Hao[3,4]*

[1]*Medical Device Regulatory Research and Evaluation Center, Chinese Evidence-Based Medicine Center, West China Hospital, Sichuan Universit*
[2]*Department of Endocrinology and Metabolism, West China Hospital, Sichuan University, Chengdu, Sichuan, China;* [3]*The Center of Gerontolog Clinical Research Center of Geriatrics, West China Hospital, Sichuan University, Chengdu, Sichuan, China;* [4]*School of Rehabilitation Science, McMaster University, Hamilton, Ontario, Canada*

Kidd *et al. BMC Geriatrics* (2019) 19:184
https://doi.org/10.1186/s12877-019-1196-x

BMC Geriatrics

JBI EVIDENCE SYNTHESIS

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SYSTEMATIC REVIEWS

Effectiveness of exercise interventions on physical function in

Contents lists available at ScienceDirect

Geriatric Nursing

journal homepage: www.gnjournal.com

ELSEVIER

Feature Article

Exercise interventions for improving physical function, daily living activities and quality of life in community-dwelling frail older adults: A systematic review and meta-analysis of randomized controlled trials

Yixiong Zhang, MD*, Yuqun Zhang, PhD, Shizheng Du, RN, MD, Qiuling Wang, MD, Haozhi Xia, MD, Rong Sun, MD

Department of Nursing, Nanjing University of Chinese Medicine, Nanjing, China

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WHAT

is an evidence-based approach to exercise prescription?

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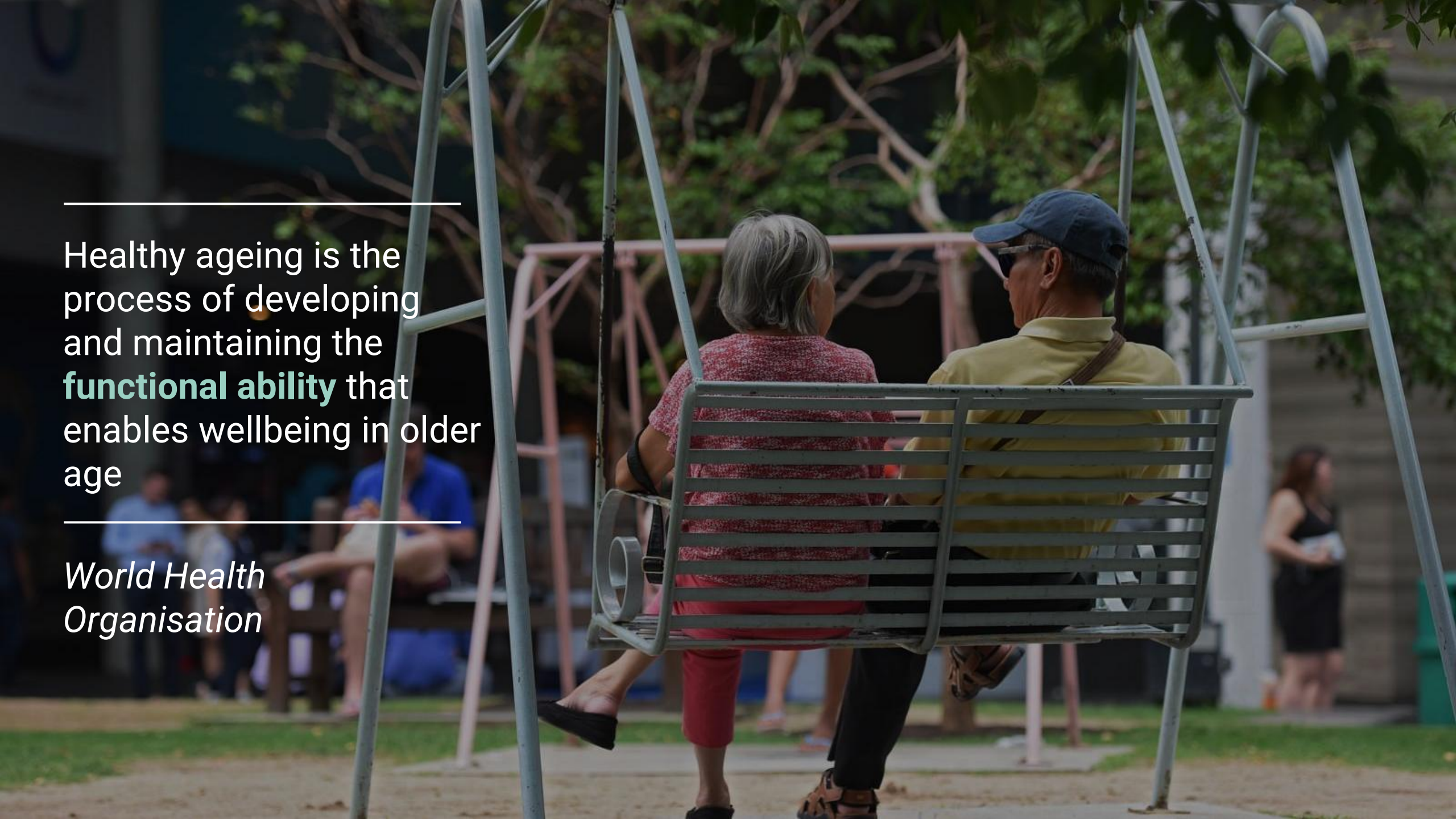
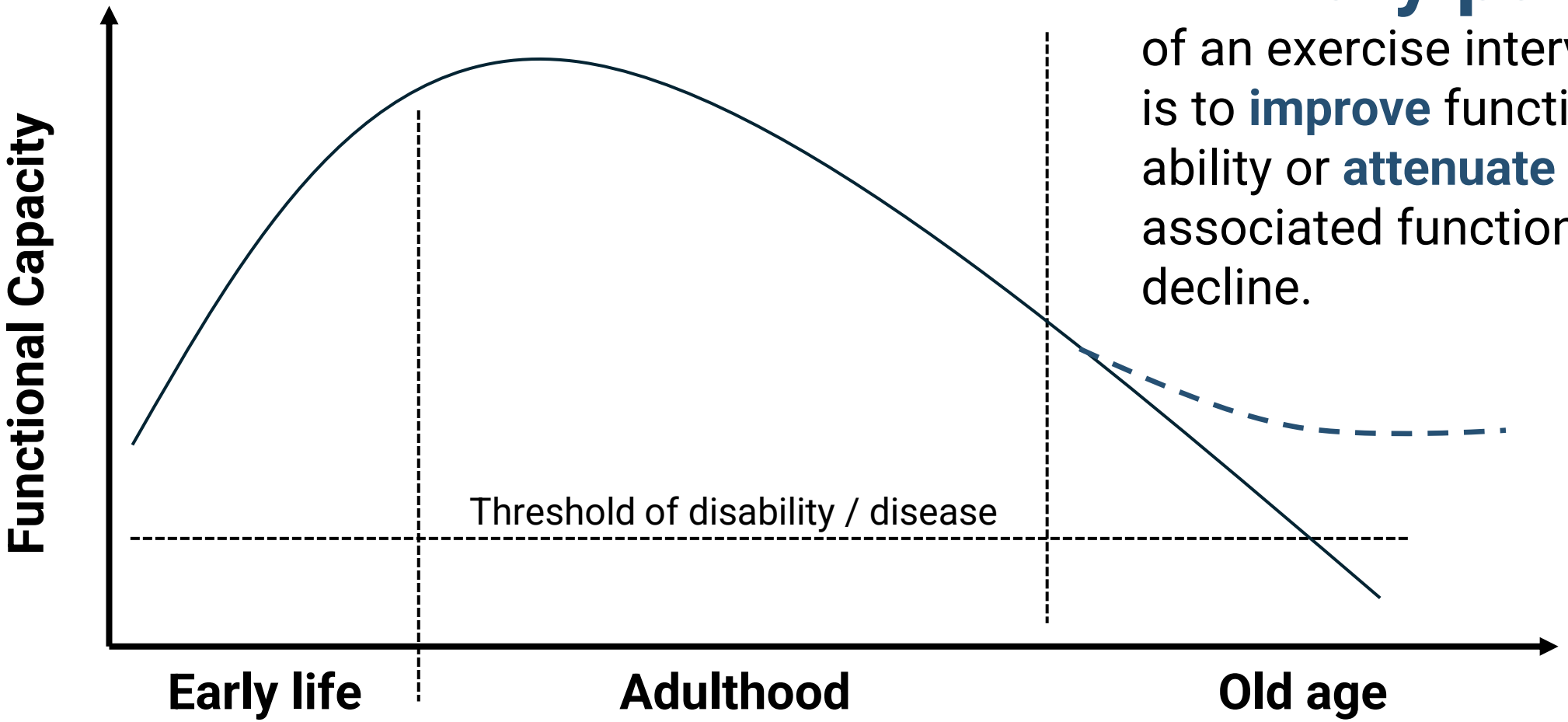


Healthy ageing is the process of developing and maintaining the **functional ability** that enables wellbeing in older age

World Health Organisation

Primary purpose

of an exercise intervention is to **improve** functional ability or **attenuate** age-associated functional decline.



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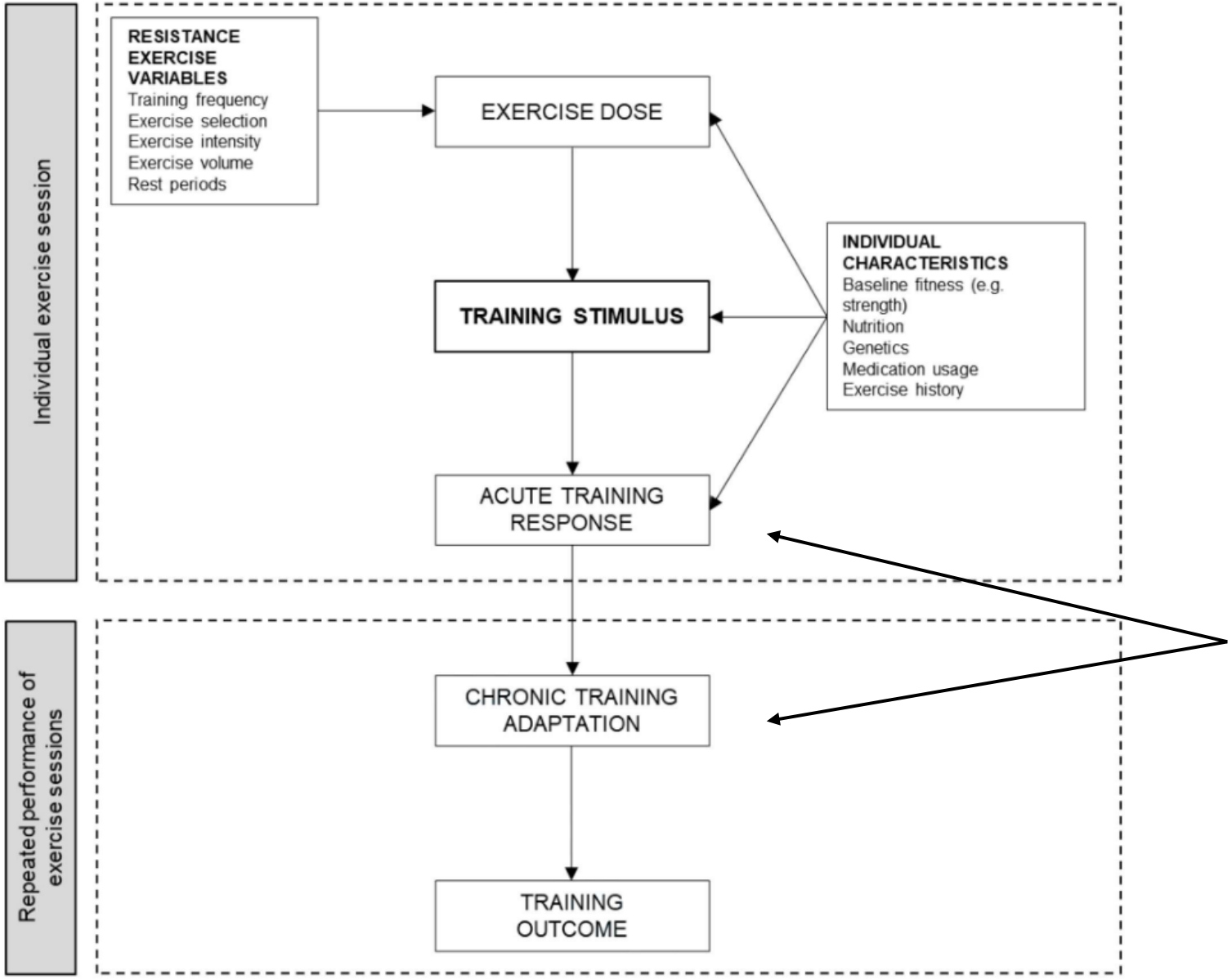

Training adaptations **have to occur** to achieve improvements in functional ability.

Hurst, C., Robinson, S. M., Witham, M. D., Dodds, R. M., Granic, A., Buckland, C., ... & Sayer, A. A. (2022). Resistance exercise as a treatment for sarcopenia: prescription and delivery. *Age and Ageing*, *51*(2), afac003.

Principle of Specificity

Exercise training adaptations are specific to the training stimulus derived from the exercise performed.

Aerobic

Improves cardiovascular health

Resistance

Improves musculoskeletal health

Balance

Improves postural stability and coordination

Flexibility

Improves range of motion

Physical Activity Recommendations for Older Adults

150 – 300 minutes of **moderate-intensity** aerobic physical activity

2 days of **moderate-intensity** muscle-strengthening activity

3 days of **moderate-intensity functional balance** physical activity

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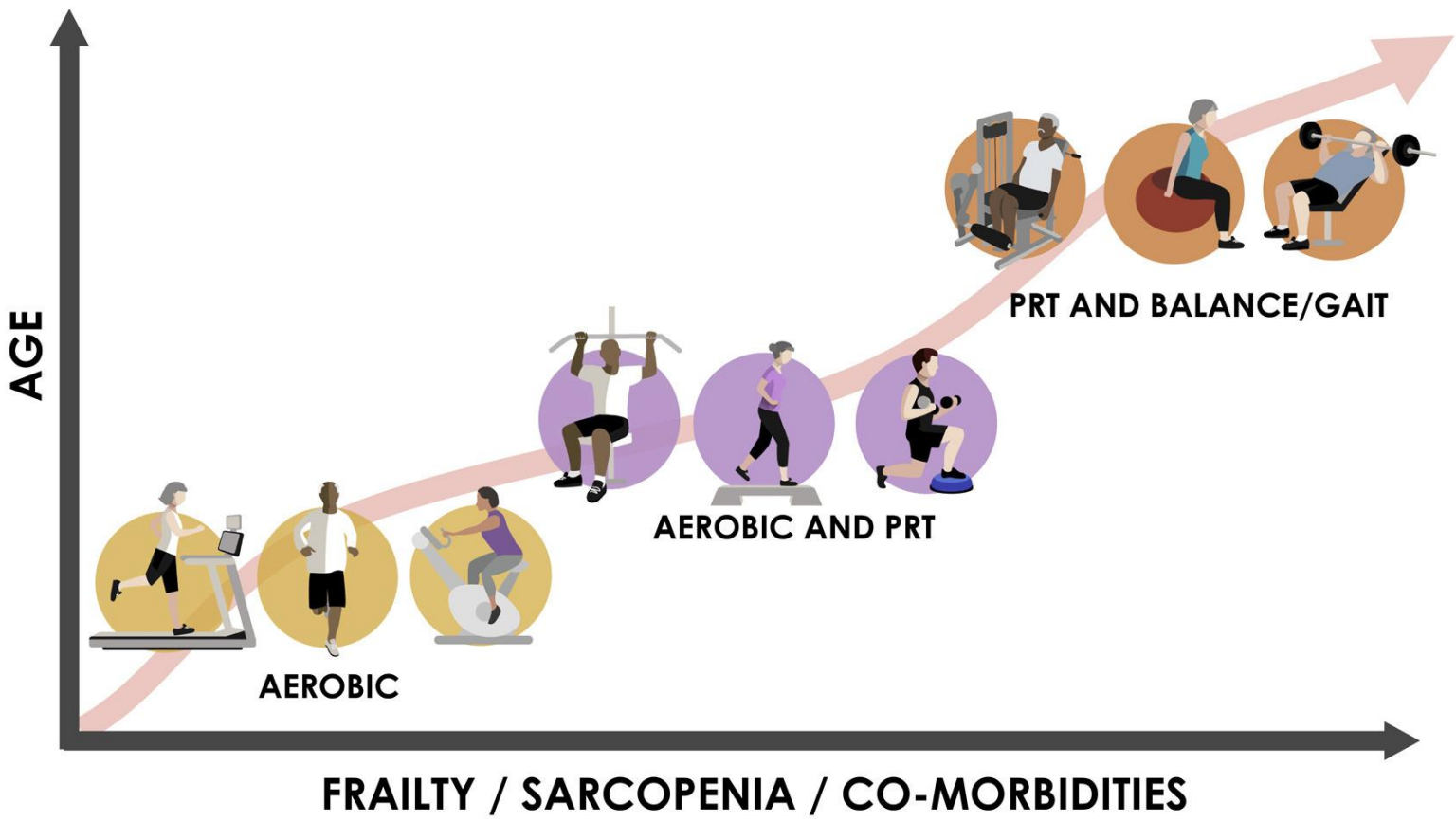

Optimal exercise changes over time.

Sequencing and **progression** of exercise modalities should follow the physical requirements underpinning mobility and specific individual deficits.

Izquierdo, M., de Souto Barreto, P., Arai, H., Bischoff-Ferrari, H. A., Cadore, E. L., Cesari, M., ... & Singh, M. A. F. (2025). Global consensus on optimal exercise recommendations for enhancing healthy longevity in older adults (ICFSR). *The Journal of Nutrition, Health and Aging, 29(1)*, 100401.

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Exercise Modality-Specific Adaptations

Priority 1 

Age-associated loss of muscle **necessitates progressive resistance training** for optimal adaptation.

Priority 2 

Balance training is critical to **reduce fall-risk**.

Priority 3 

Aerobic training is essential to improve **cardiorespiratory fitness**.

Priority 4 

Flexibility training has limited benefits beyond improving range of motion.

Izquierdo, M., de Souto Barreto, P., Arai, H., Bischoff-Ferrari, H. A., Cadore, E. L., Cesari, M., ... & Singh, M. A. F. (2025). Global consensus on optimal exercise recommendations for enhancing healthy longevity in older adults (ICFSR). *The Journal of Nutrition, Health and Aging, 29(1)*, 100401.

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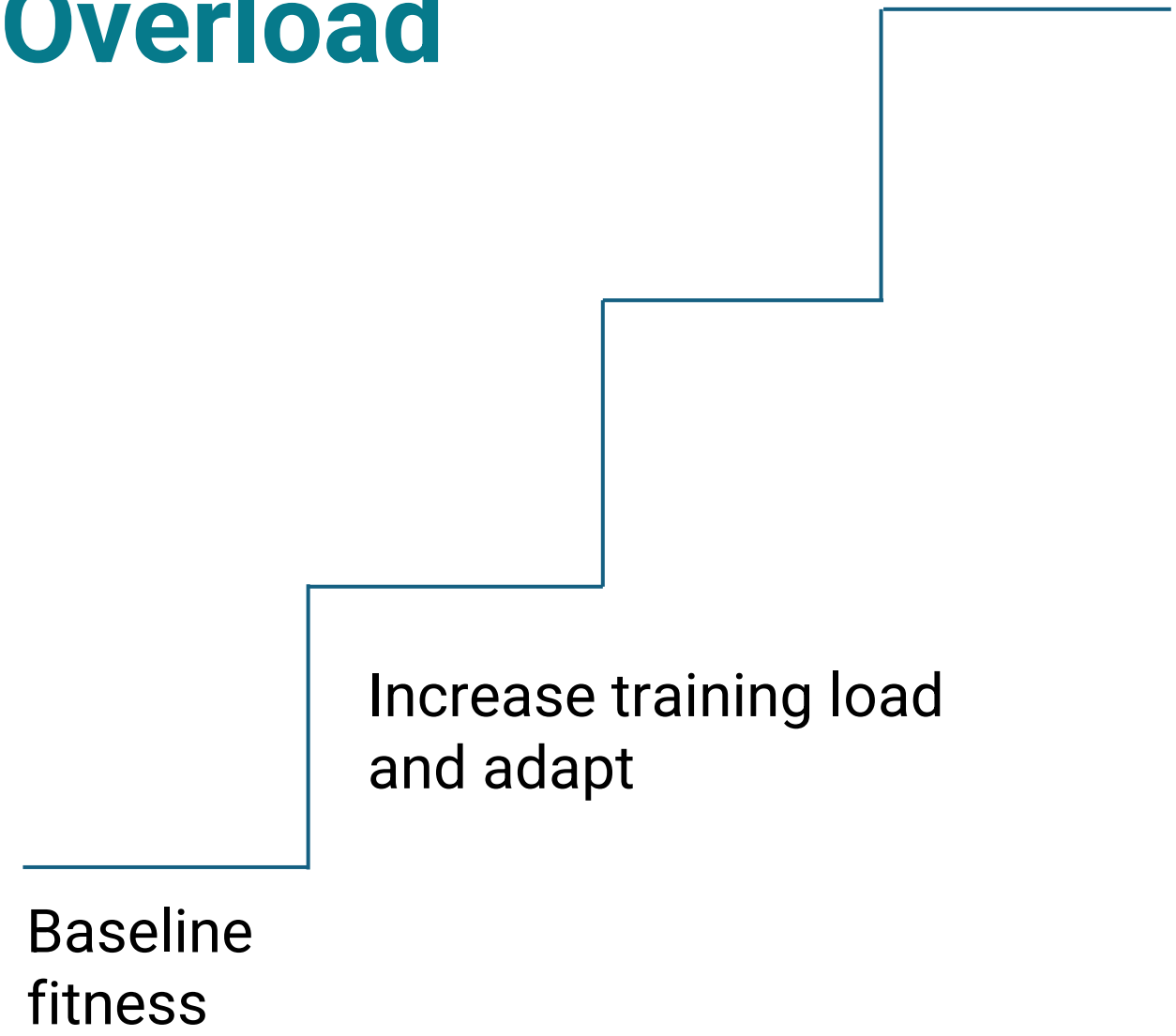
Principle of Overload

Exercise training adaptations **only occur** if there is greater than habitual stress on the body.

Principle of Overload



Exercise intervention has to be **sufficiently challenging** to elicit benefits.

Prescribing **low-intensity exercise with no progression** is not evidence-based!

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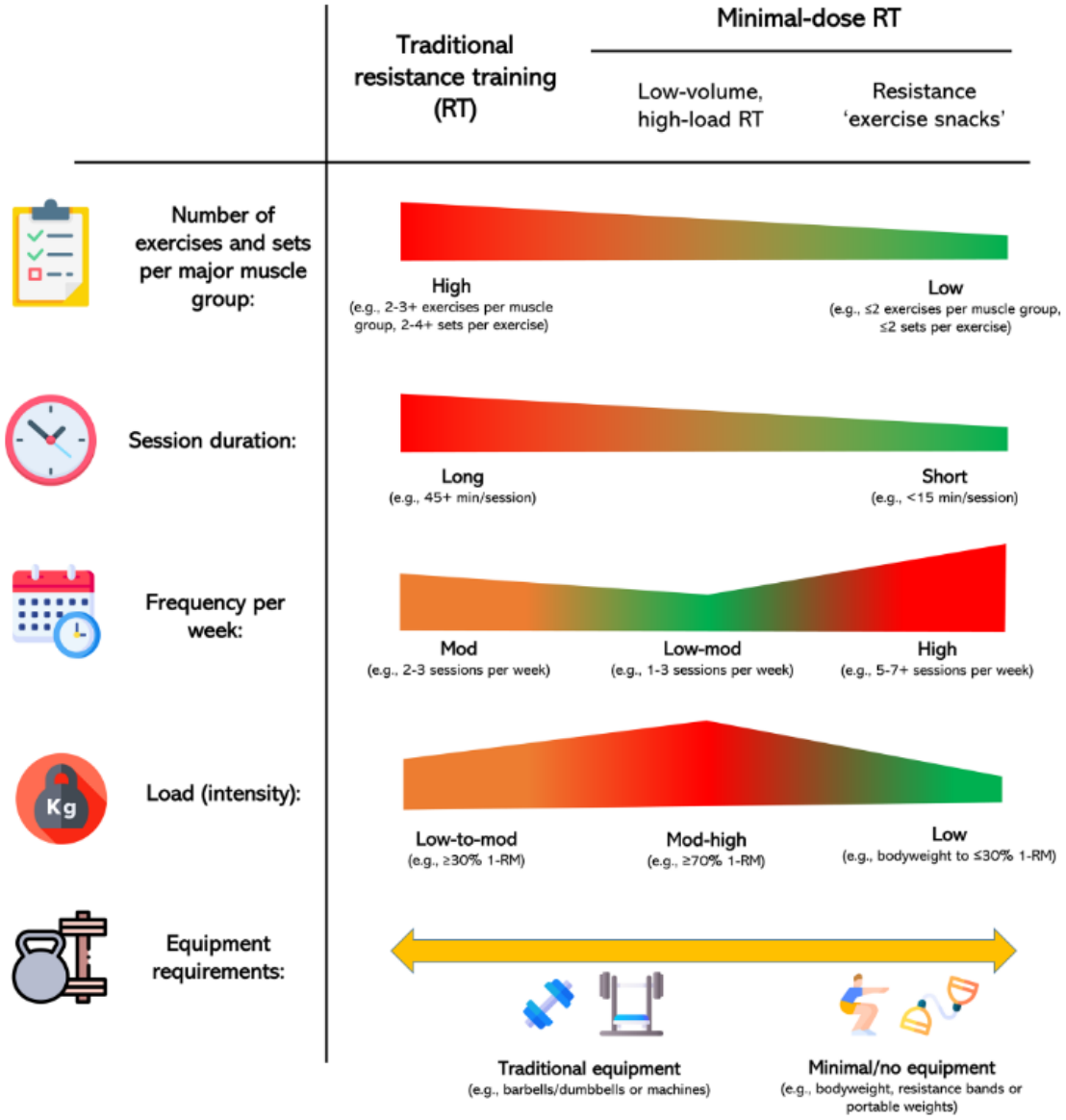

There are many ways to increase the exercise dosage.

Low frequency
High load

High frequency
Low load

Fyfe, J. J., Hamilton, D. L., & Daly, R. M. (2022). Minimal-dose resistance training for improving muscle mass, strength, and function: a narrative review of current evidence and practical considerations. *Sports Medicine, 52*(3), 463-479.

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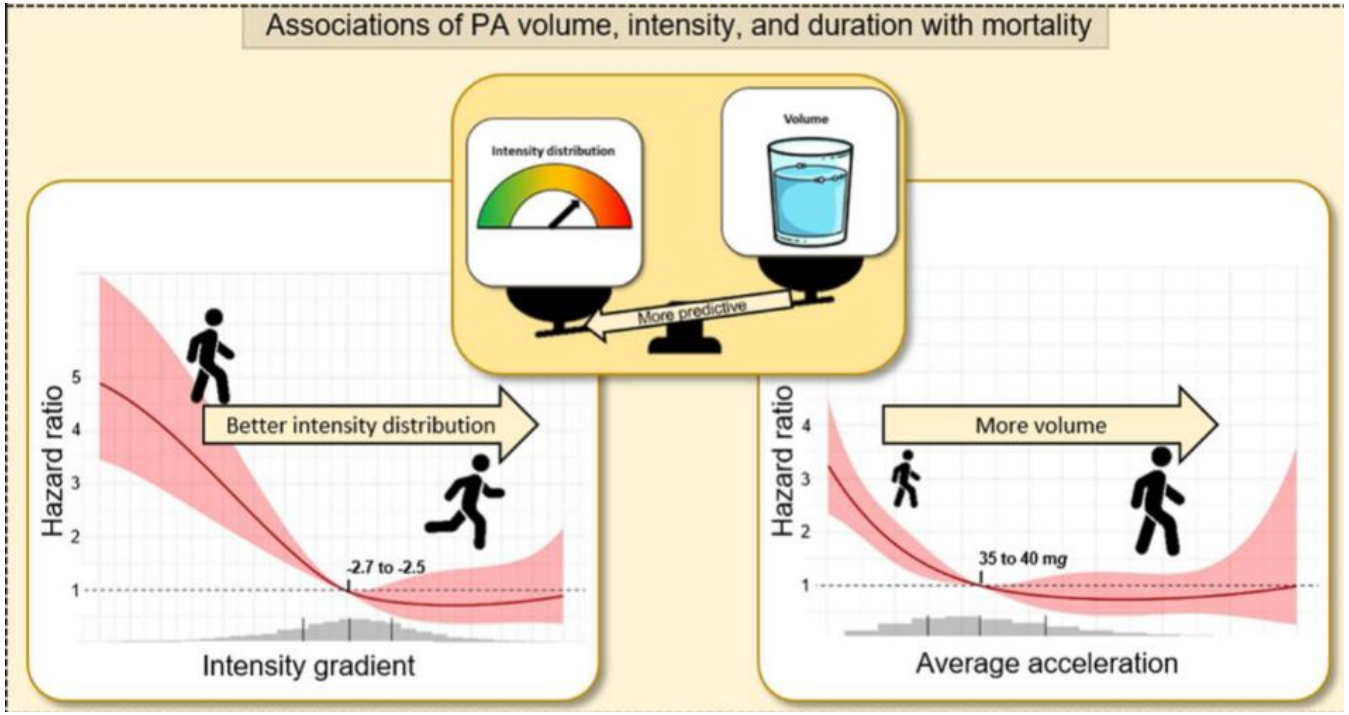
Exercise Intensity Matters

ESC European Society of Cardiology
European Journal of Preventive Cardiology (2025) **32**, 10–19
https://doi.org/10.1093/eurjpc/zwae295

FULL RESEARCH PAPER
Public health

Intensity or volume: the role of physical activity in longevity

Fabian Schwendinger [1]*, Denis Infanger [1], Eric Lichtenstein [2], Timo Hinrichs [1], Raphael Knaier [1], Alex V. Rowlands [3,4,5†], and Arno Schmidt-Trucksäss [1,6†]



Higher physical activity intensity is more closely associated with **reduced mortality risk** than total physical activity volume.

Schwendinger, F., Infanger, D., Lichtenstein, E., Hinrichs, T., Knaier, R., Rowlands, A. V., & Schmidt-Trucksäss, A. (2025). Intensity or volume: the role of physical activity in longevity. *European Journal of Preventive Cardiology, 32*(1), 10-19.

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The Journal of Nutrition, Health and Aging

journal homepage: www.elsevier.com/locate/jnha

Review

Global consensus on optimal exercise recommendations for enhancing healthy longevity in older adults (ICFSR)

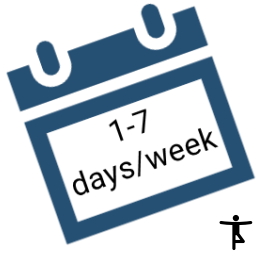
Mikel Izquierdo [a,b,*], Philipe de Souto Barreto [c,d], Hidenori Arai [e], Heike A. Bischoff-Ferrari [f], Eduardo L. Cadore [g], Matteo Cesari [h], Liang-Kung Chen [i], Paul M. Coen [j], Kerry S. Courneya [k], Gustavo Duque [l], Luigi Ferrucci [m], Roger A. Fielding [n], Antonio García-Hermoso [a,b], Luis Miguel Gutiérrez-Robledo [o], Stephen D.R. Harridge [p], Ben Kirk [q], Stephen Kritchevsky [r], Francesco Landi [s,t], Norman Lazarus [p], Teresa Liu-Ambrose [u], Emanuele Marzetti [s,t], Reshma A. Merchant [v,w], John E. Morley [x], Kaisu H. Pitkälä [y], Robinson Ramírez-Vélez [a,b], Leocadio Rodriguez-Mañas [b,z], Yves Rolland [c,d], Jorge G. Ruiz [A], Mikel L. Sáez de Asteasu [a,b], Dennis T. Villareal [B], Debra L. Waters [C,D], Chang Won Won [E], Bruno Vellas [c,d], Maria A. Fiatarone Singh [F]

Resistance Training

- 1-3 sets of 8-12 repetitions
- 8-10 exercises targeting major muscle groups
- Start at 50% of 1RM and progress to heavier loads of 70-80% 1RM

Aerobic Training

- 20-60 minutes using large muscle groups per session at 55-70% heart rate reserve
- Short bouts of high-intensity exercise lasting 30s to 4 min



Balance Training

- 1-2 sets of 4-10 different exercises on static and dynamic postures or movements
- Progressive difficulty as tolerated

Izquierdo, M., de Souto Barreto, P., Arai, H., Bischoff-Ferrari, H. A., Cadore, E. L., Cesari, M., ... & Singh, M. A. F. (2025). Global consensus on optimal exercise recommendations for enhancing healthy longevity in older adults (ICFSR). *The Journal of Nutrition, Health and Aging, 29(1)*, 100401.

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How

can we bridge the knowledge-practice gap?

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01

Be More SPECIFIC

Clearly communicate the desired physical activity behaviour with specific details to minimise ambiguity and make it actionable.

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~~Exercise more~~

~~Engage in resistance training~~

Engage in at least **2 days** of resistance training performing **8 to 10 exercises** targeting major muscle groups at **intensity of 70-80%** 1 repetition maximum

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02 Beyond INDIVUALS

Behaviour change is complex. Adopt a systems lens to better understand how individual behaviours are influenced by their environments.

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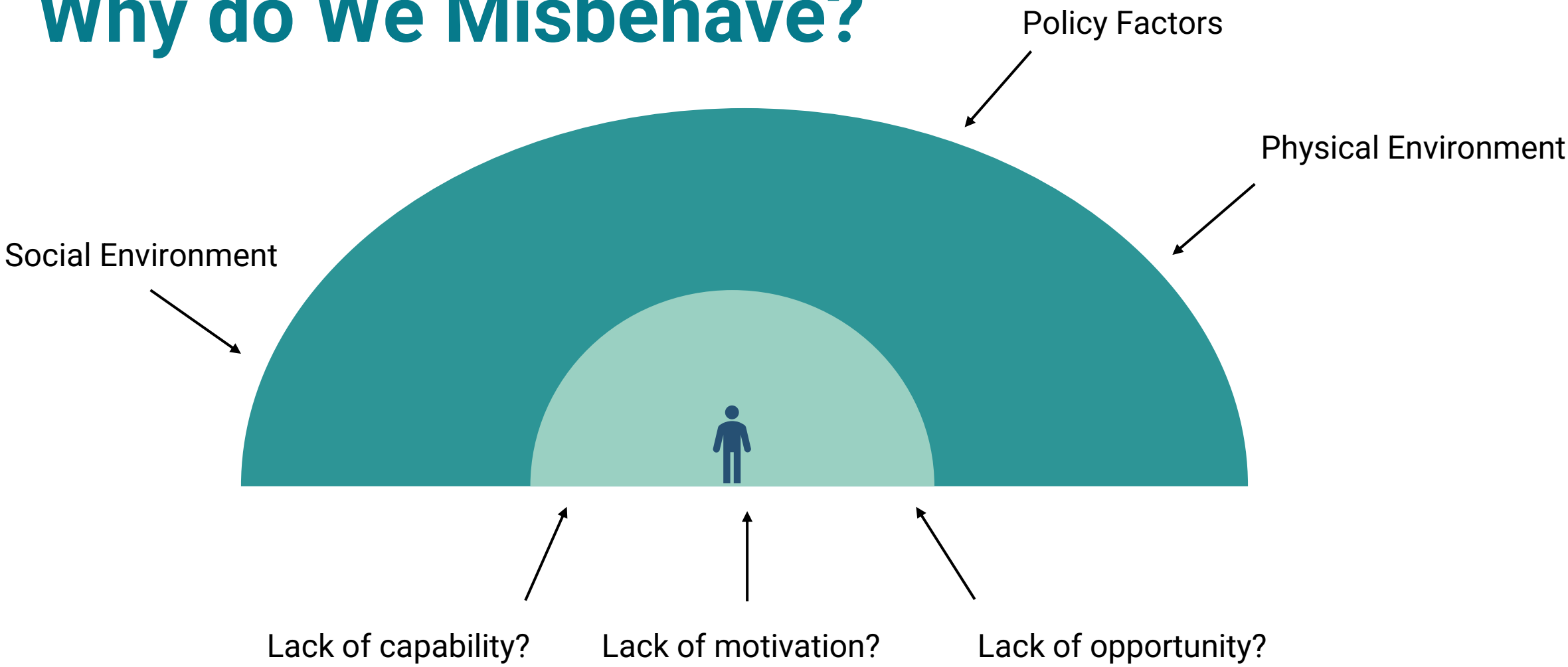
Why do We Misbehave?



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People are not dumb. The world is hard.

Richard Thaler

03

Support IMPLEMENTATION

Integrate implementation science and behaviour change theories to promote uptake of evidence-based exercise prescription practice.

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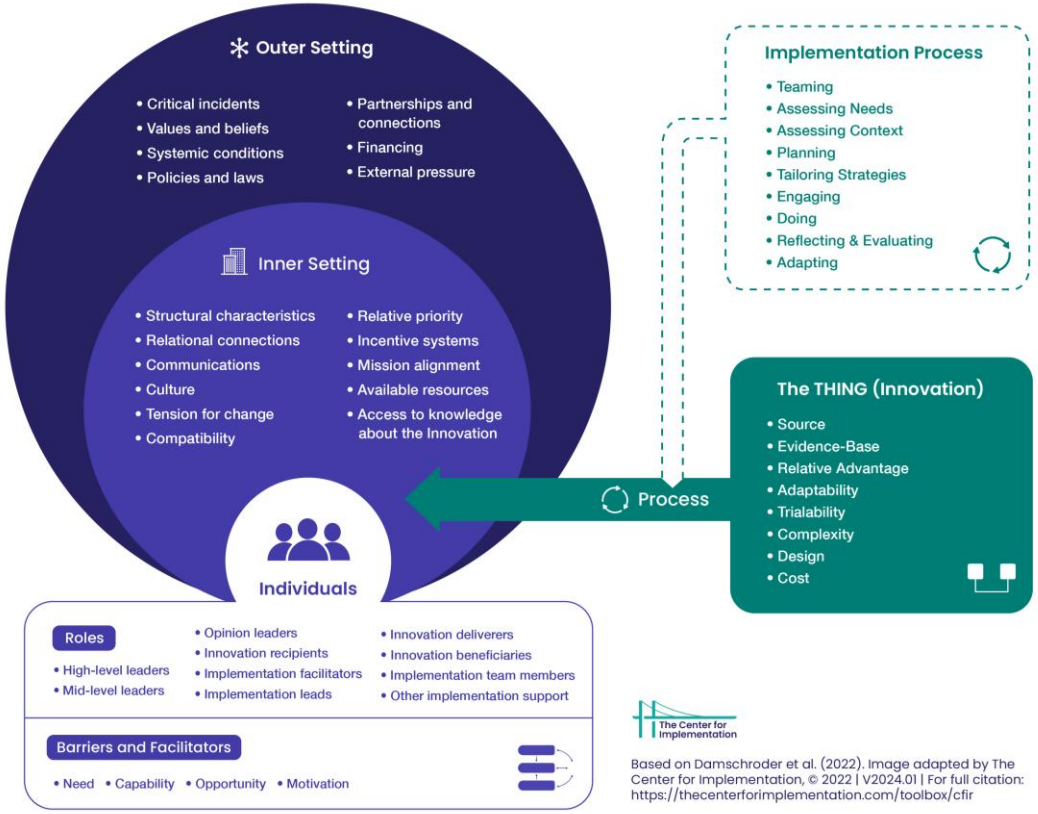
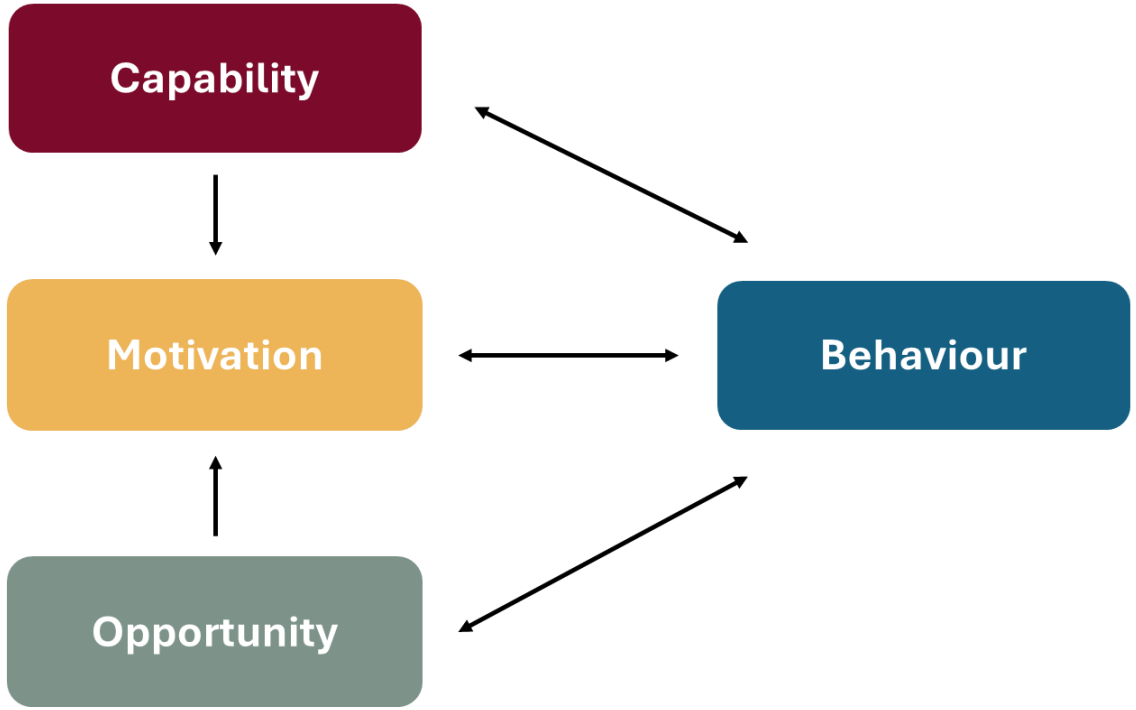
Consolidated Framework for Implementation Research (CFIR)



COM-B Model



Damschroder, L. J., Reardon, C. M., Opra Widerquist, M. A., & Lowery, J. (2022). Conceptualizing outcomes for use with the Consolidated Framework for Implementation Research (CFIR): the CFIR Outcomes Addendum. *Implementation Science*, *17*(1), 7.

Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*, 1-12.

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KEY TAKEAWAYS

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Ageing is **INEVITABLE** poor health isn’t.

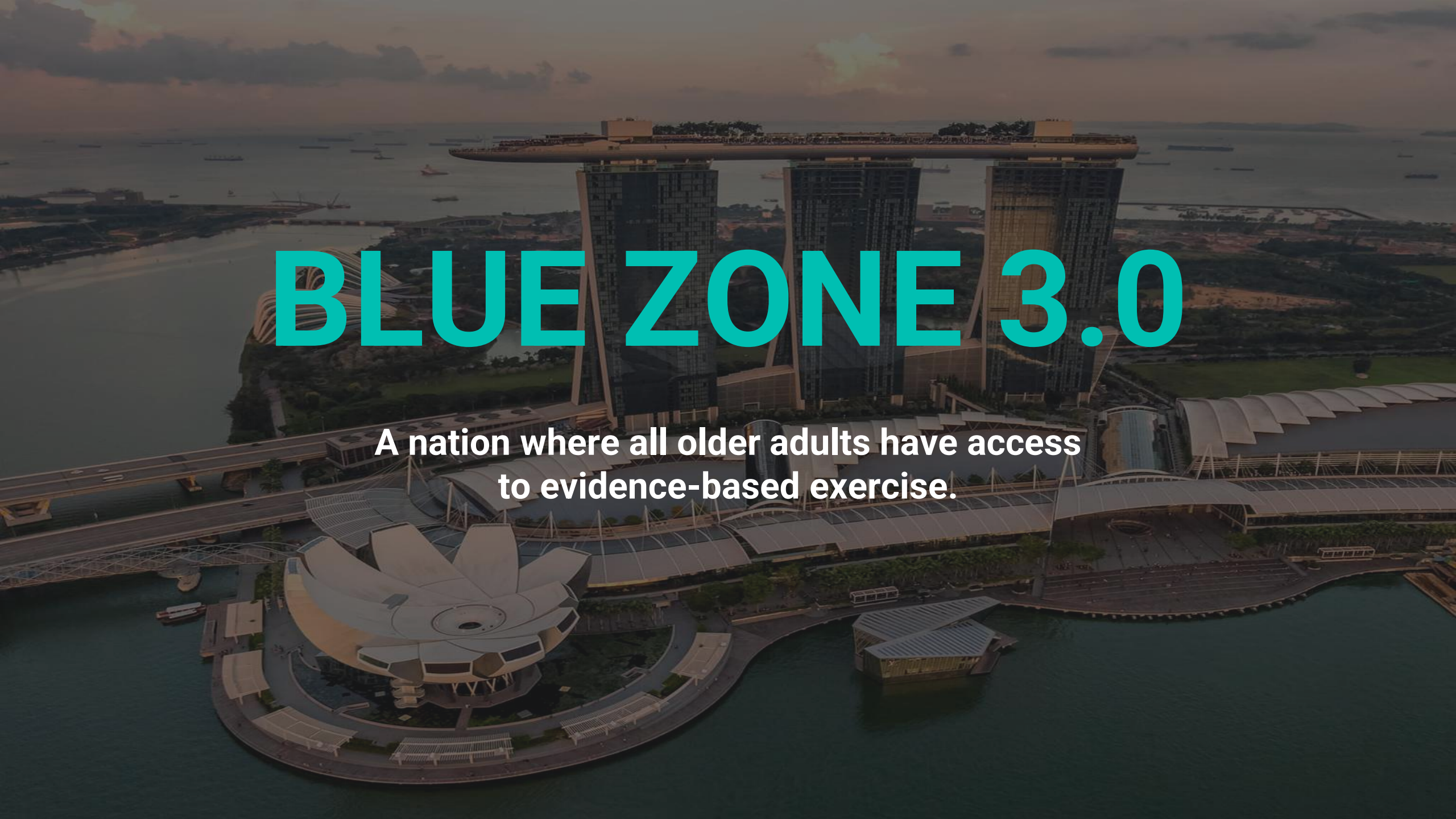
Sufficient exercise maintains functional capacity and lengthen the healthspan in our later years.

Some exercise is definitely better than none but it is **NOT THE FINAL GOAL.**

Evidence-based exercise prescription strives towards optimal dosage to maximise the health benefits of physical activity.

NOT ALL physical activity is EQUALLY EFFECTIVE.

Dose-response relationships and exercise modality-specific adaptations exist. Evidence-based exercise prescription addresses specific individual needs.



BLUE ZONE 3.0

A nation where all older adults have access to evidence-based exercise.

Thank You

Nien Xiang Tou, PhD

tou.nien.xiang@geri.com.sg

www.geri.com.sg

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