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Healthy Longevity

Supplementary appendix

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Supplement to: Bautmans I, Knoop V, Amuthavalli Thiyagarajan J, et al. WHO working definition of vitality capacity for healthy longevity monitoring. *Lancet Healthy Longev* 2022; **3**: e789–96.

**Appendix: WHO working definition of vitality capacity for monitoring healthy
longevity**

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Working group members

Invited experts	
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Jotheeswaran Amuthavalli	
Thiyagarajan	
Theresa Diaz	
Christopher Mikton	
Yuka Sumi	

All members of the vitality capacity working group.

Meeting agenda: expert meeting day 1

Day 1 – 8 December 2021

Time	Agenda	Chair(s) and speakers
3:00 pm to 3:05 pm	Welcome address	Yuka Sumi (WHO)
Section 1	Introduction	Chairpersons: Stephanie Studenski (University of Pittsburgh, USA); Ivan Bautmans (Vrije Universiteit Brussel, Belgium)
3:05 pm to 3:15 pm	Objectives of the meeting and expected outcomes	Jotheeswaran Amuthavalli Thiyagarajan (WHO)
3:15 pm to 3:22 pm	WHO's Public Health Framework for Healthy Ageing	Yuka Sumi (WHO)
3:22 pm to 3:30 pm	Vitality capacity: a clinical perspective	Matteo Cesario (WHO)
3:30 pm to 3:35 pm	Q&A	
Section 2	Conceptual framework and phenotypes of vitality capacity	Chairpersons: Stephanie Studenski (University of Pittsburgh, USA); Ivan Bautmans (Vrije Universiteit Brussel, Belgium)
3:35 pm to 3:45 pm	Conceptual framework and attributes	Veerle Knoop (Vrije Universiteit Brussel, Belgium)
3:45 pm to 4:30 pm	Discussion on the attributes (physiological markers)	Chairpersons
4:30 pm to 4:40 pm	Coffee break	
4:40 pm to 4:50 pm	Review the final list	Chairpersons
4:50 pm to 5:00 pm	Concluding remarks and plans for day 2	Christopher Mikton (WHO); Jotheeswaran Amuthavalli Thiyagarajan (WHO)

Meeting agenda: expert meeting day 2

Day 2 - 9 December 2021

Time	Agenda	Chair(s) and speakers
Section 2	Introduction	Chairpersons: Stephanie Studenski (University of Pittsburgh, USA); Ivan Bautmans (Vrije Universiteit Brussel, Belgium)
3:00 pm to 3:10 pm	Recap of day 1 and outstanding issues	Christopher Mikton (WHO)
3:10 pm to 3:15 pm	Instructions for the breakout session	Jotheeswaran Amuthavalli Thiyagarajan (WHO)
3:15 pm to 3:45 pm	Breakout session	
3:45 pm to 4:00 pm	Coffee break	
4:00 pm to 4:30 pm	Presentations from the groups	Groups leads
4:30 pm to 4:50 pm	Feedback on the conceptual definition	All participants
4:50 pm to 4:55 pm	Next steps	Ivan Bautmans (Vrije Universiteit Brussel, Belgium)
4:55 pm to 5:00 pm	Concluding remarks and the way forward	Theresa Diaz (WHO)

Focused overview of the concepts on definitions and attributes of vitality capacity

Literature search and outcomes

The databases PubMed, Web of Science, Embase, Scopus, PsychInfo, the Cochrane Central Register of Controlled Trials (CENTRAL) and the Cochrane Database of Systematic Reviews (CDSR) are systematically screened for eligible articles. For this preliminary and exploratory literature search only the PubMed database was used. The following key words were used to build a search strategy, firstly we started with including the term “vitality capacity” in the query box of PubMed (Search 29/09/2021) resulting in only 757 articles which there were a few articles including any assessment of “*vitality capacity*” in older people but not on the concept of “*vitality capacity*”. This allowed to build a detailed search strategy using different keywords along with MeSH terms to use the PubMed database. The following keywords were used in combination with each other: “Vitality Capacity” AND “Aged” OR “Older adult*” resulting in 174 articles.

Conceptual framework of vitality capacity

Based on the literature resulted from the following keywords: ((Vitality capacity) AND (“Aged”[Mesh]) OR (older adult*)) it was possible to create a framework of vitality definitions of vitality capacity that is used in the literature. This literature search conducted prior to the meeting identified three potential definitions of vitality proposed by WHO collaborators, 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 (1).
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 (2).
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 (3).

Other definitions of vitality were identified such as: vitality is one hand associated liveliness, feeling full or energy and other psychological constructs (4) but also emerges from a physical performance construct of vigor and strength concerning physical domains (5, 6). Ryan and Frederick (4) defined subjective vitality as energy that is perceived to emanate from the self, with an internal locus of causality (extent that one experiences one's energy as "one's own" and as emanating from the self) and is influenced by both psychological and physical factors (7). Giudici, de Souto Barreto (6) created 3 operational definitions of vitality: (1) Vitality representing a mental state of willingness, (2) Vitality corresponding to a physical reservoir (3) and vitality corresponding to global physiological reservoir the fourth quartile for hand grip strength. Vitality can be conceptualized as the amount of IC that can be retained and be seen as underlying a person's resilience to challenges, vigour and stamina (8) Since vitality has been proposed as the key domain in the construct of intrinsic capacity that drives the other domains it can take place on cellular level as well in higher physiologic systems meaning that when there is an accumulation of deficits this will reach a threshold where overt losses of capacity will be presented.

Attributes for measuring vitality found in the literature

Based on the outcomes of this literature search on the definitions of vitality, the PubMed database was further explored using a more advanced search string including the following keywords ((Vitality capacity) AND ("Aged"[Mesh]) OR (older adult*)) AND ((assess* OR screen* OR measur*)) resulting in 134 articles. A first preliminary search led to identification of a number of screening tools for capturing “vitality” including different domains. Energy expenditure and malnutrition vitality, Mental vitality, Physical vitality, Biomarkers for vitality and Self-reported measures of vitality. The objective recording of these parameters mirroring the individual’s vitality will predispose the monitoring over time of an essential factor for the phenotypic and functional modifications that the person may experience.

- **Energy expenditure and malnutrition vitality** was addressed in the literature through various questions and instruments of which: resting Metabolic rate(2), weight loss (2, 9), Low body mass index (2, 10), Overweight/obesity(2), question “compared with two years ago, did you lose 5kg or more?(11), question “In the last two years, have you eaten less because of loss of appetite, digestive problems, or difficulties chewing or swallowing?”(11), Abdominal circumference (10, 12), Mini Nutritional assessment (10, 12), mid-upper arm circumference (10), Phase angle derived from bioimpedance measurement (10), loss of appetite (9)
- **Mental vitality** was assessed in the literature through questions from the Geriatric Depression Scale (13) in two articles(7, 14).
- **Physical vitality** consisted of handgrip strength (7, 10, 12, 14-18), Peak flow test (8, 10, 15, 16), cycle ergometer (14), Grip Work (19, 20), fatigue resistance test(20) and Capacity to Perceived Vitality parameter (20).
- **Biomarkers for vitality** in the literature including: Dehydro-epiandrosteron (DHEA), Insulin-like growth factor (IGF-1), full blood assay and hemoglobin (10, 14-16).
- **Subjective assessment tools for vitality** including the Subjective Vitality Scale (SVS) (21, 22), MMSE (23) and self-reported fatigue(19), LASA-FI (24)

Research gaps

As shown in the previous sections it is clearly that there is a lack of a clear conceptual and operational definition of the vitality domain; no consensual operational definition of vitality has been proposed in literature so far. The lack of a definition makes that in the literature many related constructs could be found, and that is unclear which measurement tools can capture vitality.

Experts taking part to this meeting are therefore expected to reach consensus on the best applicable instruments that can be used on national level to measure the concept of “*vitality capacity*”, which, as shown, seems to have not been extensively studied so far as such. Therefore, the aims of the meeting will be 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.

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