

COMMENTARY

The frailty phenotype and the frailty index: different instruments for different purposes

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Abstract

The integration of frailty measures in clinical practice is crucial for the development of interventions against disabling conditions in older persons. The frailty phenotype (proposed and validated by Fried and colleagues in the Cardiovascular Health Study) and the Frailty Index (proposed and validated by Rockwood and colleagues in the Canadian Study of Health and Aging) represent the most known operational definitions of frailty in older persons. Unfortunately, they are often wrongly considered as alternatives and/or substitutables. These two instruments are indeed very different and should rather be considered as complementary. In the present paper, we discuss about the designs and rationals of the two instruments, proposing the correct ways for having them implemented in the clinical setting.

Keywords: *frailty, phenotype, screening, disability, older people*

Although the theoretical foundations of the frailty syndrome are well established in literature and the concept almost universally accepted, its practical translation (especially in the everyday clinical life) remains controversial [1]. The integration of frailty measures in clinical practice is crucial for the development of interventions against age-related conditions (in particular, disability) in older persons [2]. Multiple instruments have been developed over the last years in order to capture this geriatric 'multidimensional syndrome characterized by decreased reserve and diminished resistance to stressors' [3] and render it objectively measurable.

Fried *et al.* [4] initially hypothesised some core clinical presentations of frailty, which were then operationalised into the instrument (i.e. the frailty phenotype) validated in the Cardiovascular Health Study [5]. Subsequently, Rockwood *et al.* [6] used the Canadian Study of Health and Aging to develop and validate the so-called Frailty Index. During the last few years, several other instruments to measure frailty have been proposed, frequently building on these two models [7–9]. Indeed, the frailty phenotype and the Frailty Index have monopolised the attention of the scientific community, with a polarisation into distinct 'schools of thought'.

It is not uncommon to hear about the preference that a clinician or a researcher has for one or the other instrument. However, it is inappropriate to consider the frailty phenotype and the Frailty Index as alternatives and/or substitutables. These two instruments are different and should rather be considered as complementary. Their main characteristics and differences are presented in Table 1.

The frailty phenotype is based on a pre-defined set of five criteria exploring the presence/absence of signs or symptoms (i.e. involuntary weight loss, exhaustion, slow gait speed, poor handgrip strength, and sedentary behaviour) [5]. The number of criteria (a 6-level ordinal variable ranging from 0 to 5) is categorised into a 3-level variable depicting robustness (none of the criteria), pre-frailty (one or two criteria) and frailty (three or more criteria). The frailty phenotype can be applied at the first contact with the subject and does not need a preliminary clinical evaluation. Therefore, it may well serve for the initial risk stratification of the population according to different profiles (i.e. robust, pre-frail and frail). Yet, the frailty phenotype does not provide any indication about preventive or therapeutic interventions to put in place. By being composed of very general signs or

Table 1. Main characteristics of the frailty phenotype and the Frailty Index

Frailty phenotype	Frailty Index
Signs, symptoms	Diseases, activities of daily living, results of a clinical evaluation
Possible before a clinical assessment	Doable only after a comprehensive clinical assessment
Categorical variable	Continuous variable
Pre-defined set of criteria	Unspecified set of criteria
Frailty as a pre-disability syndrome	Frailty as an accumulation of deficits
Meaningful results potentially restricted to non-disabled older persons	Meaningful results in every individual, independently of functional status or age

symptoms, it can mainly rise an ‘alert’ about a possible problem. Such alert cannot generate immediate preventive or therapeutic interventions because no information is available about the underlying causes of the condition of risk. For example, it would be improper to treat involuntary weight loss or slow gait speed without knowing the underlying causal conditions. Only the subsequent comprehensive geriatric assessment (i.e. the multidimensional, interdisciplinary diagnostic process evaluating the overall health status of a frail older person in order to develop a coordinated and integrated intervention) will provide the required information supporting specific actions.

Although the frailty phenotype is composed by simple tasks, its administration and meaningfulness may sometimes result problematic. The evaluation of muscle strength and gait speed is not always doable, especially in primary care, due to the lack of dynamometers and/or space/time to assess gait speed. Moreover, specific conditions (such as disability or cognitive impairment) may affect the reliability or clinical utility of the frailty phenotype results. In particular, disabling conditions may affect the predictive value of the phenotype for negative health-related events due to a sort of ‘ceiling effect’ [10]. Furthermore, the instrument may become unfeasible if to be applied to large populations. In this case, the required contact between the individual and the assessor for measuring the frailty phenotype may render alternative screening tools (e.g. self-reported questionnaires [11]) to be preferred in the first estimation/screening of the individual’s risk profile.

Conversely, the Frailty Index is composed by a long checklist of clinical conditions and diseases. The 70 items of the original version are not to be considered as a fixed set of variables. The conceptual design of this index deems as more important the deficit accumulation. It has been reported that estimates of risk are robust when a minimum of 50 items are considered, but shorter versions (as low as 20 conditions) have also been explored [12]. Although the Frailty Index has sometimes been categorised in order to mirror dichotomous conditions (e.g. robustness versus frailty) [13], its major distinctive trait resides in its continuous nature. It is evident that the Frailty Index is inapplicable at the first contact with an individual because it can only be generated after (or in parallel

with) a comprehensive geriatric assessment. Once completed, the Frailty Index then becomes extremely informative for the continuous follow-up of the subject. In fact, the Frailty Index is likely more sensitive to modifications than the categorical frailty phenotype [1]. Thus, the Frailty Index may be a more useful tool to ascertain the effectiveness of any intervention and to describe the health status trajectories over time. The continuous variable also allows to avoid the risk of misclassifications due to the arbitrary decisions required for defining thresholds of risk (i.e. cut-points). Nevertheless, the clinical implementation of a parameter always passes through its categorisation into classes of risk, differentiating normality from abnormality. The categorisation into groups of risk of the frailty phenotype makes it closer to the definition of a standard clinical condition than the Frailty Index. In a clinical world increasingly dominated by technologies, it can be envisaged (but yet to be field-tested) that a comprehensive geriatric assessment embedded into an electronic health record would automatically generate a Frailty Index serving as reference for subsequent assessments.

Last but not least, it cannot be ignored two major conceptual differences at the basis of the two instruments:

- (1) *Relationship between frailty and nosographically classified conditions.* As mentioned, the frailty phenotype is based on the evaluation of signs and symptoms. This means that, according to Fried *et al.* [5, 14], frailty may theoretically exist even in the absence of nosographically classified conditions. Under such perspective, the frailty phenotype indeed depicts a novel age-related condition of special interest for system biology [15]. Conversely, the Frailty Index is largely based on nosographically classified conditions. It describes a risk profile closer to the one measured by the clinician, potentially defining a condition of vulnerability different from that isolated by the phenotype of frailty.
- (2) *Relationship of frailty with disability.* In their study validating the phenotype, Fried *et al.* [5] support the hypothesis that frailty causes disability independently of (sub)clinical diseases. They explain that ‘the syndrome of frailty may be a physiologic precursor and etiologic factor in disability’. This means an implicit identification of frailty as a key factor for the design and conduction of interventions against incident disability. Therefore, the frailty phenotype finds its ideal application in non-disabled older subjects. On the other hand, the Frailty Index includes items of functional disability (e.g. problems getting dressed, problems with bathing and impaired mobility) in its computation [6]. In other words, the Frailty Index does not make a clear differentiation between frailty and disability. It is more interested at objectively estimating the amount of accumulated deficits/functional losses, whichever they are.

These conceptual differences between the two instruments obviously and consequently differentiate the target populations to which they might be applied. As mentioned,

while we may meaningfully estimate the Frailty Index in every individual, the frailty phenotype may lose some of its clinical relevance when assessed in older persons already experiencing disability.

To summarise, the frailty phenotype categorically defines the presence/absence of a condition of risk for subsequent events (most specifically, disability). By differentiating a normal (i.e. robustness) versus an abnormal (i.e. frailty) status, the frailty phenotype may facilitate the implementation of the frailty concept into clinical practice. It provides the clinical-friendly dichotomous variable on which deciding the possible need of adapted care and/or interventions. Differently, the Frailty Index acts as measure of the organism capacity to accumulate deficits. It tells us how many clinical conditions are present and concur at exhausting reserves. Thus, the Frailty Index seems to act as an objective marker of deficits accumulation.

Current evidence about a relevant convergence between the two principal models of frailty should be taken as a measure of the validity of the concept of frailty [13]. Likewise, it is evident that the two measurements cannot be considered as equivalent. They find their usefulness at distinct times in the evaluation of an individual and as such they serve different purposes. The use of an instrument should always be conform to the aims for which it was designed with respect for its characteristics. The correct and combined/sequential use of the two instruments is advisable because they provide distinct and complementary clinical information about the risk profile of an older person.

The only way to prevent/delay disabling conditions is through the implementation of early actions in persons presenting an increased risk profile. Geriatricians and general practitioners should feel themselves more responsible for the tasks of measuring frailty in older persons, raising awareness about the burdens of age-related and disabling conditions among their patients and promoting primary preventive actions in the community (in collaboration with public healthcare authorities).

Key points

- The frailty phenotype and the Frailty Index are frequently perceived as alternatives although designed for different purposes.
- The frailty phenotype may be more suitable for an immediate identification of non-disabled elders at risk of negative events.
- The Frailty Index may summarise the results of a comprehensive geriatric assessment providing a marker of deficits accumulation.
- The two instruments have different purposes and are to be considered complementary in the evaluation of the older person.

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