

CoalFace Geriatrics Conference
University of Newcastle, New South Wales, Australia
August 29th - September 3rd, 2022

3RD PROFESSOR ALAN HEWSON ORATION

**INTRINSIC CAPACITY AND FUNCTIONAL ABILITY:
THE WHO APPROACH TO PROMOTION OF HEALTHY AGEING**

Finbarr C Martin

Emeritus Professor of Medical Gerontology

at King's College London

And *Emeritus* Geriatrician at Guys & St Thomas' NHS Trust

Professor Alan Hewson

1927-2017

Lifelong contributions to Newcastle and Australia

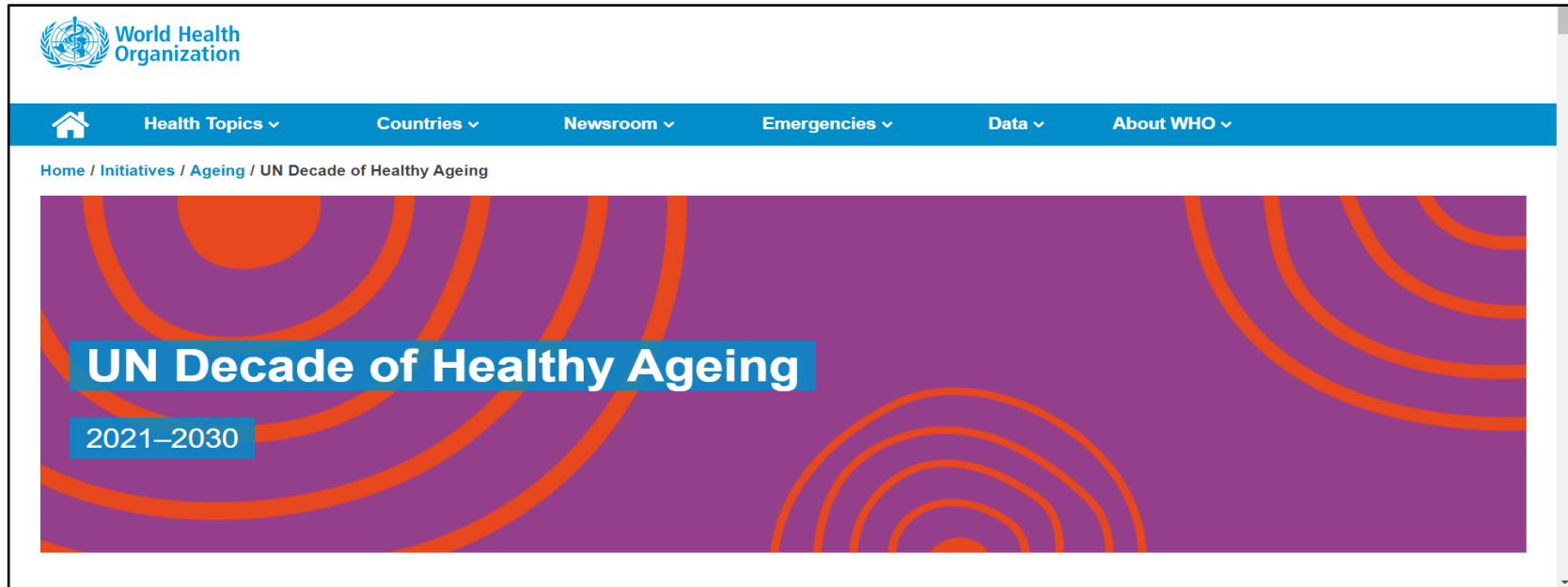
- As a clinician
- As a clinical leader and medical manager
- As a founding promoter of the University of Newcastle Medical School
- As a medical educator
- As a medical historian

Summary

- Context of my talk
- What is healthy ageing?
- Validation of Intrinsic capacity
- Trajectories of age-related changes
- Integrated care of older people (ICOPE)
- Potential utility of measuring intrinsic capacity
- Examples in recent and ongoing work

Context of my talk today

2021-2030: UN & WHO Decade of Healthy Ageing



Decade of Healthy Ageing Action Areas

- Age-friendly environments
- Combatting ageism
- **Integrated care**
- Long term care

Integrated Care of Older people (ICOPE)

The screenshot shows the WHO website's navigation bar with links for Health Topics, Countries, Newsroom, Emergencies, Data, and About WHO. On the left, a sidebar for the 'Ageing and Health Unit' features a highlighted 'Integrated care for older people (ICOPE)' link, along with other topics like long-term care, universal health coverage, and research. The main content area is titled 'Integrated care for older people (ICOPE)' and contains a paragraph about physiological changes with age, a list of symptoms (visual impairment, hearing loss, cognitive decline, malnutrition, mobility loss, depressive symptoms, urinary incontinence, falls), and a definition of ICOPE as a person-centred care model. A button for 'What is healthy ageing?' is present. Below this is a section for 'WHO Guidelines to support healthy ageing', specifically 'Guidelines on community-level interventions to manage declines in intrinsic capacity', dated 1 January 2017.

World Health Organization | Health Topics ▾ | Countries ▾ | Newsroom ▾ | Emergencies ▾ | Data ▾ | About WHO ▾

< Ageing and Health Unit

Integrated care for older people (ICOPE)

Integrated continuum of long-term care

Universal health coverage and ageing

Research, evidence and data

Integrated care for older people (ICOPE)

Numerous physiological changes occur with increasing age, and for older people the risks of experiencing declines in physical and mental capacities increase.

These declines often progress and manifest themselves as [visual impairment](#), [hearing loss](#), cognitive decline, [malnutrition](#), [mobility loss](#), [depressive symptoms](#), urinary incontinence and [falls](#).

ICOPE reflects a continuum of care that will help to reorient health and social services towards a more person-centred and coordinated model of care.

[What is healthy ageing?](#)

WHO Guidelines to support healthy ageing

Guidelines on community-level interventions to manage declines in intrinsic capacity

1 January 2017
Integrated care for older people: guidelines on community-level...

Person centred, holistic, integrated services etc

There are large global variations
in health and life expectancy



Unique journeys into old age

Differences accumulate over the entire lifespan

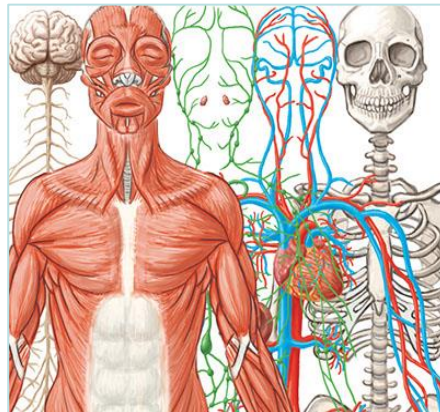
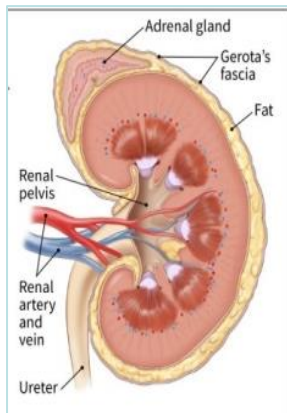
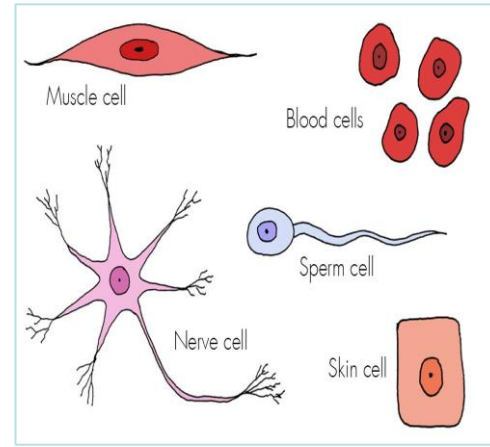
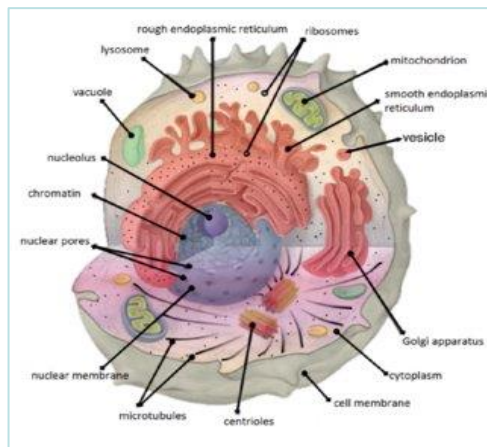
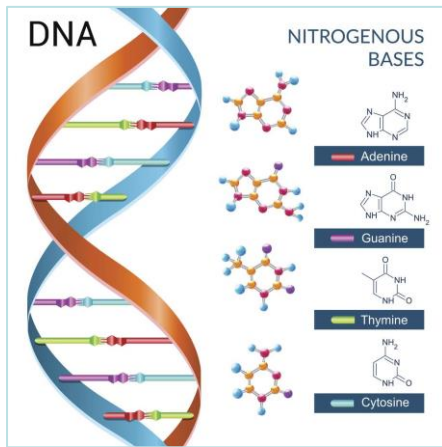
- in utero
- childhood and “peak development”
- adulthood
- old age

Variation increases as life goes on (ageing)

How can we judge a person's health?

- where do we look?

Where should we look ?



Is there an “ideal” to compare with?

At what age?

Which gender?

Which person?

In which country?

In what century?

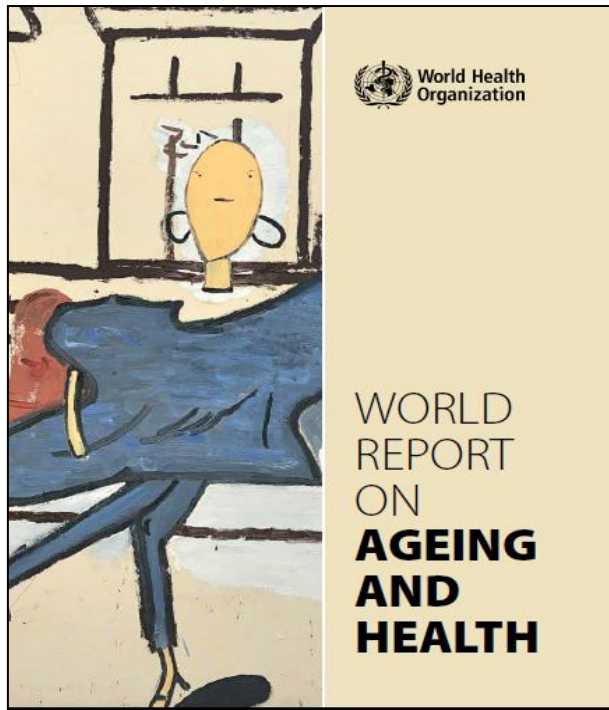
How have we defined health and ageing?

- WHO in 1948

*“Health is a state of complete physical, mental and social **well-being** and not merely **the absence of disease** or infirmity.”*

- Normal ageing vs disease
- Usual and successful aging (Rowe and Khan)
- Active ageing
- WHO in 2016: Healthy ageing

*“the process of developing and maintaining the **functional ability** that enables **well-being** in older age”*



developing and maintaining the **functional ability** that enables *well-being* in older age

- **well-being** is considered in the broadest sense and includes domains such as happiness, satisfaction and fulfilment
- **functional ability** comprises the health related attributes that *enable people to be and to do what they have reason to value.*

Functional Ability

is generated by

- **Intrinsic capacity** - composite of all the physical and mental capacities of an individual.
- **Environments** - comprising all the factors in the extrinsic world that form the context of an individual's life.
 - home, communities and the broader society.
 - range of factors, including the built environment
 - people and their relationships, attitudes, values
 - health and social policies, and their service
- **And their interaction**

What makes up Intrinsic capacity (*and associated functional ability?*)

- systematic reviews of longitudinal studies
- ELSA (English Longitudinal Study of Ageing)
 - 2560 community, representative participants aged over 60
 - multiple measures linked to later incident losses of function
- Structural equation modelling of biomarkers and self-reported measures
 - exploratory factor analysis
 - exploratory bi-factor analysis
- confirmatory factor analysis on separate cohort

BMJ Open The structure and predictive value of intrinsic capacity in a longitudinal study of ageing

John R Beard ^{1,2} A T Jotheeswaran,¹ Matteo Cesari,³
Islene Araujo de Carvalho ¹

To cite: Beard JR, Jotheeswaran AT, Cesari M, *et al*. The structure and predictive value of intrinsic capacity in a longitudinal study of ageing. *BMJ Open* 2019;**9**:e026119. doi:10.1136/bmjopen-2018-026119

► Prepublication history and additional material for this

ABSTRACT

Objectives To assess the validity of the WHO concept of intrinsic capacity in a longitudinal study of ageing; to identify whether this overall measure disaggregated into biologically plausible and clinically useful subdomains; and to assess whether total capacity predicted subsequent care dependence.

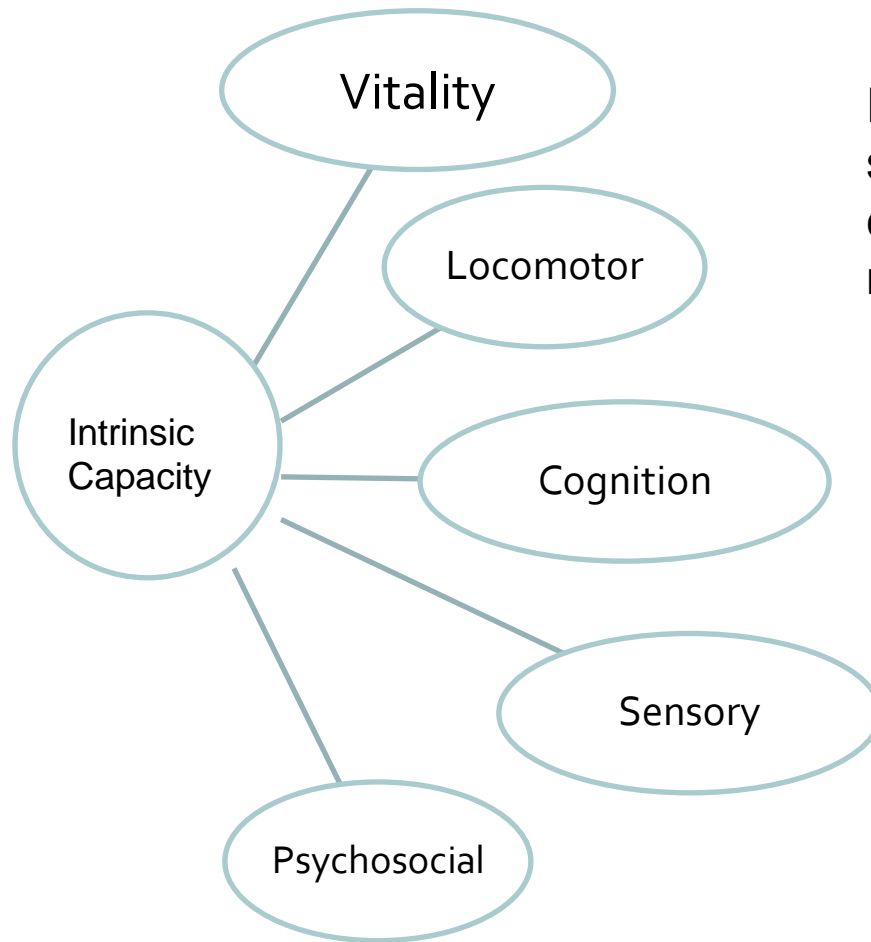
Design Structural equation modelling of biomarkers and self-reported measures in the English Longitudinal Study

Strengths and limitations of this study

► To our knowledge this is the first large population-based longitudinal analysis to examine the structure and predictive validity of the WHO concept of intrinsic capacity. We applied a rigorous psychometric approach for constructing a valid measurement model using commonly measured biomarkers and self-reported measures, allowing us to create a

BMJ Open 2019;9:e026119

(Emergent) factor structure



Each of these have several subdomains which contribute and can be measured

These five factors explained 86% of total variance among the intrinsic capacity indicators

Pathways to reduced functional ability

The contributions of age, sex and socioeconomic factors to incident functional loss **directly**, and **via multimorbidity** and **via Intrinsic capacity** can be quantified

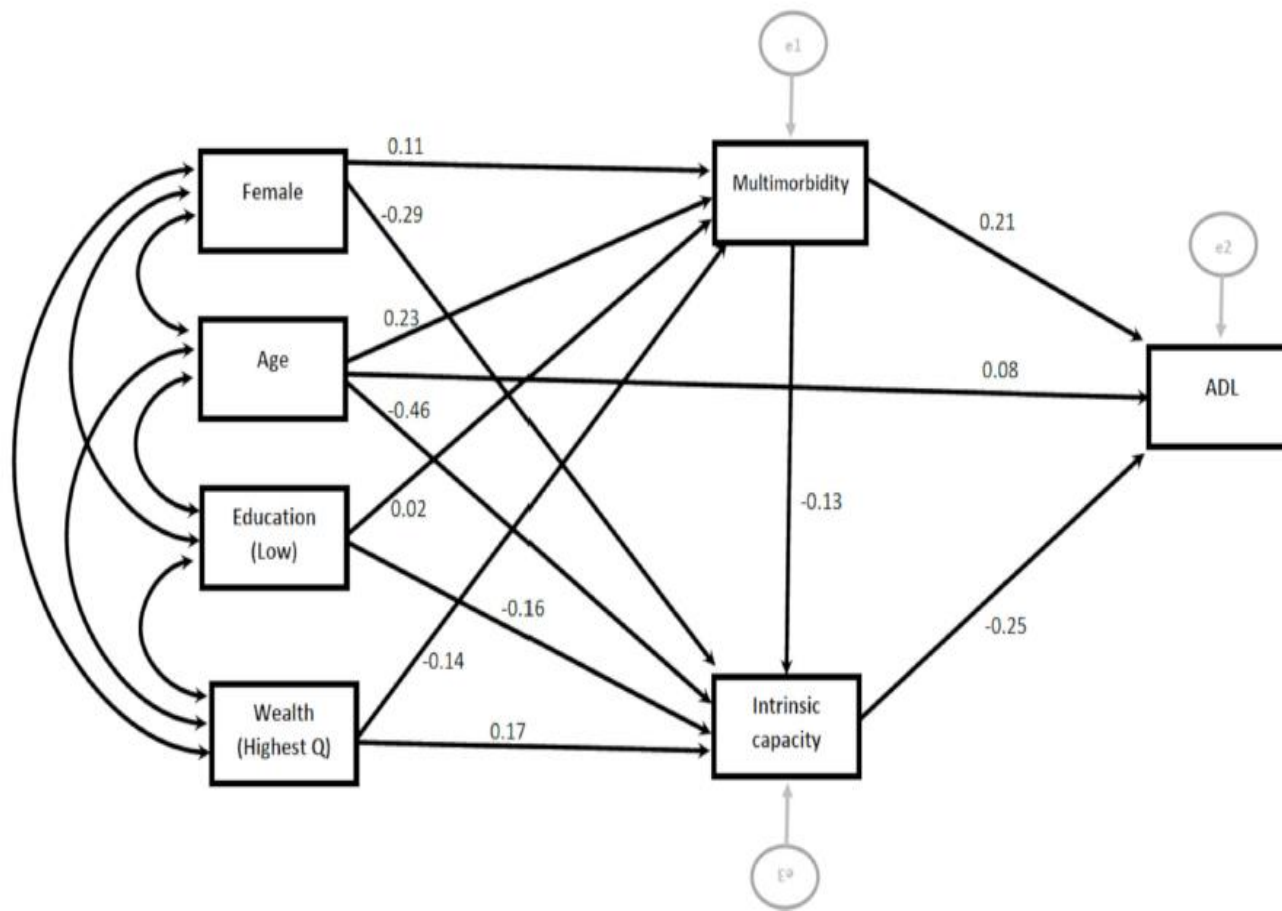


Figure 5 Direct and indirect effect of characteristics on activities of daily living (ADL).

- Impact of age on ADLs was more through intrinsic capacity (30%) than directly (24%)
- All personal characteristics had statistically significant impacts on ADLs and IADLs through intrinsic capacity

Further validation

Review of systematic reviews

- Which ICF defined body functions are most strongly associated with incident functional loss and care dependence



Journals of Gerontology: Medical Sciences
cite as: *J Gerontol A Biol Sci Med Sci*, 2018, Vol. 00, No. 00, 1–8

doi:10.1093/gerona/gly011

Advance Access publication February 02, 2018

OXFORD

Review

Evidence for the Domains Supporting the Construct of Intrinsic Capacity

Matteo Cesari, MD, PhD,^{1–4} Islene Araujo de Carvalho, MD, MPH,⁵
Jotheeswaran Amuthavalli Thiyagarajan, MSC, PhD,⁵ Cyrus Cooper, MD, FMedSci,⁶
Finbarr C. Martin, MD, MSc,⁷ Jean-Yves Reginster, MD, PhD,⁸ Bruno Vellas, MD, PhD,^{1,2}
and John R. Beard, MBBS, PhD⁵

This validated the domains identified for intrinsic capacity

The story so far

- Health of an older adult is about function not disease count
- The main domains of intrinsic capacity have been identified
- How does this turn out in practice – globally?

Study on global ageing and adult health (SAGE) longitudinal study

with nationally representative samples of persons aged 50+ years in China, Ghana, India, Mexico, Russia and South Africa

Assessment of health state:

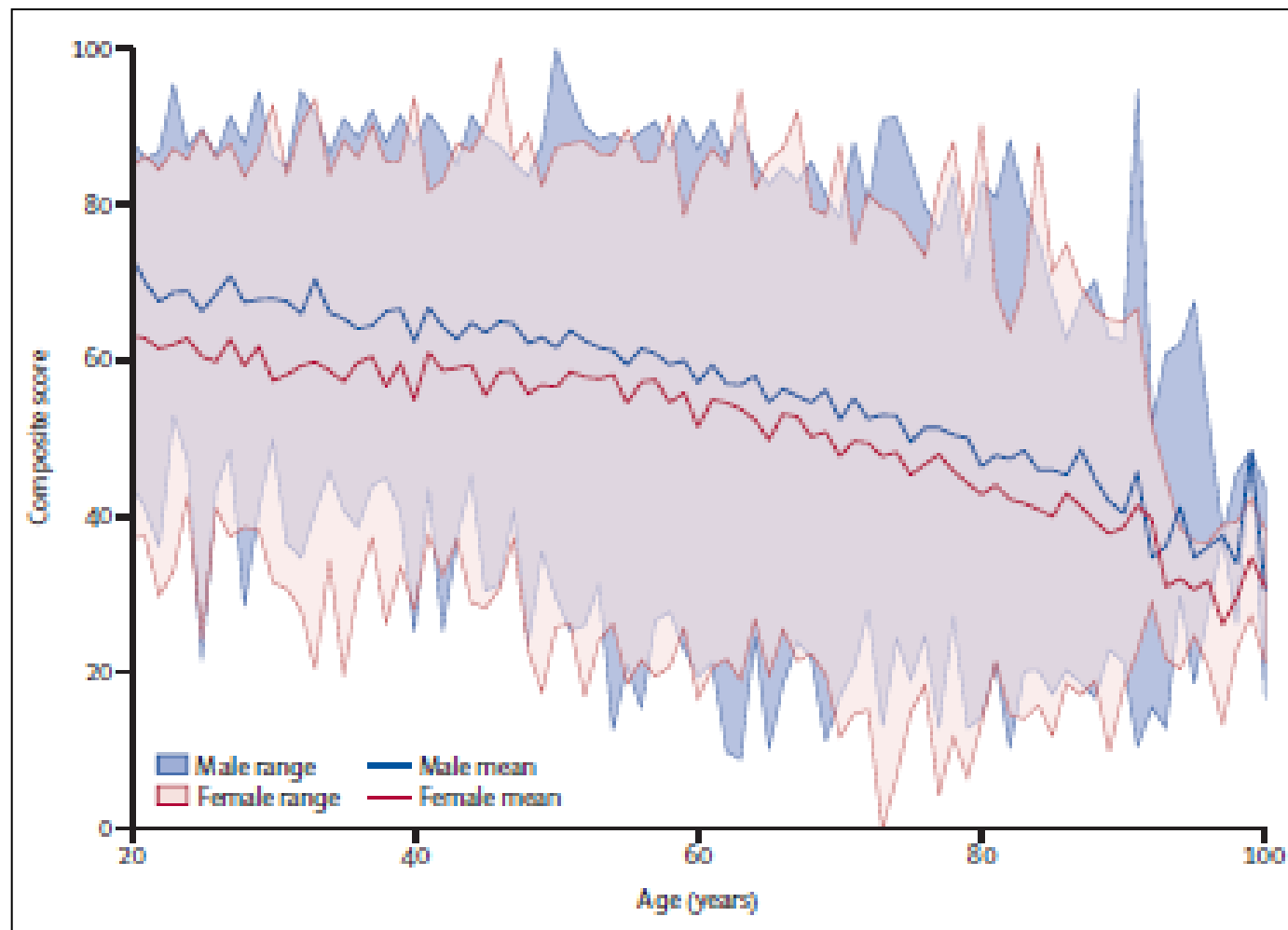
8 Domain multidimensional construct:

responses to self-reported difficulties

➤ affect, cognition, interpersonal relationships, mobility, pain, self-care, sleep/energy and vision.

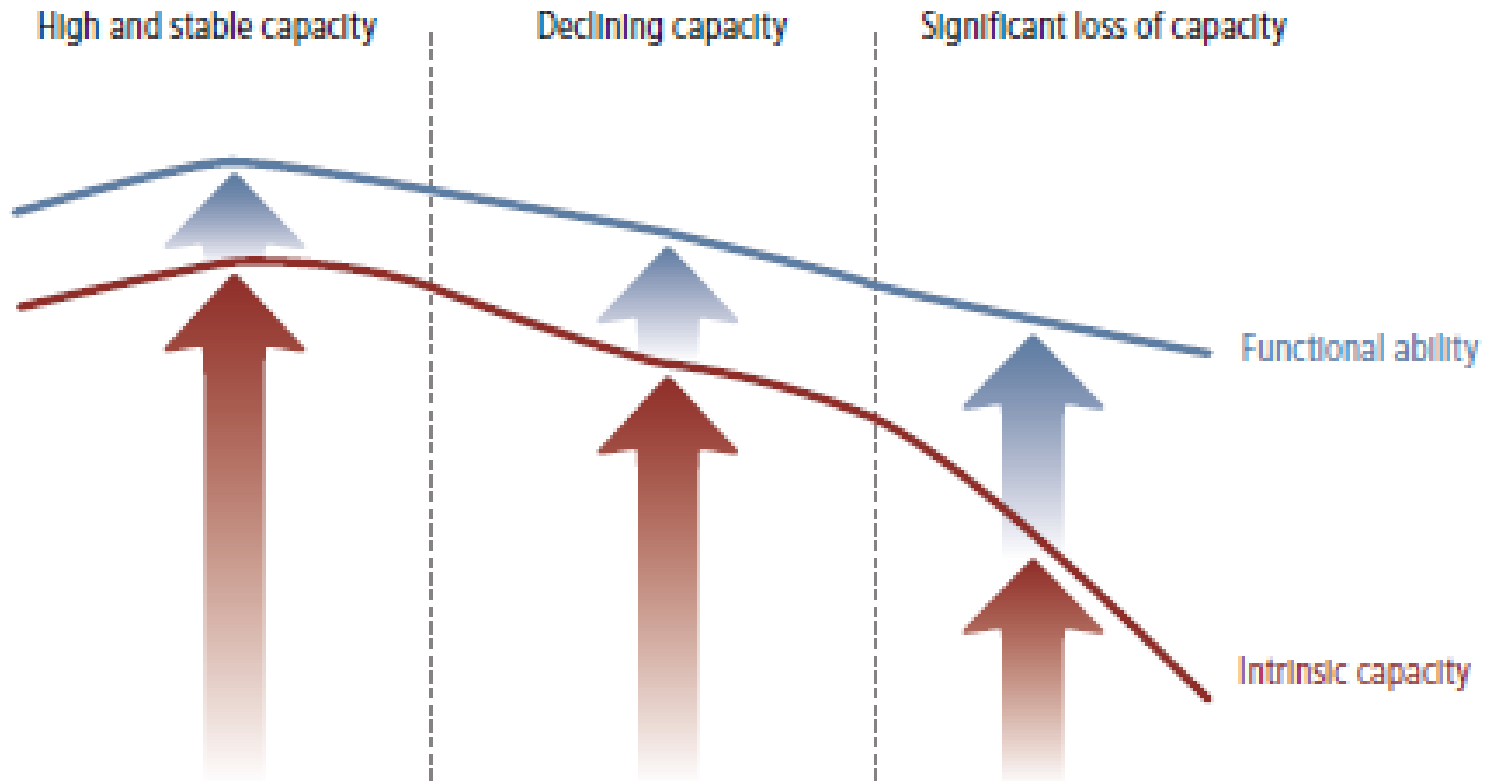
Data were scored using item response theory, and a partial credit model used to calculate the composite health score, ranging from 0 to 100 (good health)

“intrinsic capacity” adapted from the composite health measure from SAGE



Source: Beard et al. *the Lancet* 2015

Mean trajectories of Intrinsic Capacity and Functional Ability



How to measure Intrinsic capacity

WHO: (2019)

Assessment of Intrinsic capacity

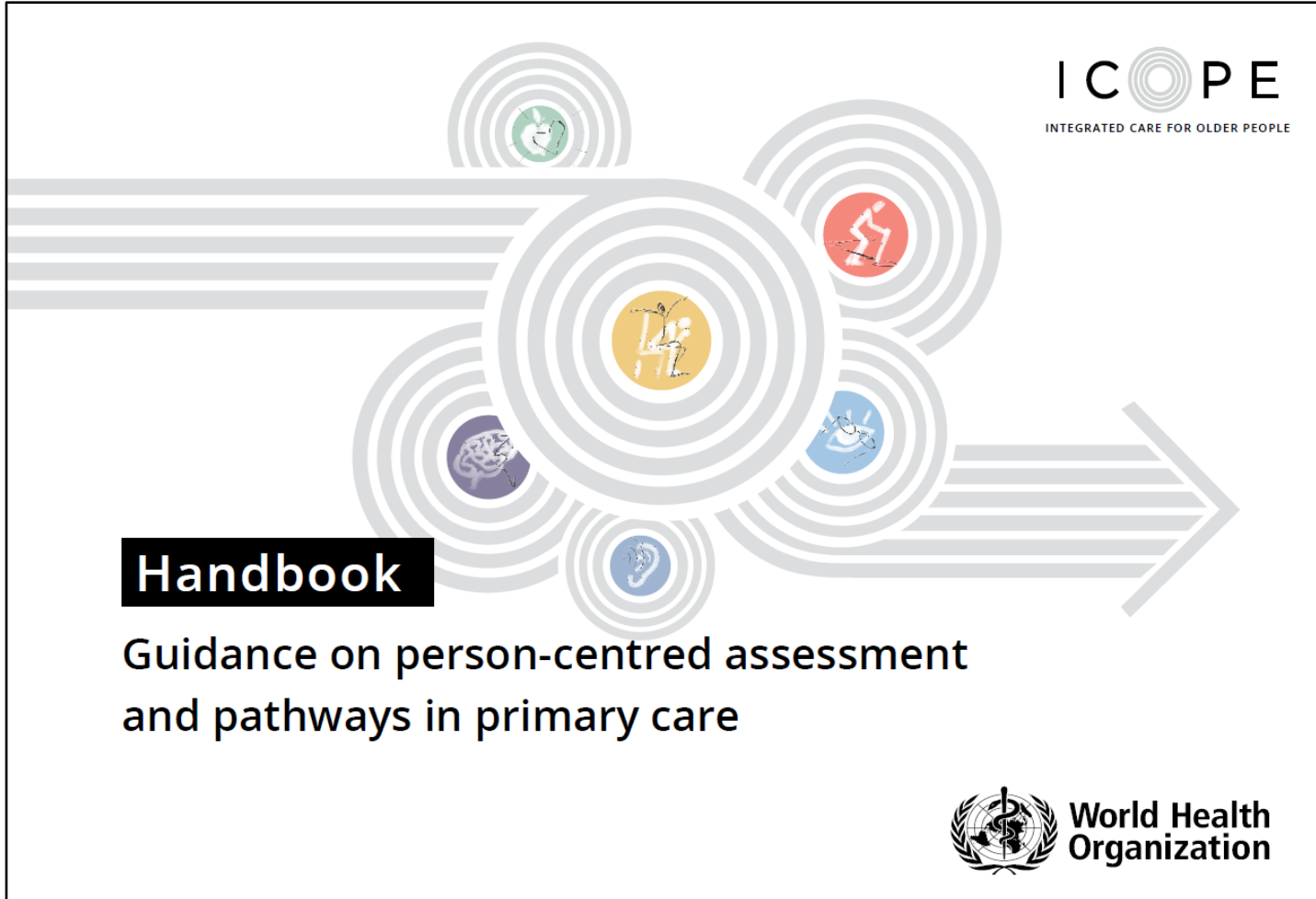


TABLE 1.
WHO ICOPE SCREENING TOOL

Priority conditions associated with declines in intrinsic capacity	Tests	Assess fully if any answer in each domain triggers this
COGNITIVE DECLINE (Chapter 4)	1. Remember three words: flower, door, rice (for example) 2. Orientation in time and space: What is the full date today? Where are you now (home, clinic, etc)? 3. Recalls the three words?	<input type="radio"/> Wrong to either question or does not know <input type="radio"/> Cannot recall all three words
LIMITED MOBILITY (Chapter 5)	Chair rise test: Rise from chair five times without using arms. Did the person complete five chair rises within 14 seconds?	<input type="radio"/> No
MALNUTRITION (Chapter 6)	1. Weight loss: Have you unintentionally lost more than 3 kg over the last three months? 2. Appetite loss: Have you experienced loss of appetite?	<input type="radio"/> Yes <input type="radio"/> Yes
VISUAL IMPAIRMENT (Chapter 7)	Do you have any problems with your eyes: difficulties in seeing far, reading, eye diseases or currently under medical treatment (e.g. diabetes, high blood pressure)?	<input type="radio"/> Yes
HEARING LOSS (Chapter 8)	Hears whispers (whisper test) <i>or</i> Screening audiometry result is 35 dB or less <i>or</i> Passes automated app-based digits-in-noise test	<input type="radio"/> Fail
DEPRESSIVE SYMPTOMS (Chapter 9)	Over the past two weeks, have you been bothered by – feeling down, depressed or hopeless? – little interest or pleasure in doing things?	<input type="radio"/> Yes <input type="radio"/> Yes

5

Locomotor capacity

Care pathways to improve mobility

Multimodal exercise → 5.1

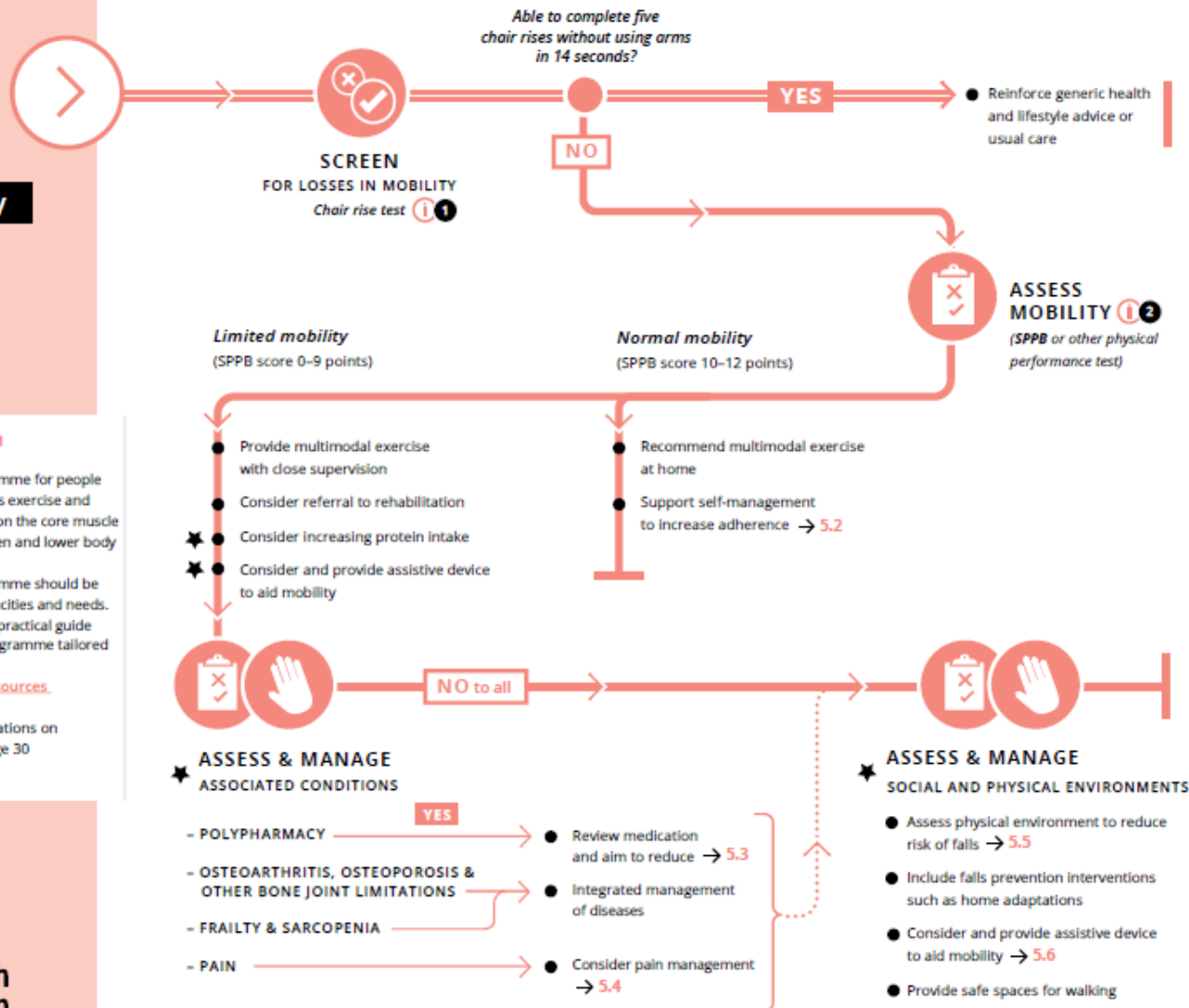
A multimodal exercise programme for people with limited mobility combines exercise and cross-training with emphasis on the core muscle groups of back, thigh, abdomen and lower body

A multimodal exercise programme should be tailored to suit individual capacities and needs. The **Vivifrail project** offers a practical guide to developing an exercise programme tailored to capacities

<http://www.vivifrail.com/resources>

For WHO global recommendations on physical activity, see box, page 30

★ Specialized care needed



WHEN SPECIALIZED CARE IS NEEDED

Locomotor capacity should be assessed together with other aspects of intrinsic capacity, such as cognition, sensory, vitality and psychological capacities. If significant declines in physical or mental capacity or comorbidities make exercise prescription more complex, specialist knowledge may be needed to devise a suitable exercise programme. Referral to rehabilitation may be considered.



CHAIR RISE TEST

A simple test can decide whether an older person needs further assessment for limited mobility.

Instructions: Ask the person, "Do you think it would be safe for you to try to stand up from a chair five times without using your arms?" (Demonstrate to the person.)

If YES, ask them to:

- sit in the middle of the chair
- cross and keep their arms over their chest
- rise to a full standing position and then sit down again
- repeat five times as quickly as possible without stopping.

Time the person taking the test - further assessment is needed if they **cannot stand up five times within 14 seconds.**



SHORT PHYSICAL PERFORMANCE BATTERY (SPPB)

While a wide range of physical performance tests is available, the SPPB is recommended, as it has superior measurement properties and is useful across a range of abilities. The SPPB measures timed performance on three tasks, each scored out of four, to derive a score from zero (worst performance) to 12 (best performance).

First, describe each test and ask if the person feels able to do it. If not, score accordingly and move to the next step.

1. Balance tests: Stand for 10 seconds with feet in each of the following three positions. Use the sum of the scores from the three positions.

2. Gait speed test: Time to walk four metres. (If they use a cane or walking aid and feel they need it to walk a short distance, they may use it.)

Time for four-metre walk:

< 4.82 seconds	4 points
4.82 - 6.20 seconds	3 points
6.21 - 8.70 seconds	2 points
> 8.70 seconds	1 point
Unable to complete	0 points

3. Chair rise test: Time to rise from a chair five times

< 11.19 seconds	4 points
11.2 - 13.69 seconds	3 points
13.7 - 16.69 seconds	2 points
16.7 - 59.9 seconds	1 point
> 60 seconds or unable to complete	0 points

Final SPPB score = sum of scores from the three tests above.



More detail on the SPPB test:

http://hdcs.fullerton.edu/csa/research/documents/sppbinstructions_scoresheet.pdf

5

Locomotor capacity

Care pathways to improve mobility



A. Side-by-side stand

Held for 10 seconds	1 point
Not held for 10 seconds	0 points
Not attempted	0 points

If not attempted, end balance tests.



B. Semi-tandem stand

Held for 10 seconds	1 point
Not held for 10 seconds	0 points
Not attempted	0 points

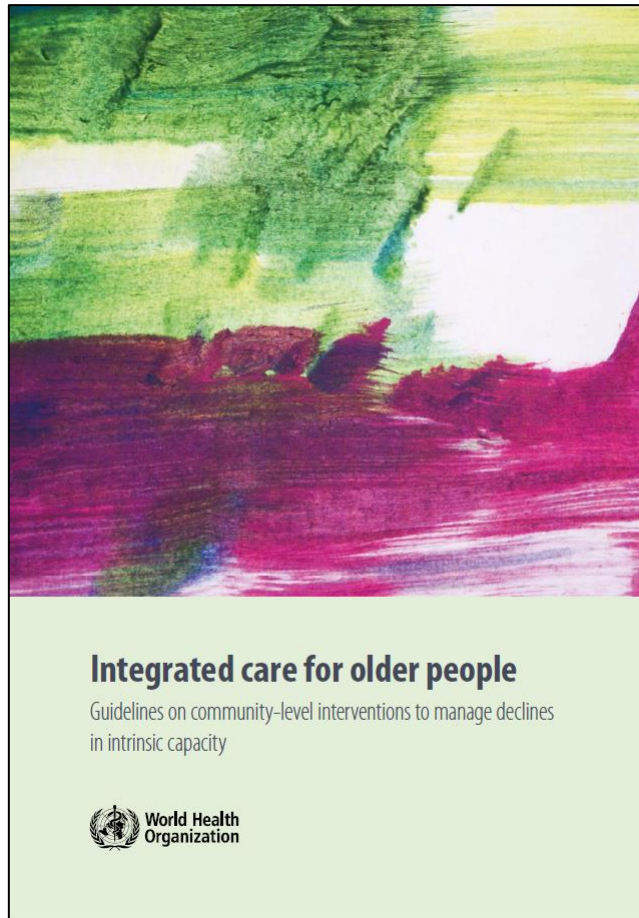
If not attempted, end balance tests.



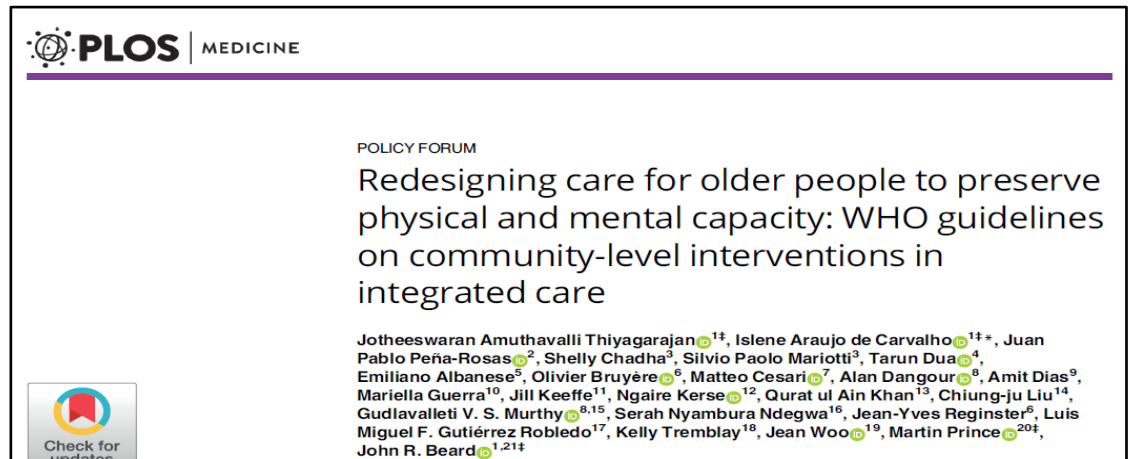
C. Tandem stand

Held for 10 seconds	2 points
Held for 3 to 9.99 seconds	1 point
Held for < 3 seconds	0 points
Not attempted	0 points

WHO Guidelines on Community level Interventions for declines in Intrinsic Capacity



Thiyagarajan JA et al.2019 PLOS Med 16(10) e1002948



Intrinsic Capacity – will it catch on?

“Competing” paradigms include

- Multimorbidity
- Frailty (and resilience?)

Intrinsic Capacity and Frailty

Share biological plausibility

Explicit structure

Sounds positive

Links to interventions

Lifecourse approach

Contentious structure

Sounds negative

Inconsistent links

Focus on late life

How does this relate to Integrated care (ICOPE)

Lifecourse approach using Intrinsic
Capacity and Functional ability

Potential uses of Intrinsic Capacity score in research, public health and clinical practice

- Globally applicable health measure
- Comparative cohort trends to inform policy
- Trajectories to monitor individuals
- Stratification to target groups
- Focus and outcome of interventions

Some examples from published work so far

External validation of the IC operationalisation

JOURNAL ARTICLE

Functional health index of intrinsic capacity: multi-domain operationalisation and validation in the Singapore Longitudinal Ageing Study (SLAS2) [Get access >](#)

Chin Yee Cheong, Philip Yap, Ma Shwe Zin Nyunt, Gao Qi, Xinyi Gwee, Shiou Liang Wee, Keng Bee Yap, Tze Pin Ng ✉

Age and Ageing, Volume 51, Issue 3, March 2022, afac011, <https://doi.org/10.1093/ageing/afac011>

Published: 01 March 2022 **Article history** ▼

> *J Gerontol A Biol Sci Med Sci*. 2022 Jan 7;77(1):94-100. doi: 10.1093/gerona/glab226.

Intrinsic Capacity: Validation of a New WHO Concept for Healthy Aging in a Longitudinal Chinese Study

John R Beard ¹, Yafei Si ^{1 2}, Zhixin Liu ³, Lynn Chenoweth ⁴, Katja Hanewald ^{1 2}





Validation of the brief screening tool to identify
those with IC declines from Hong Kong
BMC Geriatrics 2022

RESEARCH

Open Access

Intrinsic capacity of older people in the community using WHO Integrated Care for Older People (ICOPE) framework: a cross-sectional study



Angela Y. M. Leung^{1,2,3}, Jing Jing Su^{1,2,3}, Elsa S. H. Lee⁴, Jeff T. S. Fung³ and Alex Molassiotis^{1,3*}

Feasibility and predictive ability for screening high risk

> J Frailty Aging. 2022;11(3):302-308. doi: 10.14283/jfa.2022.19.

Prevalence and Distribution of Intrinsic Capacity and Its Associations with Health Outcomes in Older People: The Jockey Club Community eHealth Care Project in Hong Kong

R Yu ¹, G Leung, J Leung, C Cheng, S Kong, L Y Tam, J Woo

Predictive power of IC trajectories

The screenshot shows the front page of an article in the journal Maturitas. The journal's logo and name are at the top left. Navigation links like 'Submit', 'Log in', and 'Register' are at the top right. The article title is prominently displayed in the center. Below the title, the authors' names are listed. At the bottom, the publication date and DOI are provided, along with a 'Check for updates' button. On the right side, there are icons for 'Purchase', 'Subscribe', and 'Save'. A faint background image of a line graph is visible on the right side of the page.

MATURITAS
An international journal of midlife health and beyond

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ORIGINAL ARTICLE | VOLUME 161, P49-54, JULY 01, 2022

Longitudinal trajectories of intrinsic capacity and their association with quality of life and disability

Aarón Salinas-Rodríguez • Emmanuel González-Bautista • Ana Rivera-Almaraz • Betty Manrique-Espinoza

Published: February 26, 2022 • DOI: <https://doi.org/10.1016/j.maturitas.2022.02.005> • Check for updates

Purchase Subscribe Save

IC as a target and outcome measure for physical exercise interventions

Randomized Controlled Trial

> J Am Med Dir Assoc. 2021 Apr;22(4):780-786.e2.

doi: 10.1016/j.jamda.2020.06.048. Epub 2020 Aug 5.

Effect of Various Exercises on Intrinsic Capacity in Older Adults With Subjective Cognitive Concerns

Chi Hsien Huang¹, Hiroyuki Umegaki², Taeko Makino², Kazuki Uemura², Takahiro Hayashi², Tomoharu Kitada³, Aiko Inoue³, Hiroyuki Shimada⁴, Masafumi Kuzuya⁵

Affiliations + expand

PMID: 32768376 DOI: 10.1016/j.jamda.2020.06.048

IC assessment linked to falls and fracture prevention

The potential of assessment based on the WHO framework of intrinsic capacity in fragility fracture prevention

Paolo Astrone¹  · Monica Rodrigues Perracini^{2,3} · Finbarr C. Martin⁴ · David R. Marsh⁵ · Matteo Cesari^{6,7}

Received: 4 April 2022 / Accepted: 14 June 2022

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Ongoing work is being collated and co-ordinated by the WHO Clinical Consortium on Healthy Ageing

Data based modelling

- Mexico from Costa Rican longitudinal study
- HRS family

Intervention studies

- India
 - Clinical population
 - Community clinics
- China
- Japan –Kanagawa
- Thailand (Pilot study)

Take home thoughts

- The new definition of healthy ageing aligns better with the reality of ageing and what matters to people
- Intrinsic capacity is an important pathway between age related changes (including diseases) and functional ability
- It is a feasible approach in community, lower resource and less specialised settings
- It is conceptual and practical support to moving away from the Disease Era
- It can easily link with CGA and the “geriatrics” approach to healthcare

Thanks for listening and
enjoy the Conference