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Frailty and Multimorbidity in Elderly People: A Shift in Management Approach

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Abstract: Frailty and multimorbidity may be regarded as a homeostatic failure of a complex system, and these conditions are commonly encountered in elderly people. The concept of "frailty" has been used to describe an individual's biological age, and the concept of "multimorbidity" is reserved for the simultaneous presence of two or more chronic health problems in one person. As frailty and multimorbidity are being better understood, optimal management of frail, multimorbid elderly patients is being re-evaluated. In this article, the author provides an overview of frailty, chronic disease, and multimorbidity, and describes how their optimal management can serve as a foundation for developing more expedient, organized, and goal-oriented care of elderly people with complex health problems. The author also describes important challenges for future research and development regarding the management of complex health issues in elderly people; these include transitioning from single disease management to multiple disease management, and expanding the conventional organ-based work-up and treatment plan with repeated evaluations of different systems and functional domains using the comprehensive geriatric assessment method. As noted, one particular challenge that must be addressed is the development of medical records that can serve as a much-needed "geroscope," enabling an overview of the patient's health situation, disease management, and follow-up care.

Key Words: Frailty, multimorbidity, chronic disease, clinical analysis, comprehensive geriatric assessment.

A human being is a typically complex system. The great strength of a working complex system (biological, mechanical, political) is its innate ability to withstand stressors through multiple defense systems. A complex system can begin to fail, however, after an accumulation of successive minor injuries, and the processes that fail first are often particularly complex functions; in human beings, these functions might include cognition and gait/balance.¹ The primary difference between older and younger people is that advanced age reduces physiological reserves and lowers physiological adaptability. This increases the older adult's risk for failing homeostasis, which can manifest as a variety of health problems and make these patients particularly sensitive and vulnerable to repeated minor stressors or injuries.

The conditions that have been described as *geriatric syndromes* or *geriatric giants*, such as confusion, falls, involuntary weight loss, and urinary incontinence, can therefore be viewed as a homeostatic failure of complex systems. As a rule, there is no single causal factor that fully explains the presence of these syndromes, which means that the clinical analysis and management of these syndromes and the care of elderly people should not focus on individual health problems but rather on providing individualized and comprehensive, coordinated management, defined as follows:

- **Individualized management:** The individual patient's health situation, treatment, prognosis, and wishes are considered and the patient's care is adapted accordingly.
- **Comprehensive, coordinated management:** The various health problems, treatment methods, and follow-up should *all* be included in a surveyable, *coordinated* healthcare process performed over time, in which various assessments and management measures are carried out in an organized and targeted manner and in a well-planned sequence without the unnecessary duplication of effort.

Frailty and multimorbidity are often encountered in elderly people and lead to a complex clinical picture. Therefore, an understanding of these conditions is necessary to provide elderly patients with better individualized, comprehensive, and targeted coordinated care plans. This article provides an overview of frailty, chronic disease, and multimorbidity in elderly people and describes how using the comprehensive geriatric assessment (CGA) method can improve the care of these patients.

Frailty: Definition and Consensus Criteria

Geriatric and gerontological literature has long emphasized the necessity of differentiating between chronological and biological age. The great variation in biological aging has led to the development of the

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concept of *frail elderly*, a term that was first used in 1974 to denote the biological age of an individual both to assess the person's proximity to his or her own boundary for age-related vulnerability and to predict prognoses, particularly regarding cognitive function, physical impairment, risk of falling, institutionalization, and mortality.² Several other terms have been used to describe frailty (eg, *pre-death* or *survival of the un-fittest*,³ the pediatric term *failure to thrive* applied to elderly people,⁴ *aging syndrome*,⁵ *accelerated* or *pathological aging*⁶). Attempts have also been made to define *frailty* as a specific phenotype.⁷ **Figure 1** illustrates the differences between successful aging and frail aging.⁸ Successful aging, for example, is characterized by good physiological reserves to maintain full functional ability and resist stressors and changes, such as mental stress, changes in environment, illnesses, and injuries (functional homeostasis). Frail aging lies somewhere between successful aging and impaired personal activities of daily living (ADLs) and has no clear connection with chronological age.

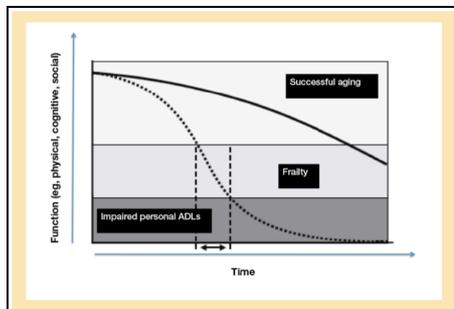


Figure 1. Graphic showing the difference between successful aging and frailty. There is a key window (indicated by the left right arrow) in which progression to frailty may be reversed. During this time period, implementing individualized, integrated, coordinated, and targeted treatment programs may help counteract or slow the progression towards a permanently reduced autonomy and an impaired ability to perform activities of daily living; thus, optimal implementation of such programs can reduce the need for care.

Adapted from reference 8 (Ferrucci et al.) in the citation list.

There is a lack of consensus criteria for frailty. Several operational proposals for frailty indices have been published,² all of which consist of the following two components: (1) impaired structure (involuntary weight loss) and (2) impaired function (physical and/or cognitive function). This definition of frailty has many similarities to a modern consensus definition of *cachexia* (ie, a complex metabolic syndrome associated with underlying illness and characterized by loss of muscle with or without loss of fat mass),⁹ The reduced body weight associated with frailty is related to a reduction in muscle mass (sarcopenia) and is associated with muscular weakness, walking difficulty, and a tendency to fall.¹⁰ The many different proposals for criteria or indices for assessing frailty have not yet been adapted for clinical use, with one study showing that the application of different frailty criteria to the same group of multimorbid, hospitalized elderly patients led to significant differences in the prevalence of frailty.¹¹

Mounting evidence indicates that the condition of frailty can be triggered and maintained by chronic, low-degree inflammation (an inflammatory phenotype referred to as *inflammaging*),^{12,13} which is characterized by the overproduction of proinflammatory cytokines, the reduced level or effect of anabolic hormones, the activation of the coagulation system, low levels of vitamin D₃ and cholesterol, and normocytic anemia, among others. One current hypothesis is that negative spirals are created via processes such as cytokine activation, neuroendocrine dysregulation, and sarcopenia.¹⁴ If this hypothesis is correct, interventions to counteract frailty could—at least partially—focus directly on these pathophysiological processes, regardless of which specific chronic diseases a given elderly person with frailty has.

Aging and Chronic Disease

Advancing age is the most important risk factor for illness and injury. When the average lifespan of a population increases, the incidence of chronic disease increases proportionately. According to Statistics Sweden, between 1900 and 2009 the expected average lifespan in Sweden increased from 54.5 to 79.4 years for men and from 57.0 to 83.4 years for women. During that same period, the number of people aged 75 years and older increased more than fivefold, from 142,920 to 798,446.¹⁵ This expanded lifespan has led to an extensive increase in the number of elderly people living with chronic diseases.

US studies have shown that the prevalence of chronic disease increases with age. In their 1996 study, for example, Hoffman and colleagues¹⁶ reported that more than 45% of the noninstitutionalized, general population and 88% of the population aged 65 years and older have at least one chronic condition. In 2002, Wolff and colleagues¹⁷ reported that the prevalence of chronic conditions among Medicare beneficiaries increased with age, from 74% of individuals aged 65 to 69 years to 88% of individuals aged 85 years and older. In the United States, 75% of the total healthcare budget goes toward treating people with chronic diseases and conditions.¹⁷

Aging and Multimorbidity

The risks associated with chronic disease include the following: (1) continuous progression of the illness; (2) reduced function in a variety of functional domains; (3) poor management, underdiagnosis, and undertreatment of other health problems that are not related to the chronic ailment(s); and (4) occurrence of other chronic diseases.^{18,19} Of all individuals with a chronic ailment, 44% have at least one additional chronic ailment,¹⁶ and, of those with multiple conditions, the diseases tend to collect in certain clusters.²⁰ Studies on the treatment of isolated illnesses in elderly people (aged ≥65 years) are generally limited and

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are even more limited for multimorbidity,²¹ meaning that the treatment of multimorbid elderly patients is primarily based on the extrapolation from scientific treatment studies involving younger people and the treatment of one illness or condition at a time.

Defining Multimorbidity

There is no consensus definition of *multiporbidity* beyond when one person concurrently has two or more verifiable chronic ailments and/or injuries in a variety of combinations.²² Any other attempts to further define and grade multimorbidity result in arbitrary delimiters regarding the number and degree of health problems. The scientific literature in this field describes the following three ways of defining *the multimorbid* as a group^{22,23}:

- Tally of the number of concurrent health problems in an individual (disease count).
- Multimorbidity index based on a limited number of defined health problems/domains, as a rule selected because they have significance for the prognosis (weighted).
- Comorbidity index based on health problems associated with a certain index problem (see below).

One review showed 13 different published proposals for validated indices to describe and measure multimorbidity; many of these were developed to describe multimorbidity linked to an index disease.²³ There are many other published indices and methods, primarily compiled for epidemiological purposes, to describe groups of patients and predict various outcome variables (ie, prognoses), such as decreased autonomy, physical impairment, falls, emergency hospitalizations, and mortality, to use in healthcare planning.²³ As a rule, however, a given index method cannot be used to predict multiple outcome variables²⁴; these indices are not developed for the comprehensive clinical analysis and management of individual patients.

Thus, the concept of multimorbidity does not include the concurrent occurrence of many different symptoms (ie, multisymptomatology), the degree of severity of illnesses/injuries, functional impairment (eg, physical, cognitive, sensory, social), or many different treatments (eg, multitreatments, including polypharmacy, polynutrition, and multiple assistive devices). The attempts that have been made to delimit the group of "multimorbid elderly" in indices or criteria based on the incidence of impaired physical function/ADLs (eg, expressed as a need for a decision on social assistance), number of prescribed medications, or a certain consumption of healthcare services have not been validated and are not supported by scientific studies. All factors, in addition to the patient's actual number of health problems, can be described as attempts to weigh the multimorbidity for illnesses/injuries according to specific criteria, such as functional consequences or the need for care and thereby cost. The multimorbidity indices mentioned above are not used in regular healthcare practice.

Types of Multimorbidity

There are two main types of multimorbidity: primary and secondary. In addition, there are two intermediate forms: concordant and discordant. What follows is a description of each of these forms of multimorbidity.

Primary multimorbidity. When a person has several different health problems that appear to be completely or partially independent of one another (co-occurrence), that individual is experiencing primary multimorbidity. An example of a patient with primary multimorbidity would be an 80-year-old woman with chronic obstructive pulmonary disease, Parkinson's disease, type 2 diabetes mellitus, urinary incontinence, osteoarthritis in her right knee with pain upon ambulation, depression, cataracts, hearing impairment, and constipation.

Secondary multimorbidity (comorbidity). This type of multimorbidity occurs when a person's underlying illness leads to several manifestations and/or complications related in whole or in part to his or her underlying illness (eg, rheumatoid arthritis, stroke, dementia, cancer, cystic fibrosis, HIV). Although a patient with secondary multimorbidity only has one formal diagnosis according to the World Health Organization International Classification of Diseases (ICD-10), he or she may demonstrate a very complex clinical picture with manifestations from several organs/systems and domains.

Concordant and discordant multimorbidity. An intermediate form of multimorbidity between primary and secondary multimorbidity can be distinguished if there are one or more common pathophysiological mechanisms or specific clustering of diagnoses. This has been described as *concordant* or *discordant multimorbidity* in relation to a given index disease.²⁵ Conditions are concordant when they represent parts of the same overall pathophysiologic risk profile and fall under the same disease management plan, and they are discordant when they are not directly related in either their pathogenesis or management and do not share an underlying predisposing factor.²⁵ Coronary disease, peripheral vascular disease, and hypertension are some examples of multimorbidities that are concordant with diabetes mellitus, while bronchial asthma, prostate cancer, and lumbago are some examples of multimorbidities that are discordant with diabetes mellitus.

Prevalence of Multimorbidity

The prevalence of multimorbidity (≥ 2 chronic diseases) increases with age²² and is therefore common in both primary care and hospital settings. A 2007 study from the United Kingdom showed that approximately 80% of patients aged 50 years and older (mean age, 66 years) in the primary care setting have multiple health problems. A corresponding primary care study from Canada reported that 97% of men and 99% of women aged 65 years and older had two or more chronic diseases or conditions.²⁶

Correlation Between Multimorbidity, Self-Assessed Health, and Physical Function

There are no simple correlations between an individual's number of concurrent illnesses, self-assessed health, and impaired physical function. A 2009 study of a cohort of 85-year-old patients in the United Kingdom showed extensive multimorbidity (approximately 90% had ≥ 3 diseases) and multiple treatments (an average of 6.7 prescribed medications per person) in its participants.¹⁹ Despite this, nearly 78% of patients assessed their own health as being "good," "very good," or "excellent" compared with other people of the same age; approximately 77% resided in their homes and only approximately 22% had received inpatient care over the previous year.

A 2007 study showed a correlation between classes of increasing multimorbidity and impaired physical function; for example, 45% of individuals in a group including persons with two or three concurrent illnesses had poor physical function, while nearly 72% of individuals in the group including persons with six or more concurrent illnesses had poor physical function.²⁷ On the individual level, however, there was no correlation between the type or degree of multimorbidity and decreasing physical function. With regard to progression over time, a Swedish study from 2005 showed that the proportion of self-reported symptoms and health problems in people aged 65 years and older appears to have increased since the 1990s in parallel with a decrease in objectively measured physical and pulmonary function.²⁸

Comprehensive Geriatric Assessment for Frail, Multimorbid Patients

When analyzing the health of elderly people with frailty and multimorbidity, one must investigate and assess the number of different health domains in addition to organ-related problems. It is for this reason that the CGA method has been recommended since 1988 for analyzing frail and multimorbid elderly patients.²⁹ The CGA serves as a sort of 'geroscope'—a multidimensional, interdisciplinary diagnostic procedure for mapping out the medical, functional, and psychosocial health problems and capacities of multimorbid, frail elderly individuals to *target* complex treatments and interventions (eg, pharmaceuticals, nutrition, physical training/activity, assistive devices, social stimulation, assistance with personal and/or instrumental ADLs) in the framework of a collective, long-term treatment program with regular follow-up.³⁰ One crucial factor for obtaining positive effects from CGA-based treatment is to direct all management of the condition toward clear, realistic objectives, which are formulated jointly by the elderly patient (preferably with his or her relatives) and the management team. **Figure 2** illustrates the possible components of a CGA. A 2006 consensus document from the American Geriatrics Society indicates that a routine CGA should include *at least* the following components: mental function, mobility, continence, nutrition, medical treatment, and resources (personal, family members, local community).³¹ Other consensus documents on CGA have been published internationally, including a 1996 paper on the Nordic approach to CGA.³²

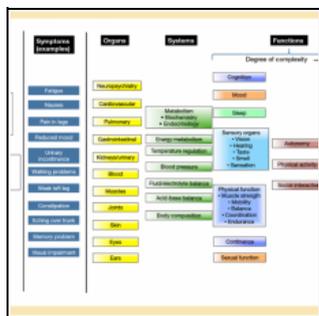


Figure 2. Components that may be included in a comprehensive geriatric assessment (CGA). The assessment comprises symptoms, organs, systems, and different types of functional impairments, with the right side of the figure showing increasing patient complexity. CGA also includes evaluation of the risk factor profile and resources regarding the individual person's life situation, motivation, and wishes.

A 2010 systematic overview and meta-analysis based on seven high-quality, randomized controlled studies showed that CGA-based treatment at specialized geriatric evaluation and management units in hospitals leads to significantly less functional decline on discharge from the hospital (relative risk [RR], 0.87; 95% confidence interval [CI], 0.77-0.99; $P= .04$) and a significantly reduced rate of institutionalization after 1 year (RR, 0.78; CI, 0.66-0.92; $P= .003$).³³ A meta-analysis from 1993 showed improved physical and cognitive function and reduced institutionalization 1 year after the intervention.³⁴

Assessment of the effects of CGA-based treatment was hampered because these studies included heterogeneous combinations of multimorbid elderly patients and the precise contents of the CGA-based treatments varied, in part depending on the health problems and available resources of the individuals involved in the studies. The more comprehensive functions being assessed (eg, combined physical functional performance, ADLs, health-related quality of life), the more healthcare providers are forced to use various assessment scales that have a limited capacity to distinguish between treatment effects. CGA-based treatment has also shown clear, positive effects in patients with more limited geriatric syndromes, such as delirium; in patients who have had a stroke; and for the prevention of falls in the home, hospital, and nursing home.³⁵⁻³⁸ CGA-based treatment has notably poorer effects when conducted as geriatric team consultations at hospitals in which the geriatric team is not responsible for and does not carry out the treatments.³⁰

CGA has rarely developed its full potential in clinical medicine. This is in part due to the fragmented nature of the healthcare organization, fragmented documentation, and the lack of geriatric medicine care units in primary and municipal care. Because of all of this, it is uncommon for multimorbid elderly people to be involved in a comprehensive, goal-oriented treatment program over time based on regularly conducted CGAs. Attempts are underway to develop methods to document and visualize CGAs in individual patients in a surveyable way, both at a specific instance and over time.³⁹

Future Research and Developments

An important challenge for future research and developments regarding the management of frailty and multimorbidity in elderly patients is to shift the focus from managing isolated diseases to managing multiple health problems and to expand the traditional medical organ-based examination and treatment with regularly recurring analyses of various system and functional domains (**Figure 2**). Since it is unlikely that there are even two individuals with identical clinical multimorbidity, this would shift the focus from illnesses to individuals—from an illness in one person to a person with multiple concurrent illnesses and

an individual unique phenotype. The technique for randomized, controlled treatment studies cannot easily be applied to multimorbid elderly people, which can be understood by considering the following questions:

- How can we state that two randomly composed groups of multimorbid elderly people are "similar"?
- What variables do we need to check (stratify) to state that the groups of multimorbid elderly patients are "similar"?
 - The number of long-term health problems
 - The type of health problems
 - The degree of severity of health problems
 - Functional consequences (physical, cognitive, social)
 - The patient's perception of ill health

There are strong arguments for changing and adapting the current healthcare organization, documentation, healthcare training, and quality control to the changed health landscape that includes a dramatically expanding number of elderly people with complex health problems and treatments. Therefore, it is necessary to establish trial projects with a focus on individualized, comprehensive, and coordinated care performed over time.³⁹

Conclusion

The conditions that have been described as geriatric syndromes, including frailty, can be viewed as a homeostatic failure of complex systems. As a rule, there is no single causal factor that fully explains these syndromes, which means that the clinical analysis, management, and care of elderly people should not focus on individual health problems but rather on individualized, comprehensive, integrated, coordinated, and targeted management. There is a lack of consensus criteria for frailty, and scientific studies on the treatment of illnesses in elderly people are generally limited for isolated illnesses and are even more limited for multimorbidity, meaning that the scientific knowledge level for the treatment of multimorbid elderly people is primarily based on the extrapolation from scientific treatment studies involving younger people and the treatment of one illness/condition at a time.

When analyzing the health of elderly patients with frailty and multimorbidity, the number of different health domains and organ-related problems must be investigated and assessed. It is for this reason that the CGA method is recommended for analyzing these patients. CGA has rarely developed its full potential in clinical medicine, in part due to the fragmented nature of the healthcare organization, fragmented documentation, and the lack of geriatric medicine care units in primary and municipal care, and it is uncommon for multimorbid elderly patients to be involved in a comprehensive, goal-oriented treatment program over time based on regularly conducted CGAs.

Attempts are underway to develop methods to document and visualize CGA in individual patients in a surveyable way, both at a specific instance and over time. An important challenge for future research and development regarding the management of frailty and multimorbidity is to shift the focus from managing isolated diseases to multiple health problems and expand the traditional medical organ-based examination and treatment with regularly recurring analyses of various system and functional domains. Establishing trial projects with a focus on individualized, comprehensive, and coordinated care performed over time is crucial.

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This excellent and thought

Barney Spivack, MD (not verified) | 10/4/2013 - 07:57am

This excellent and thought provoking article addressing modern concepts of frailty and multimorbidity, as well as the importance and settings of comprehensive geriatric assessment, has strong implications for population management and other disease management strategies as commonly implemented in Medicare Advantage and other group plans that attempt to optimize the care of older adults. As the author clearly points out, we need to incorporate a broader lens when trying to improve the health and wellbeing of older people and get away from a more limited focus on managing a single disease, especially given the prevalence of multimorbidity in this population.

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