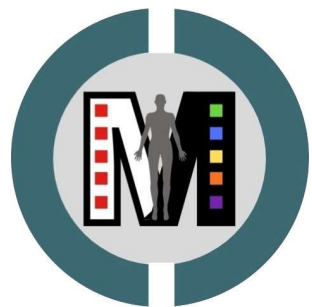


Resilience, frailty and multimorbidity from a researcher's perspective

René Melis MD PhD, senior researcher geriatric epidemiology,
Department of geriatric medicine



*2nd Symposium Multimorbidity – A complex truth for patients,
physicians and policymakers – November 7, 2022*

Radboudumc

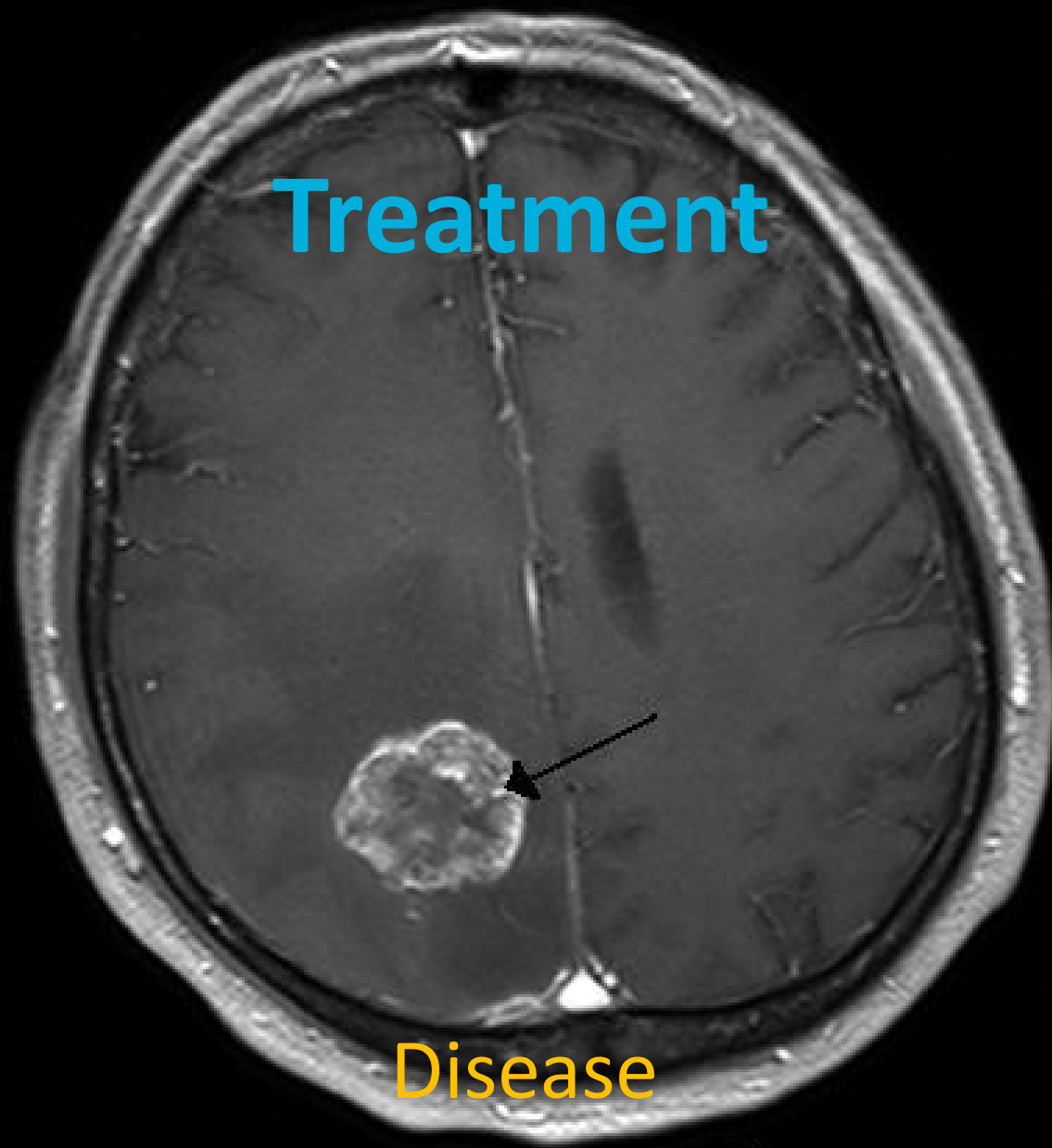
Introduction

- (Chronic) illness and treatment as (acute) health stressors are prevalent in older persons
- Older persons often have other (chronic) conditions
- Both age and multimorbidity cause heterogeneity in ...
 - Disease presentation
 - Disease course
- Unexpectedly good or bad outcomes
- COVID-19 disease presentation and course is exemplary

Contents

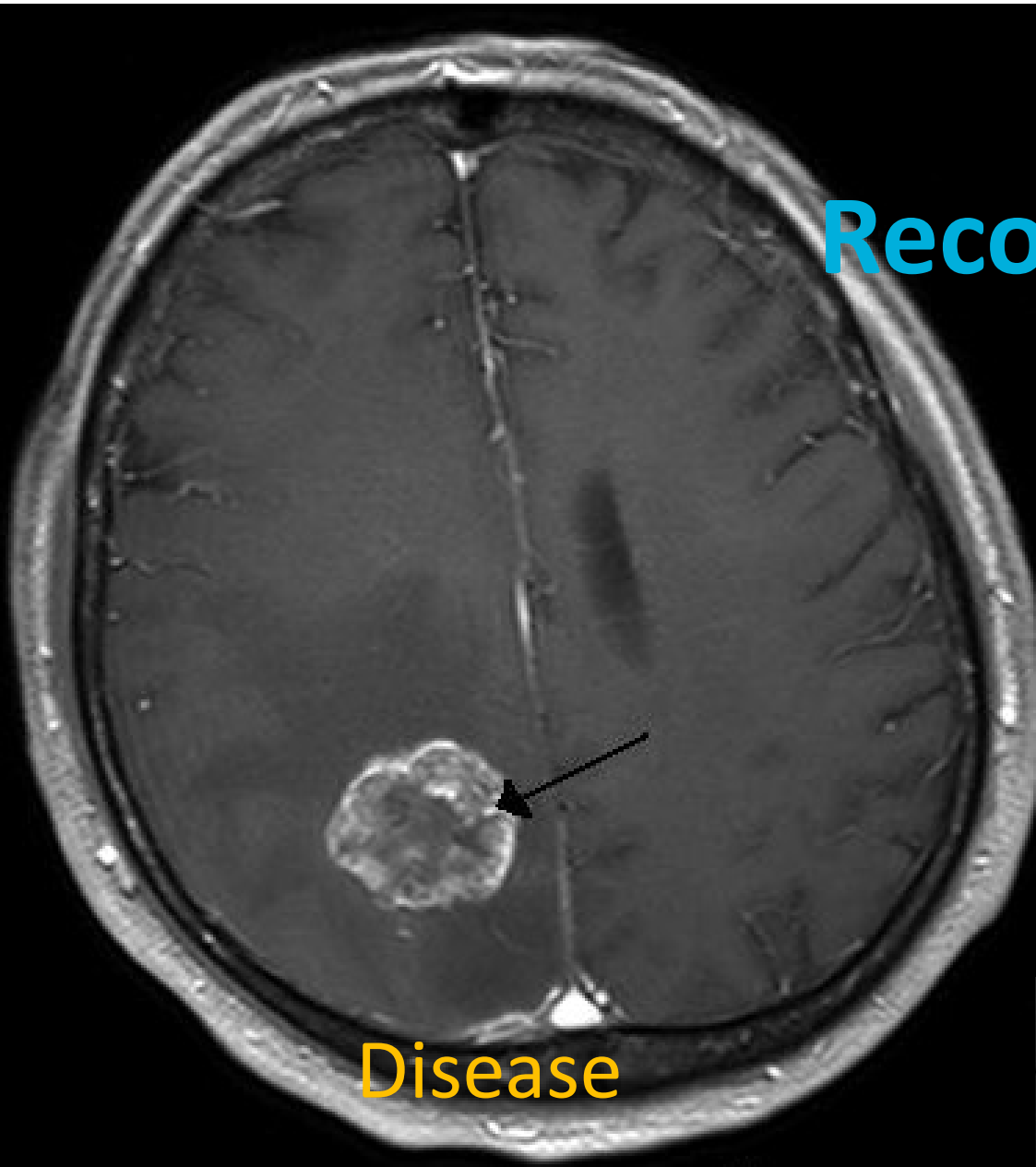
- **Why** focus on (physical) resilience?
- **What** is (physical) resilience?
- How to **measure/monitor** (physical) resilience?
- Can we **manage/support** (physical) resilience?

Why focus on resilience?



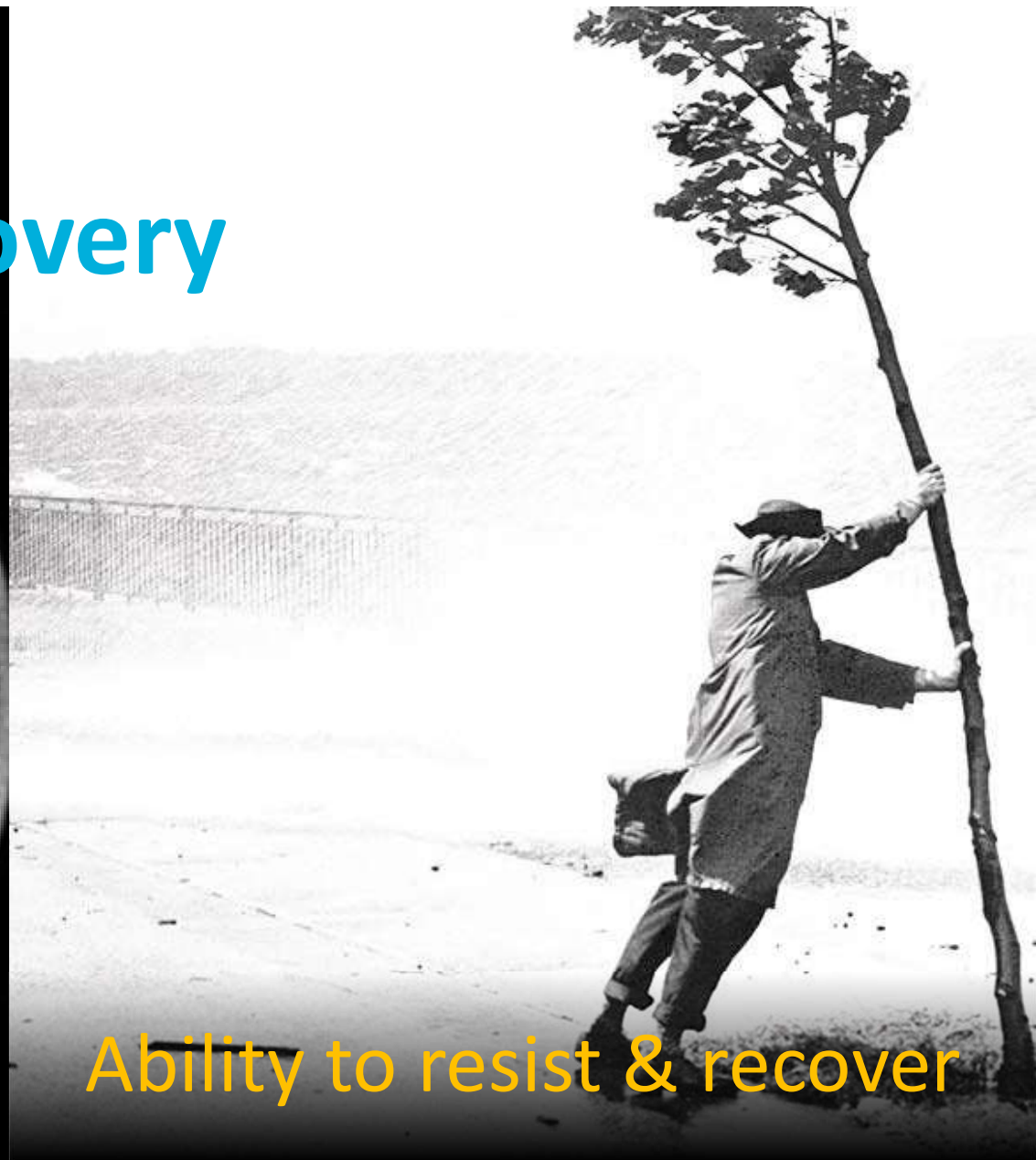
Treatment

Disease



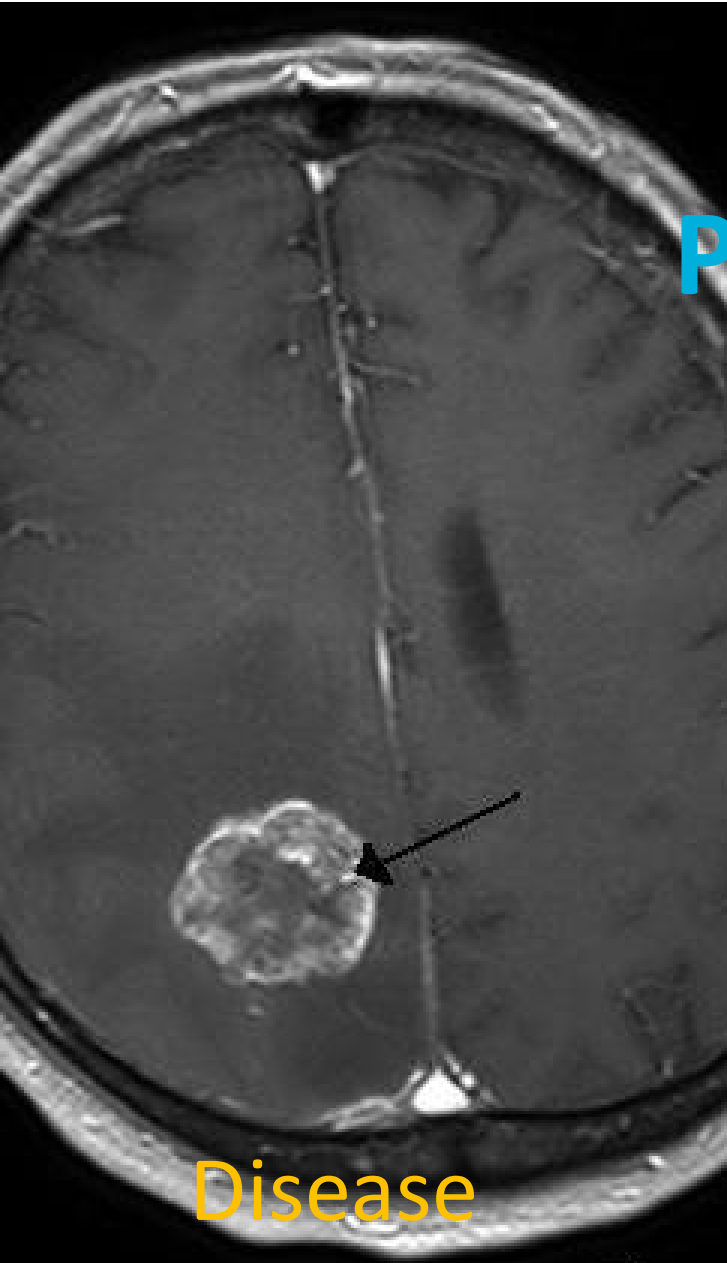
Disease

Recovery

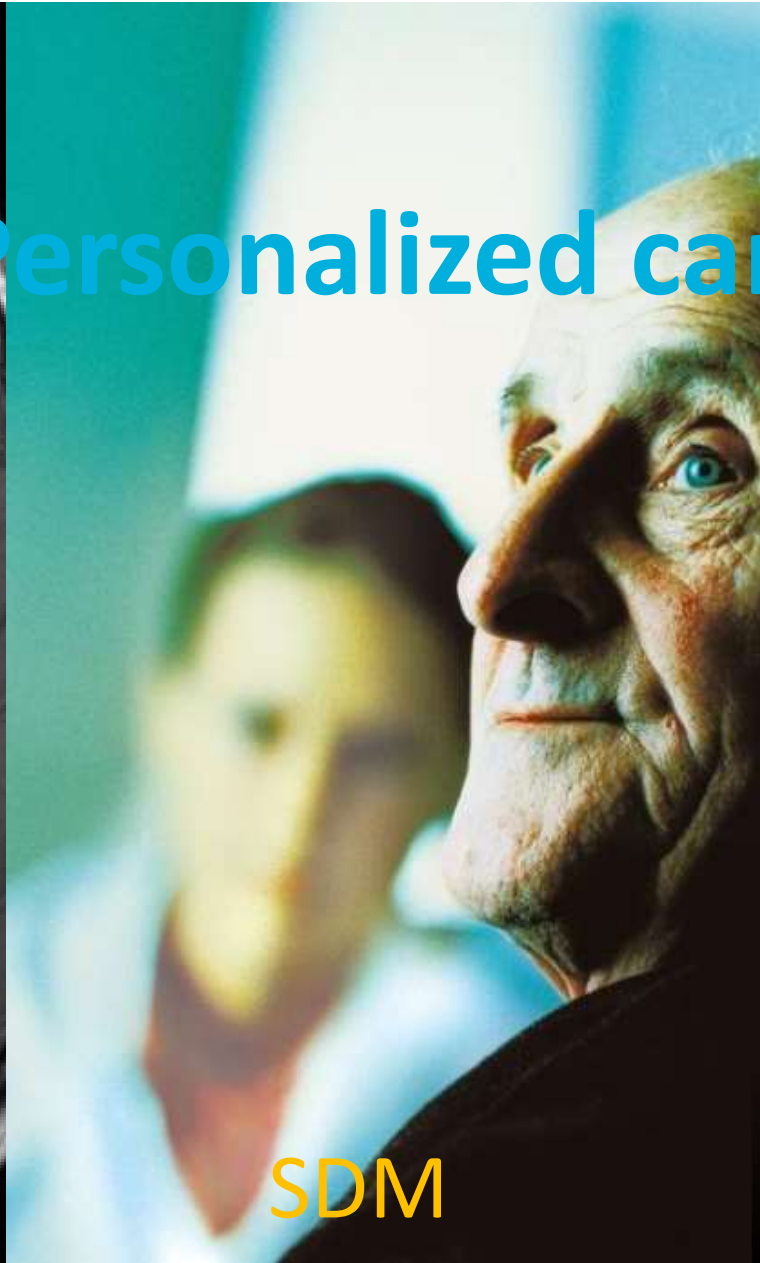


Ability to resist & recover

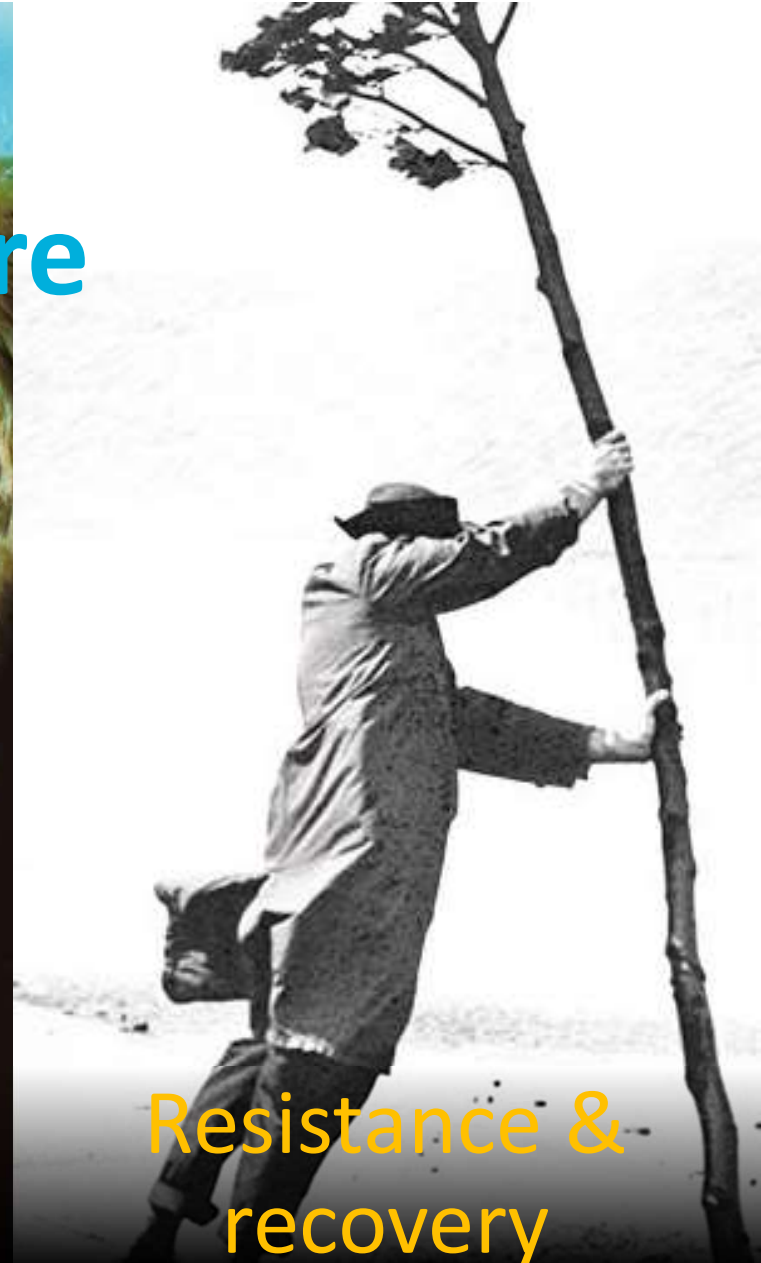
Personalized care



Disease



SDM



Resistance & recovery

Personalized care

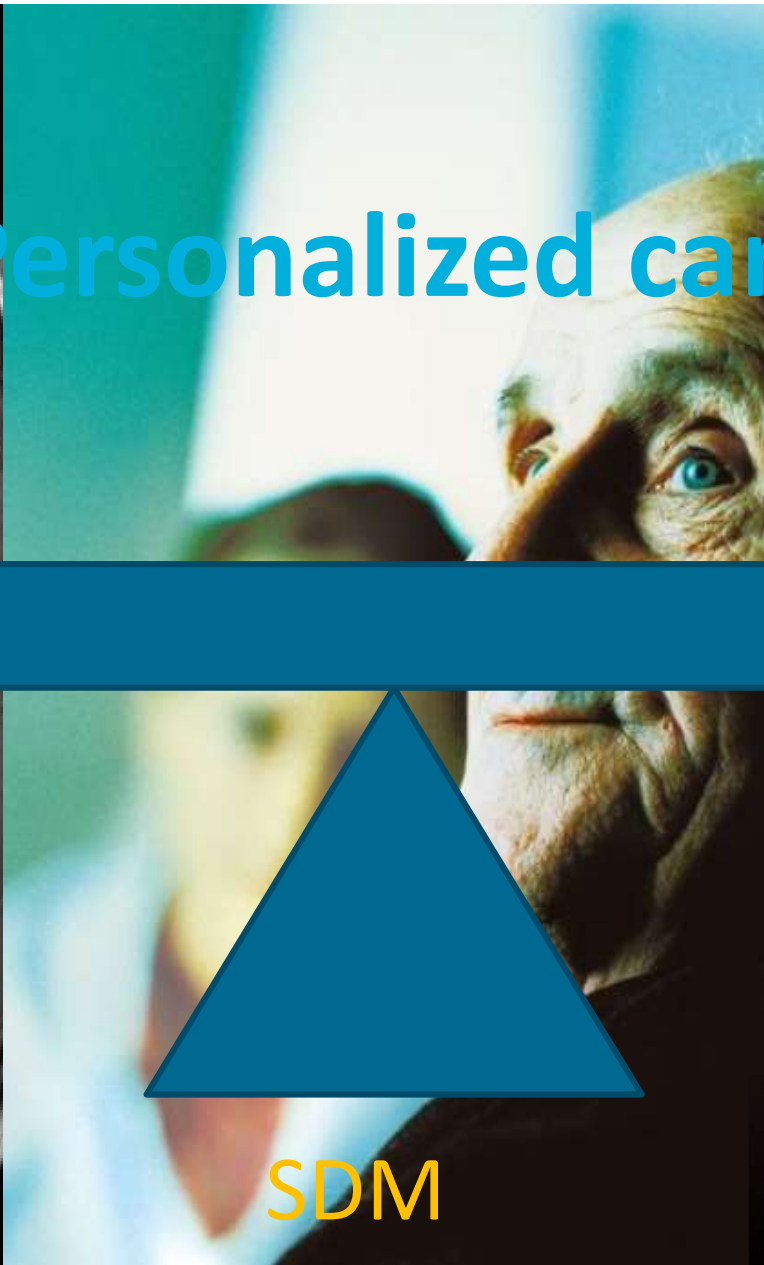
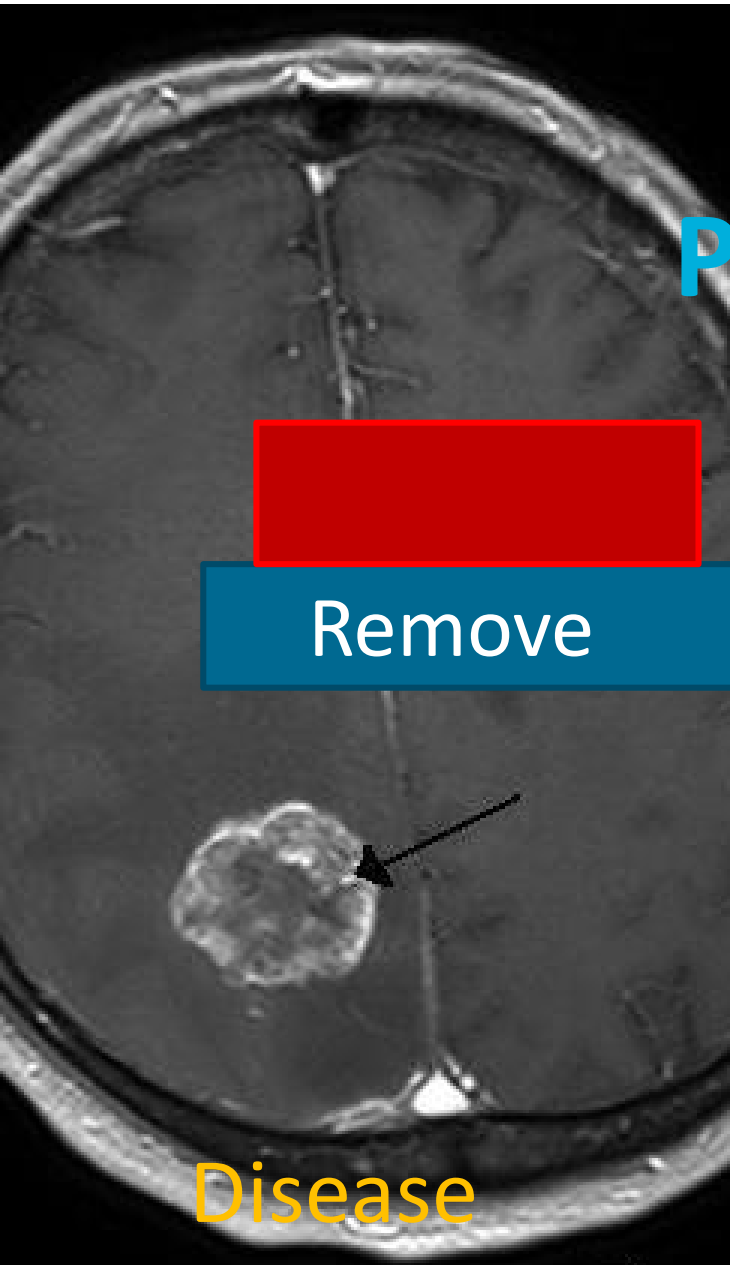
Remove

Support

Disease

SDM

Resistance & recovery



Personalized care

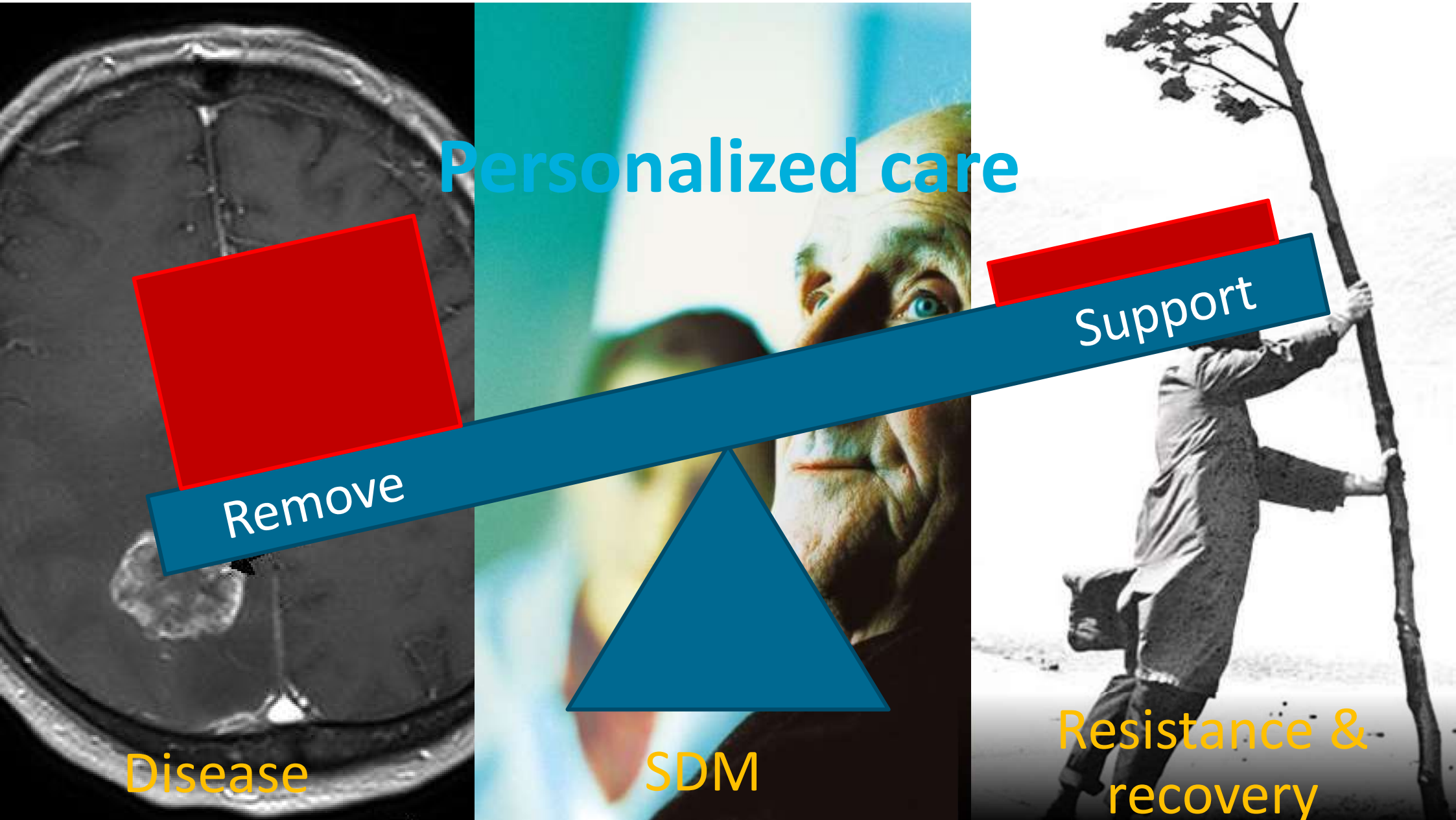
Remove

Disease

Support

SDM

Resistance & recovery



Origins of this imbalance

Central role of physician:

- Expert
- Therapist

Successes:

- Antibiotics
- Cancer treatment

Patient: Latin *patiēns* (genitief *-entis*):

- 'patient, suffering, bearing (without complaint)'

Resilience:

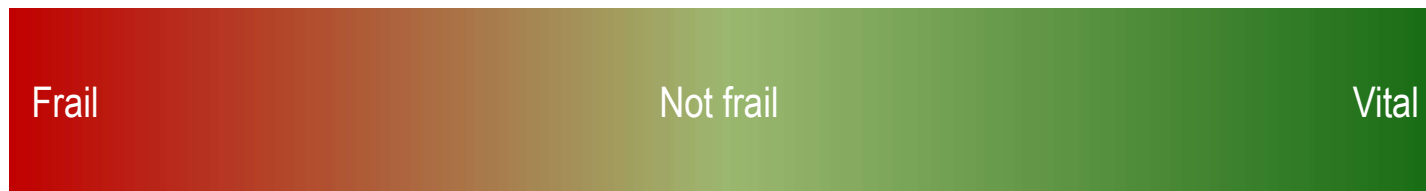
- 'Assumed'
- Difficult to measure



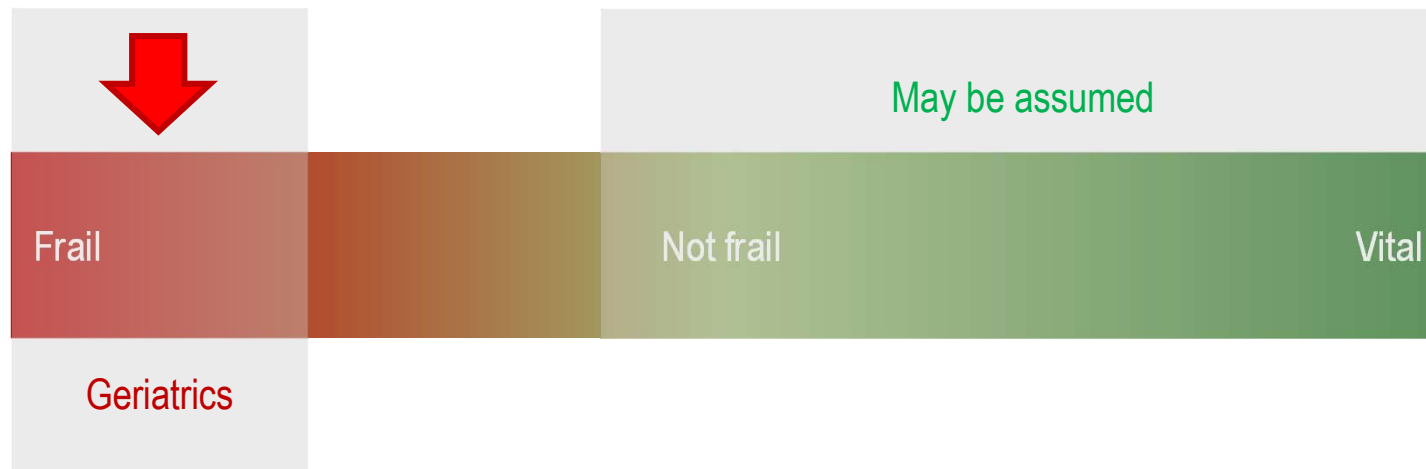
Leonid Rogozov, 1961

Relevance of this imbalance

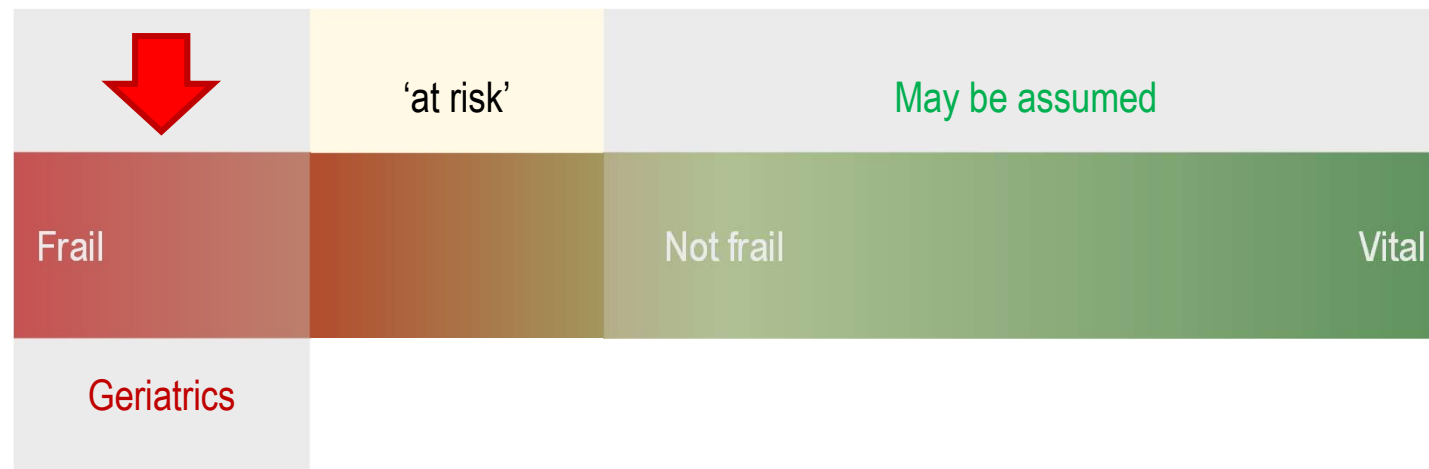
Aging spectrum



Recovery capacity



Recovery capacity



Study medical oncology Radboudumc

- 188 older persons, chemotherapy with curative intent
- Charlson Comorbidity index: 0
- Relative Dose Intensity (RDI, 0-100%):
 - Optimal, >85%: 51%
 - Suboptimal, 65-85%: 23%
 - **Insufficient, <65%: 26%**

Joint replacement surgery

ORTHOPAEDIC SURGERY



“Obesity is associated with an increased risk of undergoing KR, and at a younger age, particularly for females.”

Obesity is associated with an increased risk of undergoing knee replacement in Australia

Christopher J. Wall ^{*,†} Richard N. de Steiger ^{*,‡} Christopher J. Vertullo ^{*,||} James D. Stoney ^{*,§,**} Stephen E. Graves ^{*,§} Michelle F. Lorimer ^{††} and Srinivas Kondalsamy-Chennakesavan [†]

^{*}Department of Orthopaedics, Toowoomba Hospital, Darling Downs Health, Toowoomba, Queensland, Australia

[†]School of Medicine, Rural Clinical School, University of Queensland, Toowoomba, Queensland, Australia

[‡]Department of Surgery, The University of Melbourne, Melbourne, Victoria, Australia

[§]Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR), Adelaide, South Australia, Australia

^{||}Knee Research Australia, Gold Coast, Queensland, Australia

^{||}Menzies Health Institute Queensland, Griffith University, Gold Coast, Queensland, Australia

^{**}Department of Orthopaedics, St. Vincent's Hospital, Melbourne, Victoria, Australia and

^{††}South Australian Health and Medical Research Institute (SAHMRI), Adelaide, South Australia, Australia

Study	Joint	% suboptimal recovery
Bourne (2010)	Knee	Function: 16 - 30% / Pain: 14 - 28%
Vissers (2010)	Knee	11 - 25%
Robertsson (2000)	Knee	8 - 19%
Bryan (2018)	Knee	16%
Baker (2007)	Knee	18%

Exemplary for many patient groups

- Trend of ...
 - Treatments become safer/better *alongside*
 - Broadening of treatment indication to include groups ...
 - Not evidently frail, but ...
 - Older, lifestyle (obesity), chronic (multi)morbidity
- Better recovery support is needed

Why focus on resilience? Summary (1)

- To complement **disease management** with **recovery support**
- Quote from focus group study on application of resilience in older adult care (Angevare et al.):
 - *“resilience [...] allows [...] to [...] create a thinking model in which it makes sense that you **go a little further than just treating the disease.**’
(care professional)”*

Why focus on resilience? Summary (2)

- Reframes the *“failure model of ageing”* (Desmond O’Neill) positively
 - Older persons as respondents *“universally regarded ‘frail’ as a negative label.”* (Nicholson et al.)
 - Successful aging as *“selective optimization and compensation”* (Baltes & Baltes)
 - Positive health as *“the ability to adapt and to self manage, in the face of [...] challenges”* (Huber et al.)

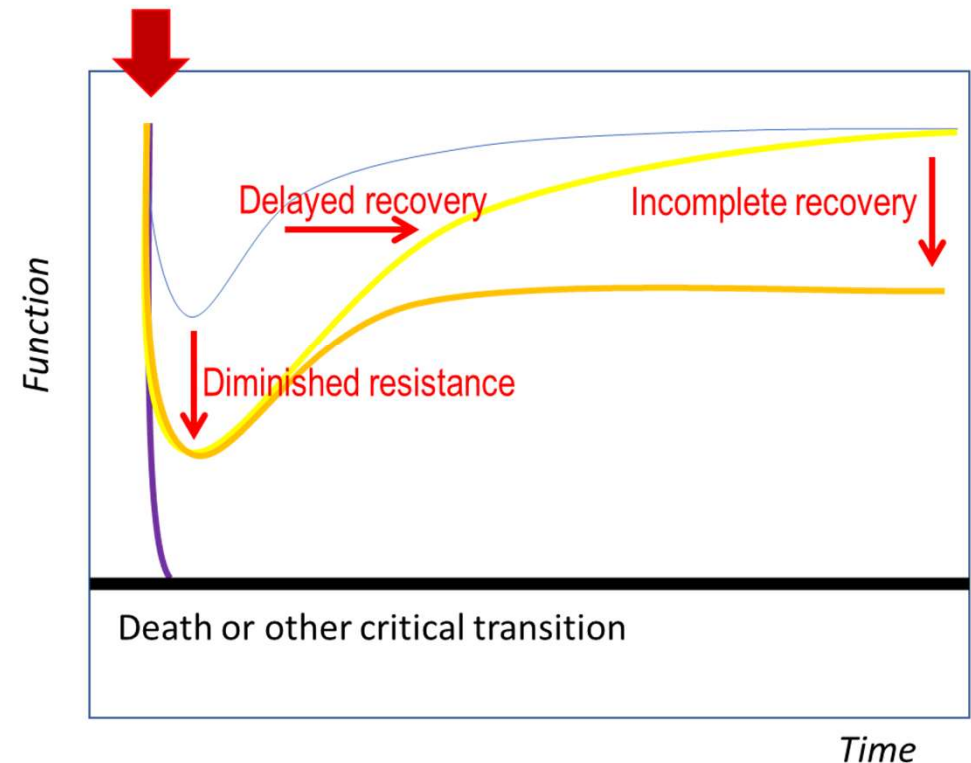
What is resilience?

Physical resilience

- “Ability to resist or recover from functional decline following *health* stressor(s)”



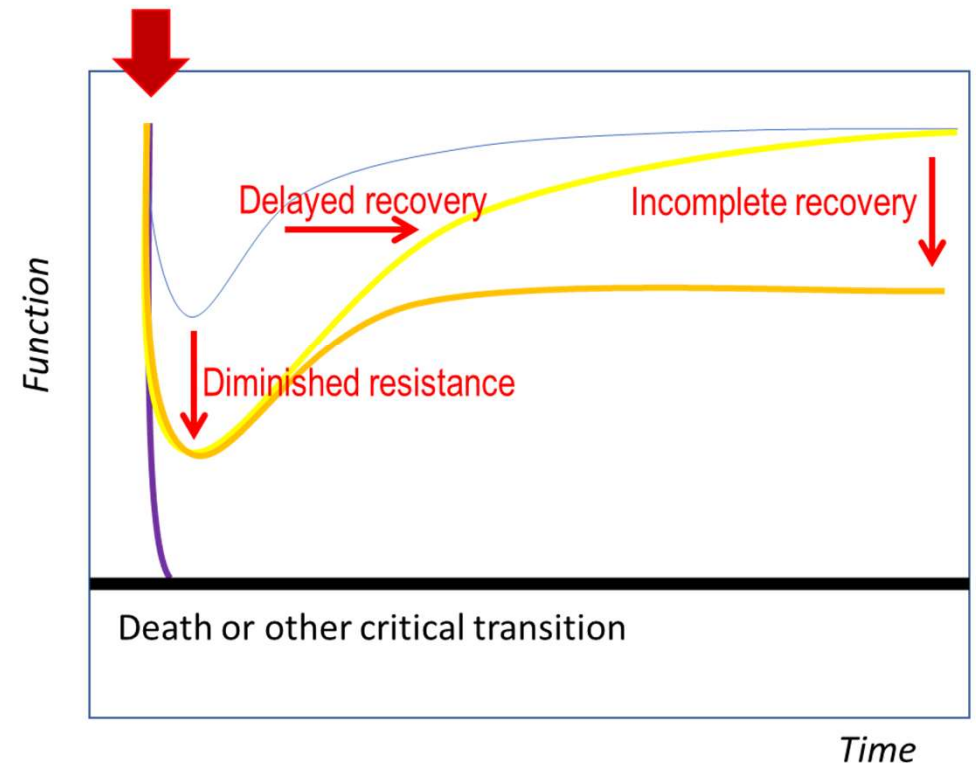
Disease, treatment or other stressor



Physical resilience

- Dynamic response to a stressor/perturbation
- No two stressors are the same
- Resilience is an outcome
 - Stressor \leftrightarrow older person
- Needs to be assessed longitudinally!
- Resilience trajectory

Disease, treatment or other stressor



Psychological resilience

- Adversity
 - Acute stressor (e.g., (sexual) assault)
 - Major event (e.g., early life adversity, bereavement, job loss)
 - Chronic stressor (e.g., poverty, chronic health problems)
- Outcomes
 - Recovery
 - Adaptation
 - Sustainability
 - Growth
- Resilience is sometimes equated to personality traits, however ...

Psychological resilience

nature
human behaviour

PERSPECTIVE

<https://doi.org/10.1038/s41562-017-0200-8>

The resilience framework as a strategy to combat stress-related disorders

Raffael Kalisch^{1,2,3,4*}, Dewleen G. Baker^{5,6}, Ulrike Basten^{4,7}, Marco P. Boks⁸, George A. Bonanno⁹, Eddie Brummelman^{3,10,11}, Andrea Chmitorz^{1,3,12}, Guillén Fernández^{3,13}, Christian J. Fiebach^{4,7,14}, Isaac Galatzer-Levy¹⁵, Elbert Geuze^{8,16}, Sergiu Groppa^{1,4,17}, Isabella Helmreich^{1,3,12}, Talma Hendler^{3,18,19}, Erno J. Hermans^{3,13}, Tanja Jovanovic²⁰, Thomas Kubiak^{1,3,21}, Klaus Lieb^{1,3,4,12}, Beat Lutz^{1,4,22}, Marianne B. Müller^{1,4,12}, Ryan J. Murray^{3,23,24,25}, Caroline M. Nievergelt^{5,6}, Andreas Reif^{3,4,26}, Karin Roelofs^{3,13,27}, Bart P. F. Rutten²⁸, David Sander^{3,24,25}, Anita Schick^{1,2,3}, Oliver Tüscher^{1,3,4,12}, Ilse Van Diest^{3,29}, Anne-Laura van Harmelen^{3,30}, Ilya M. Veer^{3,31}, Eric Vermetten^{16,32,33}, Christiaan H. Vinkers⁸, Tor D. Wager^{34,35}, Henrik Walter^{3,31,36}, Michèle Wessa^{1,3,4,37}, Michael Wibral^{4,38} and Birgit Kleim^{3,39}

Consistent failure over the past few decades to reduce the high prevalence of stress-related disorders has motivated a search for alternative research strategies. Resilience refers to the phenomenon of many people maintaining mental health despite exposure to psychological or physical adversity. Instead of aiming to understand the pathophysiology of stress-related disorders, resilience research focuses on protective mechanisms that shield people against the development of such disorders and tries to exploit its insights to improve treatment and, in particular, disease prevention. To fully harness the potential of resilience research, a critical

Bart P. F. Rutten²⁸, David Sander^{3,24,25}, Anita Schick^{1,2,3}, Oliver Tüscher^{1,3,4,12}, Ilse Van Diest^{3,29}, Anne-Laura van Harmelen^{3,30}, Ilya M. Veer^{3,31}, Eric Vermetten^{16,32,33}, Christiaan H. Vinkers⁸, Tor D. Wager^{34,35}, Henrik Walter^{3,31,36}, Michèle Wessa^{1,3,4,37}, Michael Wibral^{4,38} and Birgit Kleim^{3,39}

appraisal of the current state of the art — in terms of basic concepts and key methods — is needed. We highlight challenges to resilience research and make concrete conceptual and methodological proposals to improve resilience research. Most importantly, we propose to focus research on the dynamic processes of successful adaptation to stressors in prospective longitudinal studies.

Each year, more than half a billion people around the globe suffer from a mental disorder such as anxiety, post-traumatic stress disorder (PTSD), depression or addiction that can, to some extent, be traced back to the influence of exogenous or endogenous stressors. Such stressors include traumatic events, challenging life circumstances or life transitions, or physical illness¹. Together,

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Box 1 | Proposals for future resilience research

Proposal 1. The maintenance or quick recovery of mental health during and after exposure to significant stressors results from a dynamic process of adaptation to the given stressful life circumstances.

Proposal 2. Resilience is not a trait or stable personality profile, or a specific genotype or some hardwired feature of brain architecture. Resilience should not be understood as a predisposition and, thus, is not the flip-side of vulnerability. We refer to stable resilience-conducive traits or other predispositions as resilience factors.

Proposal 3. Resilience should operationally be defined ex post facto, that is, as a good mental health outcome following an adverse life event or a period of difficult life circumstances.

Proposal 4. At present, there is a pressing need for prospective longitudinal resilience studies.

Radboudumc

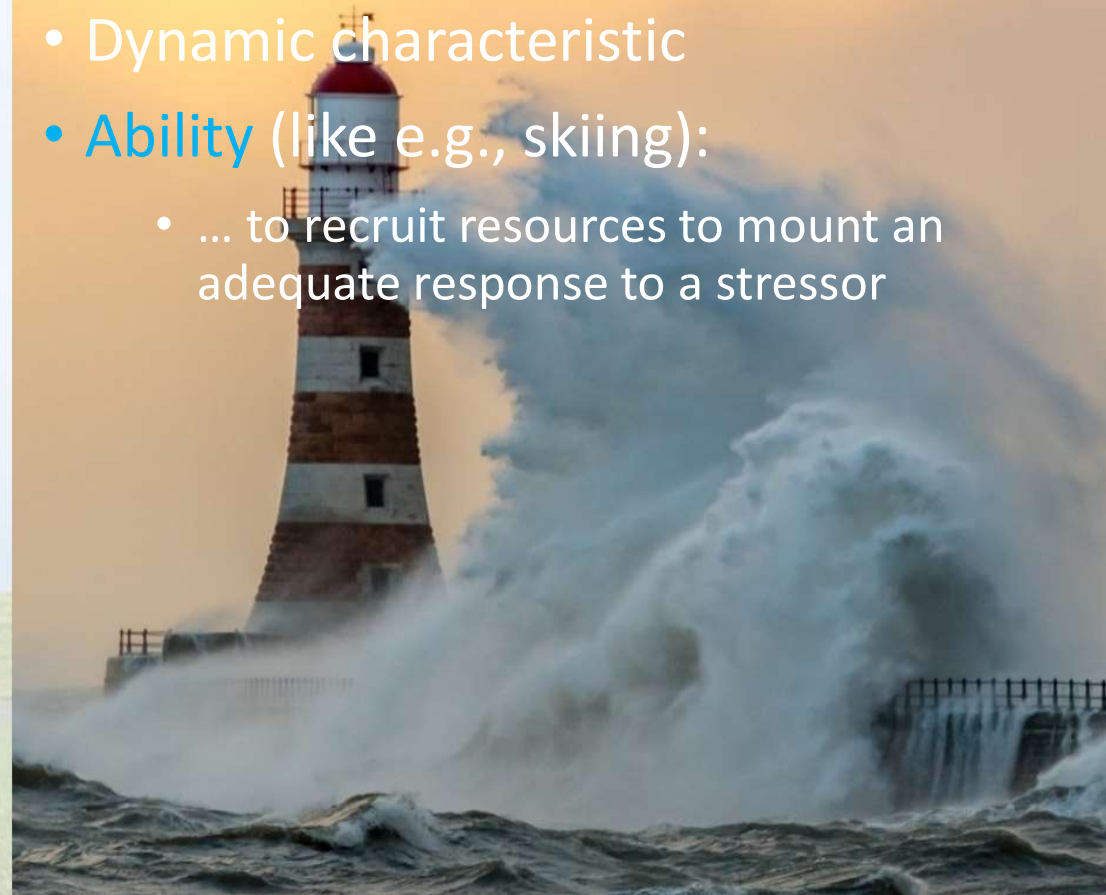
Frailty

- Structural characteristic
- **Resources** available for showing resilience



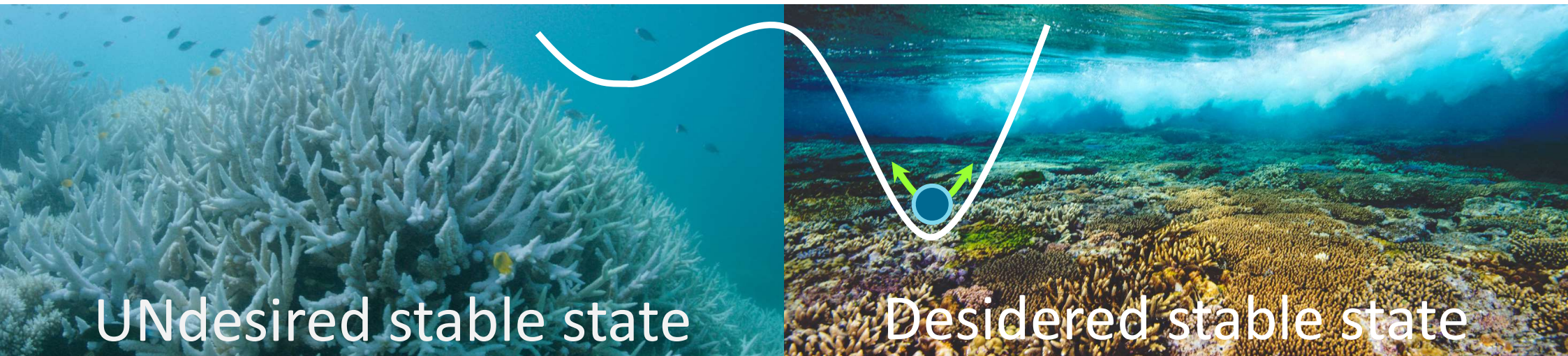
Physical resilience

- Dynamic characteristic
- **Ability** (like e.g., skiing):
 - ... to recruit resources to mount an adequate response to a stressor



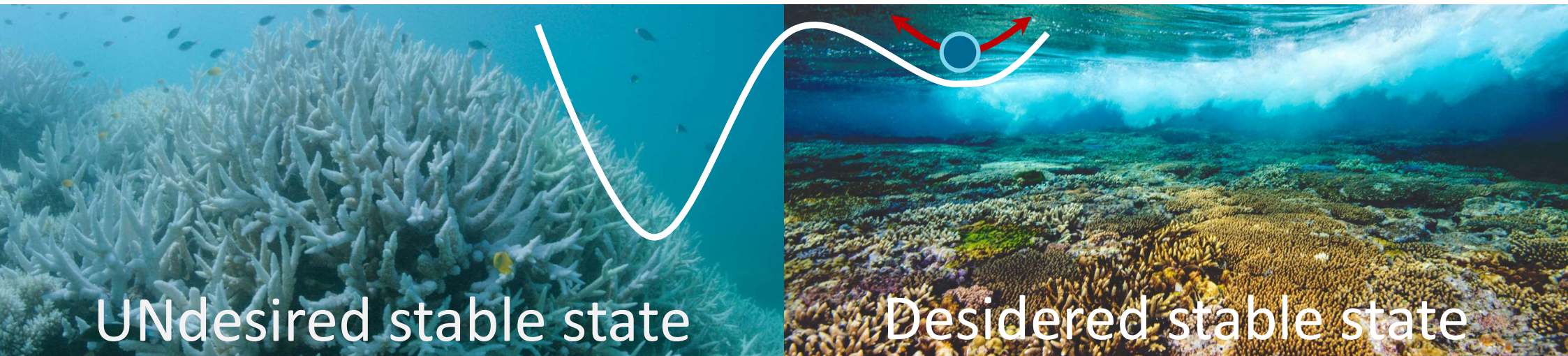
Resilience

- Ecology:
 - Dynamic, complex (eco)system
 - Several stable states OR equilibria
 - Resilience reflects the stability of an equilibrium



Resilience

- Ecology:
 - Dynamic, complex (eco)system
 - Several stable states OR equilibria
 - Resilience reflects the stability of an equilibrium



Resilience

- Ability to bounce back after a stressor

Alternatively...

- Probability of staying in the current stable state
 - Probability of moving to an **alternative stable state**
-



ResilienCE versus resilienCIES

- Systemic resilience
- Resilience of subsystems
 - Physical resilience
 - Psychological resilience
- Different stressors
- Different outcomes



Journals of Gerontology: Medical Sciences
cite as: *J Gerontol A Biol Sci Med Sci*, 2016, Vol. 71, No. 4, 489–495
doi:10.1093/gerona/glv202
Advance Access publication December 29, 2015



Review

Physical **Resilience** in Older Adults: Systematic Review and Development of an Emerging Construct

Heather E. Whitson,^{1,2,3,4} Wei Duan-Porter,^{1,5} Kenneth E. Schmader,^{1,2,3} Miriam C. Morey,^{1,2,3} Harvey J. Cohen,^{1,2,3} and Cathleen S. Colón-Emeric^{1,2,3}

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cite as: *J Gerontol A Biol Sci Med Sci*, 2017, Vol. 72, No. 7, 980–990
doi:10.1093/gerona/glx015
Advance Access publication May 5, 2017



Special Article

Report: NIA Workshop on Measures of Physiologic **Resiliencies** in Human Aging

Evan C. Hadley,¹ George A. Kuchel,² and Anne B. Newman³ on behalf of Workshop Speakers and Participants*

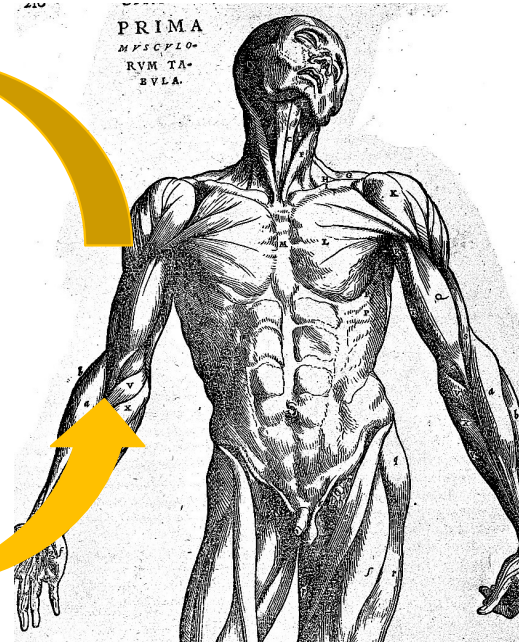
¹National Institute on Aging, Bethesda, Maryland. ²University of Connecticut, Farmington. ³Graduate School of Public Health, University of Pittsburgh, Pennsylvania.

Address correspondence to Anne B. Newman, MD, MPH, Department of Epidemiology, Graduate School of Public Health, University of

Whole system's property



Psychological resilience



Physical resilience

What is resilience? Summary

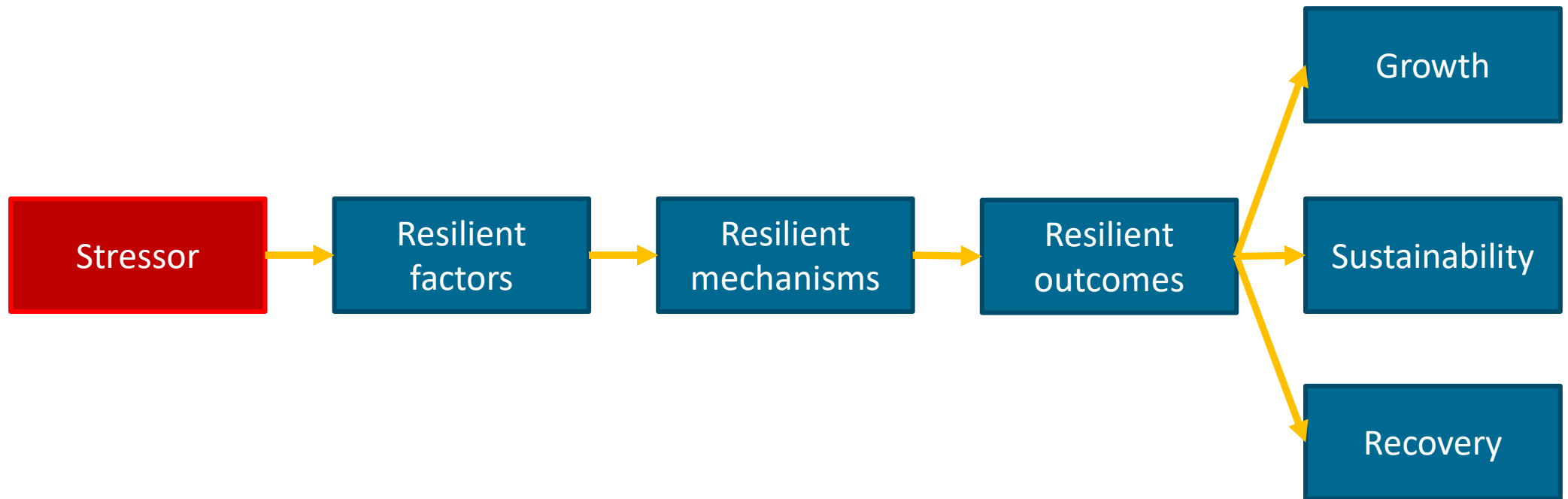
- Ability to resist or recover from stressors
- Dynamic, emergent property of a complex system

How to measure resilience?

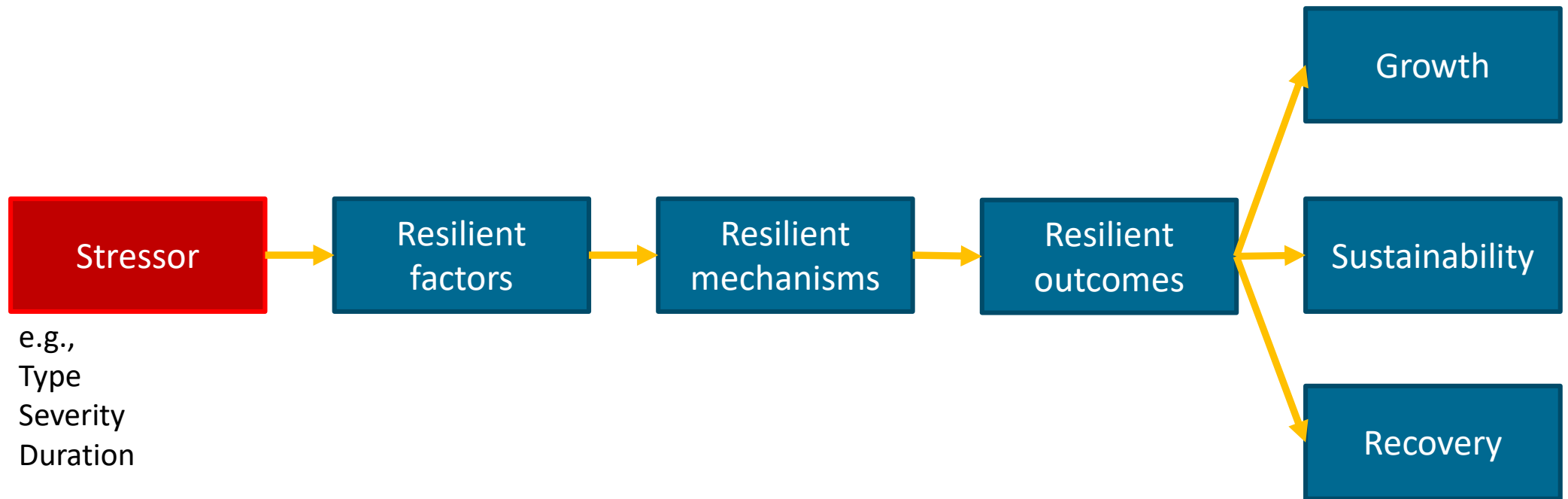
Knowledge gap:

- Can we upfront and during the recovery predict/monitor which resilience trajectory a person will follow in response to health stressor?
- Potential pitfall is to strive for a single measurement scale

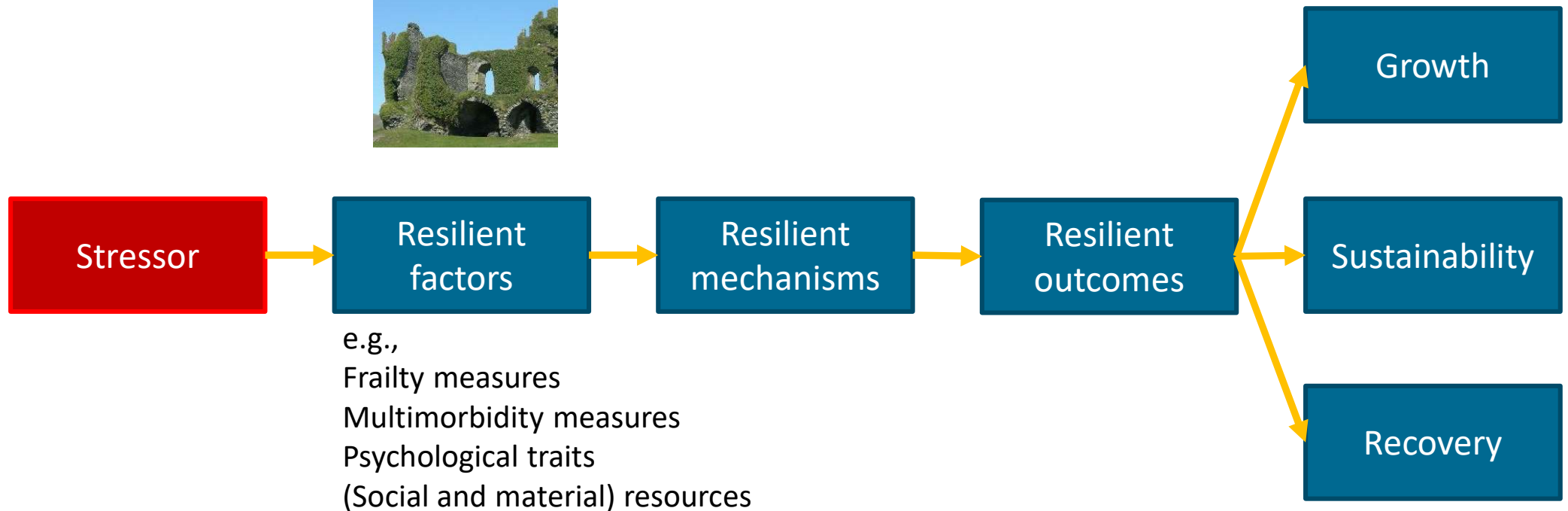
How to measure resilience?



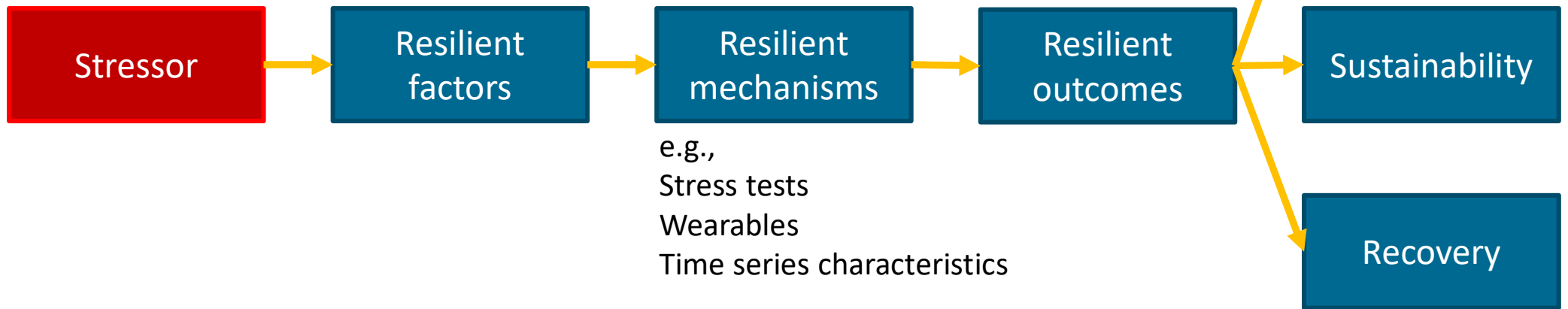
How to measure resilience?



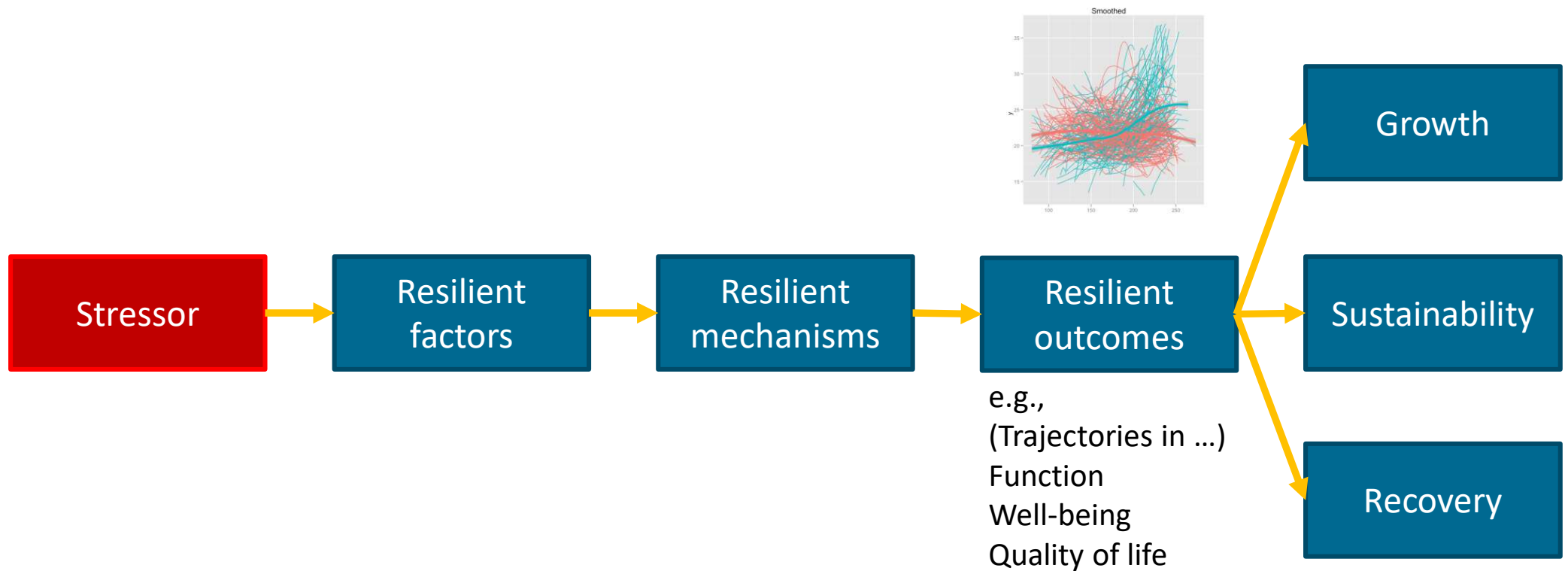
How to measure resilience?



How to measure resilience?



How to measure resilience?



RESILIENCE



Resilience factors

Wister *et al.* *BMC Geriatrics* (2018) 18:170
<https://doi.org/10.1186/s12877-018-0851-y>

BMC Geriatrics

RESEARCH ARTICLE

Open Access



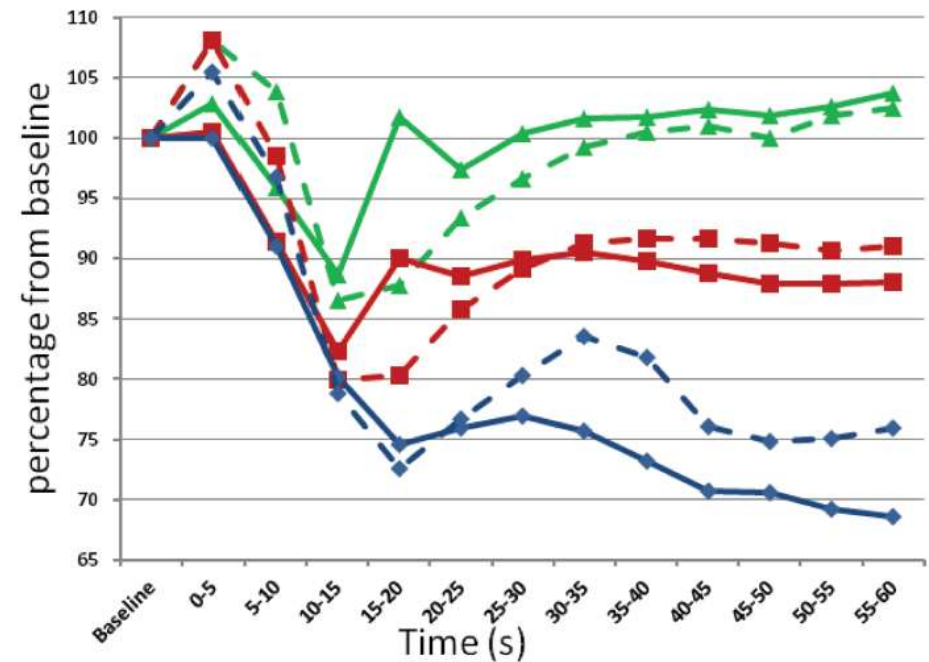
Development and validation of a multi-domain **multimorbidity resilience index** for an older population: results from the baseline Canadian Longitudinal Study on Aging

Resilience mechanisms: stress tests

- Provide a standardized stressor
- Evaluate response
 - Resistance
 - Recovery time
- Stimulus Response Paradigm
 - E.g., Sit-to-stand challenge



% blood pressure recovery



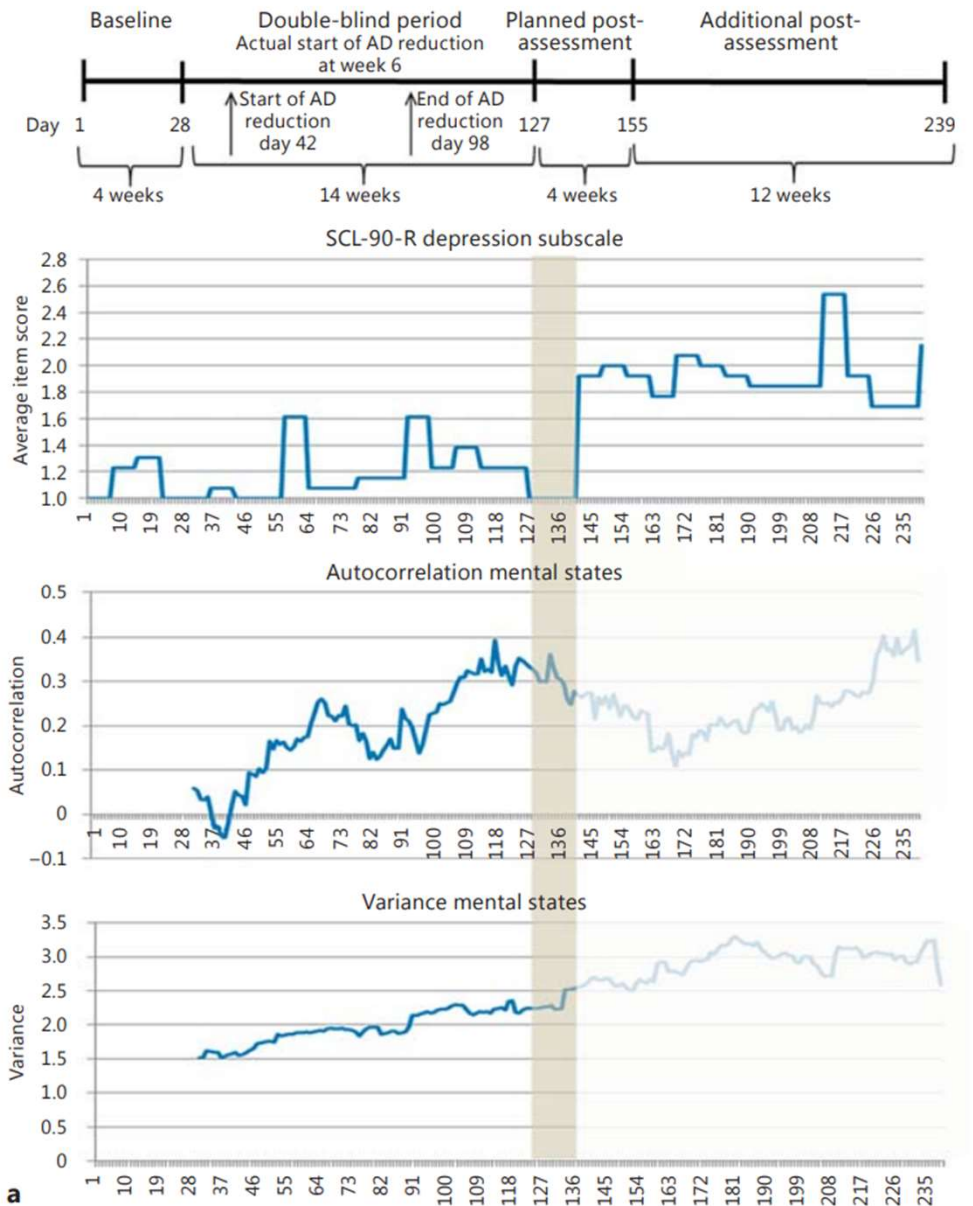
Resilience mechanisms: time series characteristics

- Continuous monitoring, e.g., wearables, apps
- Assess response to **naturally occurring (micro)stressors/perturbations**



Male, 57y

- Multiple episodes major depression
- Discontinuation of antidepressant Tx
- Time series of 10x/day momentary assessments mental functioning



How to measure resilience? Summary

Resilience measurement framework

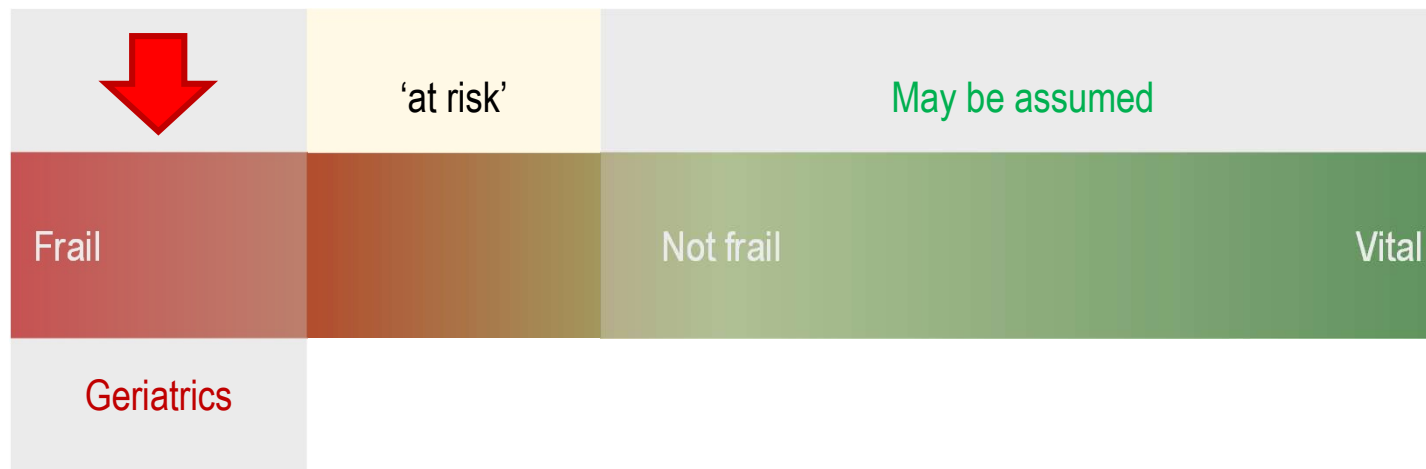
- Stressor (type and intensity)
- Outcome (trajectory): multidimensional
- Predictors
 - Multidimensional
 - Structure of system: [static indicators of resilience](#)
 - Intrinsic capacity
 - Frailty
 - Well-being
 - Process/function operated by system: [dynamic indicators of resilience](#)
 - Stress tests: resistance/recovery (time)/fatigue
 - Continuous monitoring/time series

How to support resilience?

Can we manage/support resilience?

- Should we await valid resilience monitoring tools?
- Terminology can already be used (Gijzel et al.)
 - Implicitly, much care is “resilience support”, using the term brings the importance further to forefront
 - To move from implicitly assumed recovery capacity to explicit attention
 - To express clinical intuitions in daily communication with patients and colleagues
 - A priori approach (Angevaere et al.)

Target group resilience management



How to support resilience? Summary

Resilience management framework

- Triage and clinical decision support
 - Intensive and burdensome treatments with broadening treatment indications
 - E.g., Thoracic aortic aneurysm surgery
 - Prestressor assessment of recovery capacity
- Actively support resource (recruitment) available for resilience
 - Integrate with prehabilitation and (geriatric) rehabilitation support programmes for better targeting
- Longitudinal monitoring of recovery
- Teaching and training programmes for care professionals
- Self management and coping support for older persons and informal carers

Conclusions

- Resilience is the ability to resist, adapt and recover from stressors
- With aging and multimorbidity resilience can no longer be assumed, but may be better than expected
- There are multiple approaches from which valid resilience measurements can be developed
- Resilience management complements active disease elimination approach currently dominating medicine

