WHO Vitality Capacity Working Group report on initial steps towards measurements of vitality capacity in older people

Virtual meeting
8–9 December 2021
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Acknowledgements

This document was written under the overall technical oversight of Jotheeswaran Amuthavalli Thiyagarajan, Technical Officer (Epidemiologist), Ageing and Health Unit, Department of Maternal, Newborn, Child and Adolescent Health and Ageing, World Health Organization (WHO), Geneva, Switzerland; Ivan Bautmans, Head of Gerontology department and Frailty in Ageing research group, Vrije Universiteit Brussel, Belgium; Christopher Mikton, Technical Officer, Demographic Change and Healthy Ageing Unit, Department of Social Determinants of Health, WHO, Geneva, Switzerland; and Theresa Diaz, Unit Head, Epidemiology, Monitoring and Evaluation Unit, Maternal, Newborn, Child and Adolescent Health and Ageing, WHO, Geneva, Switzerland.

None of the experts involved in developing this document declared any conflict of interest.

Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>BMI</td>
<td>body mass index</td>
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<tr>
<td>HbA1c</td>
<td>glycated haemoglobin test</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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</table>
The United Nations proclaimed 2021–2030 as the Decade of Healthy Ageing, with the World Health Organization (WHO) leading international action to improve the lives of older people, their families and their communities. The Decade brings together a variety of stakeholders to galvanize concerted action to (i) change how we think and feel about age and ageing; (ii) develop communities in ways that foster the abilities of older people; (iii) deliver person-centred, integrated care and primary health services that are responsive to older people; and (iv) provide older people with access to long-term care when they need it.

To assess the impact of these actions at the national, regional and global levels, WHO proposed using intrinsic capacity and functional ability as outcome indicators for healthy ageing. Functional ability comprises the health-related attributes that enable people to be who they want and to do what they value. It is made up of the intrinsic capacity of the individual, relevant environmental characteristics and the interactions between the two. Intrinsic capacity comprises all the mental and physical capacities that a person can draw on. WHO’s conceptual framework suggests that vitality capacity is one of the domains of intrinsic capacity. However, the concept of vitality capacity is not well defined.

To advance the thinking around measuring vitality capacity in older persons, WHO’s Ageing and Health Unit of the Department of Maternal, Newborn, Child and Adolescent Health and Ageing in collaboration with the Frailty in Ageing research group at Vrije Universiteit Brussel, established a Vitality Capacity Working Group and organized a virtual meeting with 20 experts representing the six WHO regions. The meeting was held 8–9 December 2021.

The aims of the meeting were to (i) review the conceptual framework for vitality capacity in older people, (ii) discuss the attributes of vitality capacity and (iii) agree on a draft working definition of vitality capacity.

The meeting was co-chaired by Stephanie Studenski, Professor Emeritus at the University of Pittsburgh, Pennsylvania, United States of America, and Ivan Bautmans, Professor of Gerontology and Head of the Frailty in Ageing research group at Vrije Universiteit Brussel, Belgium.

A literature review conducted prior to the meeting identified three potential definitions of vitality, but none clearly articulated the construct in a way that would support its measurement.

1. The term vitality is used to describe the biophysiological status of an individual and their capacity for maintaining homeostasis in the face of usual daily exposures, as well as more extreme and unusual or unexpected challenges, such as injury or infection.

2. Alternatively, vitality could be defined as the body functions devoted to metabolizing dietary intake to produce the required amount of energy to maintain an optimal homeostatic level.

3. Vitality might be conceptualized as the amount of intrinsic capacity that can be retained, and it may be seen as underpinning a person’s resilience to challenges, as well as their vigour and stamina.

The conceptual framework for vitality capacity was presented to describe its underlying mechanisms. There are three different levels of vitality capacity: (i) genetic inheritance; followed by (ii) the biomolecular systems affected by biological ageing, such as cellular senescence, glycation, low-grade inflammation; and (iii) higher-level physiological systems, including energy, stress responses and repair. The experts attending the meeting advised adapting the model to distinguish between the predictors and outcomes of vitality capacity and to focus on the higher-level physiological systems when elaborating a working definition.

In virtual brainstorming sessions attendees were asked to indicate all potentially relevant attributes of vitality capacity that are related to higher-level physiological systems. A large set of attributes was collected, and then the attributes were clustered under the following labels: energy, fatigue, metabolism, strength, respiratory system, body composition, cardiovascular system, nutrition and immune system response, but some attributes were not able to be gathered into a cluster. Also, several tests of physical ability, such as gait speed and lower extremity muscle strength, were proposed; however, these were not...
retained since they were useful for describing locomotor capacity, which is a domain of intrinsic capacity.

Consensus was not reached during the meeting about other possible attributes, such as nutritional status, because, for example, some experts considered this to be a determinant of vitality while others considered it to be an outcome of vitality. In the end, nutrition was included and considered to represent the capacity of the body to convert food in a nutrient to produce energy; thus, it was put into the domain energy and metabolism.

On the second day of the meeting, Jotheeswaran Amuthavalli Thiyagarajan, WHO, presented a summary of all the attributes from the brainstorming sessions. Three temporary constructs of vitality capacity were proposed to relate these attributes to higher-level physiological systems: (i) strength, (ii) energy and metabolism, and (iii) resilience. The attendees found the term resilience to be unclear since it refers more to a physiological reserve and is an outcome of several factors. Therefore, resilience was changed to immune and stress response functions, leading to new constructs for vitality capacity at higher physiological levels: (i) energy and metabolism, (ii) neuromuscular function and (iii) the immune and stress response functions of the body.

A draft conceptual working definition that captures the main attributes of vitality at higher physiological levels was agreed: **Vitality capacity** is a physiological state (due to normal or accelerated biological ageing processes) resulting from the interaction between multiple physiological systems, reflected in (the level of) energy and metabolism, and the neuromuscular and immune and stress response functions of the body.

At the close of the meeting, Professor Bautmans outlined the next steps in this initiative:

- preparing a Viewpoint article for *Lancet Healthy Longevity* on behalf of all participants in the Working Group;
- conducting a systematic review of measures of vitality capacity (e.g. blood-based, physical and self-reported biomarkers) to develop an operational definition that will allow for systematic measurement and monitoring;
- organizing another meeting to move towards an operational definition of vitality capacity once the outcomes of the systematic review are available.
Introduction

The United Nations proclaimed 2021–2030 as the Decade of Healthy Ageing, with the World Health Organization (WHO) leading international action to improve the lives of older people, their families and their communities. The Decade brings together a variety of stakeholders to galvanize concerted action to (i) change how we think and feel about age and ageing; (ii) develop communities in ways that foster the abilities of older people; (iii) deliver person-centred, integrated care and primary health services that are responsive to older people; and (iv) provide older people with access to long-term care when they need it.

To assess the impact of these actions at the national, regional and global levels, WHO proposed using intrinsic capacity and functional ability as outcome indicators for healthy ageing. Functional ability comprises the health-related attributes that enable people to be who they want and to do what they value. It is made up of the intrinsic capacity of the individual, relevant environmental characteristics and the interactions between the two. Intrinsic capacity comprises all the mental and physical capacities that a person can draw on(1). WHO’s conceptual framework suggests vitality capacity as one of the domains of intrinsic physical capacity(2).

Although various domains of intrinsic capacity have been proposed along with complementary subfactors (i.e. locomotion, psychosocial, sensory, cognitive)(2), there is no consensus about how the construct might be composed, and few metrics have been identified that allow for systematic quantification and monitoring of intrinsic capacity. Additionally, no consensus operational definition of vitality capacity has yet been proposed. The lack of an operational definition results in confusion about the term in the literature and a lack of clarity about the measurement tools that might be used to capture or quantify vitality. In order to move towards a positive model of healthy ageing and focus on preserving functional ability, it is crucial to develop a consensus definition of vitality capacity and its measurements.

To close these gaps, the WHO Ageing and Health Unit, part of the Department of Maternal, Newborn, Child and Adolescent Health and Ageing, in collaboration with the Frailty in Ageing research group at Vrije Universiteit Brussel, established a Vitality Capacity Working Group and organized a virtual meeting attended by 20 experts representing the six WHO regions on 8–9 December 2021.

Aims and expected outcomes of the meeting

The aims of the meeting were to (i) review the conceptual framework for vitality capacity in older people, (ii) discuss the attributes of vitality capacity and (iii) develop a working definition of vitality capacity.

The specific expected outcomes of the meeting were to agree (i) to conduct a review of the attributes of vitality capacity and (ii) on a working draft definition of vitality capacity.
The meeting was co-chaired by Stephanie Studenski, Professor Emeritus at the University of Pittsburgh, Pennsylvania, United States of America, and Ivan Bautmans, Professor of Gerontology and Head of the Frailty in Ageing research group at Vrije Universiteit Brussel, Belgium. Based on the discussion summarized below, a draft working definition was developed during the meeting. During the process of developing a working definition, the group voted on each attribute by raising their hands (virtually). Working definition attributes were largely agreed upon by all experts who participated in the meeting.

Day 1, Wednesday, 8 December 2021

The meeting began with presentations by WHO staff members and of Vrije Universiteit Brussel (Annex 1) describing the objectives and also offering some background information to pave the way for discussions. The presentations included information about the WHO Public Health Framework for Healthy Ageing, a clinical perspective of vitality capacity and the outcome of a rapid literature review of the definitions and attributes of vitality capacity.

The three definitions found during the literature search performed by Veerle Knoop and devised with the collaboration of WHO were presented. It is important to acknowledge that none of these definitions are proposed by WHO and these can be modified.

1. The term vitality is used to describe the biophysiological status of an individual and the capacity for maintaining homeostasis in the face of usual daily exposures, as well as more extreme and unusual or unexpected challenges, such as injury or infection (3).

2. Alternatively, vitality could be defined as the body functions devoted to metabolizing dietary intake to produce the required amount of energy to maintain an optimal homeostatic level (4).

3. Vitality might be conceptualized as the amount of intrinsic capacity that can be retained, and it may be seen as underpinning a person’s resilience to challenges, as well as their vigour and stamina (5).

The conceptual framework (Fig. 1) includes the mechanisms underlying vitality capacity. This framework is still in development, and it was used only as an example. Fig. 1 shows the three proposed levels of vitality capacity: (i) genetic inheritance; followed by (ii) the biomolecular systems affected by biological ageing, such as cellular senescence, glycation, low-grade inflammation; and (iii) higher-level physiological systems, including energy, stress responses and repair. The experts attending the meeting advised adapting this model to distinguish between the predictors and outcomes of vitality capacity and to focus on the higher-level physiological systems when elaborating a consensus definition.
In virtual brainstorming sessions attendees were asked to indicate all potentially relevant attributes of vitality capacity that are related to higher-level physiological systems. A large set of attributes was collected from the sessions, and the attributes were clustered under the following labels: energy, fatigue, metabolism, strength, respiratory system, body composition, cardiovascular system, nutrition and immune system response, but some attributes that were not able to be gathered into a cluster (Table 1, Step A). Also, several tests of physical ability, such as gait speed and lower extremity muscle strength, were proposed; however, these were not retained since they were useful for describing locomotor capacity, which is a domain of intrinsic capacity.
Table 1. Stepwise identification of attributes of vitality capacity

<table>
<thead>
<tr>
<th>STEPS</th>
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<tbody>
<tr>
<td><strong>A. Identify all potentially relevant attributes related to</strong></td>
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<tr>
<td><strong>higher-level biomolecular functioning</strong></td>
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<tr>
<td><strong>Attributes</strong></td>
</tr>
<tr>
<td><strong>Strength and respiratory system</strong></td>
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<tr>
<td>Respiratory muscle strength</td>
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<tr>
<td>Handgrip strength</td>
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<tr>
<td>Respiratory rate at rest and during exercise</td>
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<tr>
<td><strong>Energy</strong></td>
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<td>Energy level</td>
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<td>Energy balance</td>
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<tr>
<td>Energy metabolism</td>
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<tr>
<td>Energy expenditure</td>
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<tr>
<td><strong>Fatigue</strong></td>
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<tr>
<td>Fatigue symptoms</td>
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<tr>
<td>Fatiguability</td>
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<tr>
<td>Muscle endurance</td>
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<tr>
<td>Daytime fatigue</td>
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<tr>
<td>Low self-perceived fatigue</td>
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<tr>
<td><strong>Metabolism</strong></td>
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<tr>
<td>Insulin sensitivity</td>
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<td>Haemoglobin</td>
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<tr>
<td>HbA1c (glycated haemoglobin)</td>
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<td>Serum albumin</td>
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<td>Fasting blood sugar</td>
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<td>Hypothalamic–pituitary–adrenal axis hormone status</td>
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<tr>
<td><strong>Body composition</strong></td>
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<td>Anthropometry</td>
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<tr>
<td>Body weight</td>
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<td>Body mass index (BMI)</td>
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<td>Waist circumference</td>
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<td>Muscle mass</td>
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<tr>
<td><strong>Cardiovascular system</strong></td>
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<tr>
<td>Heart rate during and after physical activity</td>
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<td>Heart rate variability</td>
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<tr>
<td>Oxygen saturation</td>
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<td>Orthostatic hypotension</td>
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<td>Orthostatic response after recumbency</td>
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<tr>
<td>Blood pressure</td>
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<tr>
<td>Cardiovascular system</td>
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<tr>
<td>Maximal oxygen consumption (VO2 max)</td>
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<td><strong>Energy and metabolism</strong></td>
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<tr>
<td>Self-perceived fatigue</td>
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<tr>
<td>Muscle fatiguability</td>
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<tr>
<td>Malnutrition or nutritional status</td>
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<tr>
<td>Body composition</td>
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<tr>
<td>Circulating biomarkers of metabolism (e.g. HbA1c)</td>
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<tr>
<td><strong>Neuromuscular function</strong></td>
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<td>Knee extensor strength</td>
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<tr>
<td>Handgrip strength</td>
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<tr>
<td>Respiratory muscle strength</td>
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<tr>
<td><strong>Nutrition</strong></td>
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<td>Nutritional status</td>
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<tr>
<td>(Mini Nutritional Assessment)</td>
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<tr>
<td>Undernutrition</td>
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<td>Malnutrition</td>
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<td>Weight loss</td>
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<td>Loss of appetite</td>
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<td><strong>Others</strong></td>
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<td>Sympathetic and parasympathetic nervous systems</td>
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<td>Low self-esteem</td>
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<td>Mitochondrial function</td>
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<td>Sedentary behaviour</td>
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<td>Sleep quality</td>
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<tr>
<td>Methylation clock</td>
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<td>Electrolyte balance</td>
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Step A. Attendees were asked to indicate all potentially relevant attributes of vitality capacity that are related to biomolecular systems. Then these attributes were clustered by domain. Based on these attributes, three constructs of vitality capacity focused on biomolecular systems were identified: (i) strength, (ii) energy and metabolism, and (iii) resilience.

Step B. Attendees were divided into three groups and asked to indicate the top three potential biomarkers for each of the three major domains of vitality capacity. These biomarkers needed to fulfill the following criteria: (i) be feasible to measure or collect in low-resource settings, (ii) provide useful information for monitoring (i.e. they needed to have sufficient sensitivity to monitor change or response to an intervention, or both), (iii) describe a distinct attribute (i.e. there would be no redundancy with other attributes), (iv) have an acceptable cost and level of need for resources, (v) be sufficiently available and not raise any ethical concerns about collecting and reporting the data, and (vi) be implementable (e.g. for dedicated population surveys on ageing or for multipurpose surveys). To reach consensus, we performed a sticky note exercise during which attendees had to propose their top two candidate biomarkers for neuromuscular function, energy and metabolism and immune and stress response functions.
Consensus was not reached during the meeting about other possible attributes, such as nutritional status, because, for example, some attendees considered this to be a determinant of vitality while others considered it to be an outcome of vitality.

Concluding remarks were made by Dr Christopher Mikton, WHO, and Dr Amuthavalli Thiyagarajan, WHO, and the agenda for the next day was presented.

Day 2, Thursday, 9 December 2021

Dr Amuthavalli Thiyagarajan presented a summary of the first day’s discussions. The aims for the second day of the meeting were to develop a conceptual definition and identify potential biomarkers.

Dr Amuthavalli Thiyagarajan presented a summary of all of the attributes discussed during the previous brainstorming sessions. Three temporary constructs of vitality capacity were proposed to relate these attributes to higher-level physiological systems: (i) energy and metabolism, (ii) neuromuscular function and (iii) resilience. The attendees found the term resilience to be unclear since it refers more to a physiological reserve and is an outcome of several factors. Therefore, resilience was changed to immune and stress response functions, leading to new constructs for vitality capacity at higher physiological levels: (i) neuromuscular function, (ii) energy and metabolism and (iii) the immune and stress response functions of the body.

In three breakout rooms, attendees were asked to indicate the top three potential biomarkers for each of the three major constructs of vitality capacity. The biomarkers needed to fulfil the following criteria: (i) be feasible to measure or collect in low-resource settings, (ii) provide useful information for monitoring (i.e. they needed to have sufficient sensitivity to monitor change or response to an intervention, or both), (iii) describe a distinct attribute (i.e. there would be no redundancy with other attributes), (iv) have an acceptable cost and level of need for resources, (v) be sufficiently available and not raise any ethical concerns about collecting and reporting the data, and (vi) be implementable (e.g. for dedicated population surveys on ageing or for multipurpose surveys).

These criteria reflect the dynamic nature of vitality capacity and, therefore, the biomarkers need to be able to detect changes over time. The following biomarkers were discussed: (i) strength, specifically handgrip strength; (ii) energy and metabolism, specifically albumin, glycated haemoglobin (or HbA1c), malnutrition as measured by questionnaire, waist and calf circumference, fatigue, body mass index (or BMI), inflammation and haemoglobin; and (iii) inflammation and stress responses, specifically C-reactive protein, self-reported immune status and oxygen saturation in combination with strength tests, and measurement of orthostatic hypotension and heart rate variability. To reach consensus, a virtual sticky note exercise was performed asking participants to propose their top two candidate biomarkers for neuromuscular function, energy and metabolism functions, and immune and stress response functions. The shortlisted biomarkers are presented in Table 1 (Step B).

Discussion points

During the meeting the Working Group developed several discussion points.

• The Working Group identified several challenges that must be addressed before the measurement of vitality capacity can be integrated into health care systems designed to promote healthy ageing. These challenges include developing standardized, valid, and objective tools for assessing vitality capacity and determining how to monitor it in populations.

• The current work on vitality capacity can be used as a start; however, a more advanced research agenda will need to be developed for the future. First, research should identify the role of vitality capacity in the healthy lifespan and determine the role that changes in vitality capacity have in improving the functional healthy lifespan.

• Next, it is necessary to identify measures of vitality capacity that are sensitive to changes and that can be applied at the population level.
• Last, since vitality is meaningful in targeting age-related diseases, there is a need to understand how vitality capacity can be improved and which long-term interventions can boost it to prevent these diseases.

• The current model of care is designed to anticipate a disease or react when it is already clinically manifested, thus resulting in medical treatment to eliminate or limit the consequences of the disease. In contrast, the WHO model identifies people in the community who have either stable or reduced intrinsic capacity, the latter at an early stage when it might be feasible to deliver interventions to prevent further decline and functional loss. Measuring vitality capacity as one of the components of intrinsic capacity can facilitate monitoring health trajectories throughout the life course and across multiple care settings.

• It may be informative to observe trends in vitality capacity over time, for example in a country, since this may provide information about the factors influencing biological age. Biological ageing is reflected in the accumulation of damage (e.g. DNA damage, oxidative damage, mitochondrial damage) and compensation for different hallmarks of ageing (e.g. genomic instability, telomere shortening, cellular senescence) (7) rather than in functional limitation (8). Cellular and intercellular measures of biological age have been validated against chronological age; therefore, measurements of vitality capacity may help determine an individual’s vulnerability based on their level of reserves and functioning rather than on their chronological age (9, 10).

• Changes in vitality capacity over time may be related to biological ageing, and biomolecular systems may be responsible for some of the underlying processes that determine the level of vitality capacity. There is growing interest in the vitality domain of intrinsic capacity, and there is an ongoing debate about whether vitality capacity can be considered as a precondition for good intrinsic capacity rather than a separate domain. If early detection of deterioration leads to interventions that preserve or increase intrinsic capacity then older persons may be able to do what they value and ensure they remain active and functional in the society where they live.

• Measuring vitality in the context of frailty can corroborate clinical decisions with objective data that will go beyond the traditional view of frailty. Where the assessment of frailty is based on the accumulation of deficits with ageing, the assessment of vitality takes a more positive approach that moves away from a disease-focused model of ageing (11). Understanding how vitality capacity impacts changes in health trajectories will bring benefits in terms of identifying a person’s risk of developing frailty.

• Measuring vitality capacity over time can indicate the level of a person’s reserve capacity: this measurement of the dynamics of vitality capacity will identify changes. The measurement of frailty is a static approach to evaluating reserve capacity; in contrast, vitality capacity is conceptualized as a continuum in older adults. Vitality capacity can give an overview of the changes in reserve capacity and, therefore, it is highly important in the context of healthy ageing. Thus, we assume that these two concepts are complementary since a reduction in vitality can lead to vulnerability to the stressors that lead to frailty.

• Vitality capacity should be monitored by older persons themselves (via self-testing or a proxy measure), by professional health care providers in clinical practice, in scientific research and by creating anonymized dashboards for supporting policy-making. In these ways, changes in vitality capacity will be monitored in real time. The available technology allows for the detection of clinical signs of frailty and dependency.

• The aim of measuring and monitoring vitality capacity is to avoid symptoms by having vitality capacity act as an early warning system for declining resistance to health stressors. When self-assessment tools are available in addition to objective tools, older persons will be empowered to manage their lifestyle and behaviour to determine their own trajectory for ageing. Therefore, it is important that simple, noninvasive and relatively inexpensive tools are developed that can provide a good overview of someone’s vitality capacity. Health care professionals need to be able to comprehensively monitor trajectories of healthy ageing over time to estimate the risks of adverse health outcomes and deliver personalized care to older persons.
• Monitoring vitality capacity can shift the curative focus of health care towards a more preventive approach: information about vitality capacity can be used to support tailored interventions and enrich clinical evaluation. The timely identification of older persons at risk of declining vitality capacity is essential to provide targeted preventive and health-promoting support to optimize healthy ageing and well-being in older persons.

• Measuring vitality capacity at the population level can provide policy-makers with information about its trajectories in their communities and enable them to investigate which interventions are necessary to enhance healthy ageing. Future research should focus on optimizing the biomarkers of vitality capacity that can be used in clinical and policy-making contexts.

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**Working definition of vitality capacity**

Based on discussions at the meeting, the Working Group proposed a conceptual working definition: Vitality capacity is a physiological state (due to normal or accelerated biological ageing processes) resulting from the interaction between multiple physiological systems, reflected in (the level of) energy and metabolism and the neuromuscular and immune and stress response functions of the body.

Three essential domains of vitality capacity were identified: (i) energy and metabolism, (ii) neuromuscular function and (iii) the immune and stress response functions. The following biomarkers for each of these domains were proposed by the attendees.

- **Energy and metabolism**
  - self-perceived fatigue
  - muscle fatiguability
  - malnutrition or nutritional status
  - body composition
  - circulating biomarkers of metabolism (e.g., HbA1c).

- **Neuromuscular function**
  - knee extensor strength
  - handgrip strength
  - respiratory muscle strength.

- **Immune and stress responses**
  - circulating biomarkers of inflammation
  - immune symptoms
  - oxygen saturation
  - autonomic function.

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**Next steps**

The next steps to be taken include:

- preparing a Viewpoint article for *Lancet Healthy Longevity* on behalf of all participants in the Working Group;

- conducting a systematic review of measures of vitality capacity (e.g., blood-based, physical and self-reported biomarkers) to develop an operational definition that will allow for systematic measurement and monitoring;

- organizing another meeting to move towards an operational definition of vitality capacity once the outcomes of the systematic literature review are available.
References


### Annex 1: Meeting agenda

**Day 1. Wednesday, 8 December 2021**

<table>
<thead>
<tr>
<th>TIME</th>
<th>AGENDA</th>
<th>CHAIR, CO-CHAIR AND SPEAKER</th>
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<tbody>
<tr>
<td>3:00 pm to 3:05 pm</td>
<td>Welcome address</td>
<td>Yuka Sumi (WHO)</td>
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<tr>
<td><strong>Section 1</strong></td>
<td><strong>Introduction</strong></td>
<td><strong>Chairpersons:</strong> Stephanie Studenski (University of Pittsburgh, USA); Ivan Bautmans (Vrije Universiteit Brussel, Belgium)</td>
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<tr>
<td>3:05 pm to 3:15 pm</td>
<td>Objectives of the meeting and expected outcomes</td>
<td>Jotheeswaran Amuthavalli Thiyagarajan (WHO)</td>
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<tr>
<td>3:15 pm to 3:22 pm</td>
<td>WHO’s Public Health Framework for Healthy Ageing</td>
<td>Yuka Sumi (WHO)</td>
</tr>
<tr>
<td>3:22 pm to 3:30 pm</td>
<td>Vitality capacity: a clinical perspective</td>
<td>Matteo Cesario (WHO)</td>
</tr>
<tr>
<td>3:30 pm to 3:35 pm</td>
<td>Q&amp;A</td>
<td>Stephanie Studenski and Ivan Bautmans</td>
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<tr>
<td><strong>Section 2</strong></td>
<td><strong>Conceptual framework and phenotypes of vitality capacity</strong></td>
<td><strong>Chairpersons:</strong> Stephanie Studenski (University of Pittsburgh, USA); Ivan Bautmans (Vrije Universiteit Brussel, Belgium)</td>
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<tr>
<td>3:35 pm to 3:45 pm</td>
<td>Conceptual framework and attributes</td>
<td>Veerle Knoop (Vrije Universiteit Brussel, Belgium)</td>
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<tr>
<td>3:45 pm to 4:30 pm</td>
<td>Discussion on the attributes (physiological markers)</td>
<td>Chairpersons</td>
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<tr>
<td>4:30 pm to 4:40 pm</td>
<td>Coffee break</td>
<td>Chairpersons</td>
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<tr>
<td>4:40 pm to 4:50 pm</td>
<td>Review the final list of attributes</td>
<td>Chairpersons</td>
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<tr>
<td>4:50 pm to 5:00 pm</td>
<td>Concluding remarks and plans for day 2</td>
<td>Christopher Mikton (WHO); Jotheeswaran Amuthavalli Thiyagarajan (WHO)</td>
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### Day 2. 9 December 2021

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<thead>
<tr>
<th>TIME</th>
<th>AGENDA</th>
<th>CHAIR, CO-CHAIR AND SPEAKER</th>
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<tbody>
<tr>
<td><strong>Section 1</strong></td>
<td><strong>Introduction</strong></td>
<td><strong>Chairpersons:</strong> Stephanie Studenski (University of Pittsburgh, USA); Ivan Bautmans (Vrije Universiteit Brussel, Belgium)</td>
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<tr>
<td>3:00 pm to 3:10 pm</td>
<td>Recap of day 1 and outstanding issues</td>
<td>Christopher Mikton (WHO)</td>
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<tr>
<td>3:10 pm to 3:15 pm</td>
<td>Instructions for the breakout session</td>
<td>Jotheeswaran Amuthavalli Thiyagarajan (WHO)</td>
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<tr>
<td>3:15 pm to 3:45 pm</td>
<td>Breakout session</td>
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<tr>
<td>3:45 pm to 4:00 pm</td>
<td>Coffee break</td>
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<tr>
<td>4:00 pm to 4:30 pm</td>
<td>Presentations from the groups</td>
<td>Groups leads</td>
</tr>
<tr>
<td>4:30 pm to 4:50 pm</td>
<td>Feedback on the conceptual definition</td>
<td>All participants</td>
</tr>
<tr>
<td>4:50 pm to 4:55 pm</td>
<td>Next steps</td>
<td>Ivan Bautmans (Vrije Universiteit Brussel, Belgium)</td>
</tr>
<tr>
<td>4:55 pm to 5:00 pm</td>
<td>Concluding remarks and the way forward</td>
<td>Theresa Diaz (WHO)</td>
</tr>
</tbody>
</table>
Annex 2: List of participants

Invited experts and co-authors
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Declaration of interests:

Declaration of interest for external contributors acting on their individual capacity has been collected, assessed, and managed as per WHO policy. All invited experts participated in the meeting in their individual expert capacity and did not represent any governments, any commercial industries or entities, any research, academic or civil society organizations, or any other bodies, entities, institutions or organizations. The experts involved in the development of this document declared no conflict of interest.