Frailty in elderly people: an evolving concept

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Résumé : Les termes «frêle» et «fragilité» sont très répandus dans les publications sur la gériatrie et la gérontologie, mais qui sont les «personnes âgées frêles»? Dans la plupart des définitions actuelles c'est habituellement l'aspect biomédical ou psychosocial qui prédomine; par ailleurs on entend habituellement par fragilité une baisse de fonctions physiques au-dessous d'un seuil donné. Les auteurs proposent plutôt une définition dynamique de la fragilité qui tient compte de l'équilibre entre les atouts qui favorisent l'indépendance chez les personnes âgées et les déficits qui la menacent, ce qui combinerait les aspects biomédicaux et psychosociaux. Cette stratégie visant à mieux différencier les personnes âgées en bonne santé des personnes âgées frêles sert dans le traitement médical des personnes âgées, dans l'élaboration de stratégies de prévention à leur égard et dans l'établissement de politiques publiques sur les soins qui leur sont destinés. Elle trace aussi les grandes lignes de recherches futures.

The terms "frail" and "frailty" are now part of the language of geriatric medicine and gerontology.[1-6] Characterizing the physiologic basis of frailty has been described as one of the most important research endeavours in medical gerontology.[2,5] However, "frail" and "frailty" are often undefined.[5] As the concept of frailty is increasingly invoked (a MEDLINE search revealed that citations with the MeSH term "frailty" increased from 13 in 1986 to 80 in the first 9 months of 1992), it is important to understand what is meant by the term and to discover if this understanding offers any useful insights. In this article we review existing definitions of frailty and examine an alternative working definition that encompasses medical, psychologic and social factors. We then review the evidence supporting this approach and discuss its implications for the prevention of disease and disability, public policy, medical practice — particularly the practice of geriatric medicine — and future research.

Definitions of frailty

In 1988 Woodhouse and associates[6] defined frail elderly people as those more than 65 years of age who depended on others for the activities of daily living and were often under institutional care. Gillick[7] defined frail elderly people as "old debilitated individuals who cannot survive without substantial help from others," emphasizing the social consequences of frailty.

Frailty is often equated with functional dependence in the activities of daily living,[8-15] although frail elderly people are sometimes described in predominantly medical terms. For example, Pawlson[16] focused on their multiple illnesses, MacAdam and collaborators[17] referred to them as "elderly with chronic conditions," and Williams and colleagues[3] defined them as "requiring long-term hospital care owing to chronic debilitating diseases."

Nevertheless, there is little argument that dependence on others for the activities of daily living is a sufficient condition for frailty.[18] Whether such dependence is a necessary condition for frailty is less clear, and thus some authors are reluctant to equate the two. Moreover, if frailty is a state or outcome, it is reasonable to suppose that there are risk factors for frailty and that the amount of risk varies. Frailty is not "all-or-nothing," and as the risk of frailty increases, the line between the at-risk state

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and functional dependence becomes blurred. This risk of frailty is sometimes expressed as a loss of stamina[9] or as vulnerability[19,20] and is congruent with the notion that homeostasis decreases with age.[21,22]

Three other approaches to defining frailty are of interest. Because frailty is emphasized in the evaluation of specialized geriatric interventions, it is tempting to define frail elderly people as those who benefit from such interventions. Clayman,[23] for example, described frail elderly people as "neither too well nor too disabled." Similarly, Winograd and coworkers[4] classified elderly patients admitted to hospital in subgroups of independent elderly people, frail elderly people and those too "severely impaired" to be defined as frail.

Frailty may also be defined by patients' illnesses, especially the so-called "geriatric giants" of confusion, falls, immobility, incontinence and pressure sores. Winograd and associates[24] proposed considering these illnesses as marker conditions for frailty. Spirduso and Gillam-Macrae[15] related the concept of frailty in elderly people to Bortz's[25] characterization of the human condition as necessarily frail: we are all subject to the effects of time — "an insidious and relentless thief of energy and vitality."[25] Bortz included disease and disuse of the body as two other dimensions of human frailty, but clearly these conditions are not as inevitable a part of life as aging is.

Recently Buchner and Wagner[5] comprehensively reviewed the concept of frailty, which they defined as "losses of physiologic reserve that increase the risk of disability." They regarded frailty as a "precursor state" to disability and, in particular, dependence on others for the activities of daily living.

> The precursor state represents a loss of physiologic capacity that is either not severe enough to interfere with the major activities of daily living . . . or [is] compensated for by alternative strategies.

Buchner and Wagner[5] suggested three important components of the precursor state: impaired neurologic control (indicated by a diminished ability to perform complex tasks), decreased mechanical performance (e.g., diminished strength) and impaired energy metabolism (e.g., decreased aerobic status due to cardiac or pulmonary disease or both). The concept of the precursor state and its components has not been tested empirically.

Although frailty has many definitions, there are some common themes. In general, frailty is defined in predominantly biomedical or psychosocial terms. In addition, most authors define frailty as having a "threshold limit": people have a given amount of "physiologic reserve" (or "stamina") that diminishes over time until they reach a threshold below which they are considered frail. Witten[21] cautioned against this approach, favouring a dynamic model with interacting factors. He demonstrated that a dynamic model with multiple critical points is compatible with human survival curves. We now turn to a definition that incorporates both the biomedical and the psychosocial aspects of frailty and uses a dynamic model instead of a threshold limit model.

A dynamic model of frailty

Brocklehurst[26] used a balance between biomedical and psychosocial components to elaborate a dynamic model of frailty. His "model of breakdown" included many factors that affect whether a person can live in the community (Fig. 1). On one side of the balance are assets, which help a person to maintain his or her independence in the community: health, functional capacity, a positive attitude toward health and other resources (social, spiritual, financial and environmental). On the other side are deficits, which threaten independence: ill health (particularly chronic disease), disability, dependence on others for the activities of daily living and burden on caregivers. For those dependent on others, a caregiver is a crucial asset and the burden on the caregiver an equally important deficit.

From this approach we derived a dynamic model of frailty. For most elderly people, the assets heavily outweigh the deficits: they are well. For others, the deficits outweigh the assets, so these people can no longer maintain their independence in the community: they are the frail elderly people who live in institutions. A third group comprises those for whom the assets and the deficits are in a precarious balance: they are frail but still live in the community.

Our model recognizes a complex interplay of assets and deficits, "medical" and "social," that maintain or

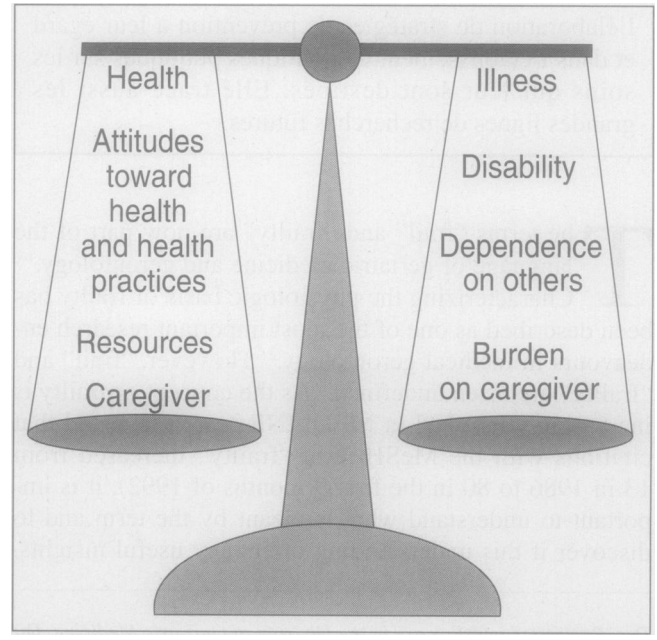

Fig. 1: Dynamic model of frailty in elderly people, in which the balance between assets (left) and deficits (right) determines whether a person can maintain independence in the community.

threaten independence. For well elderly people the scales are "out of balance" in favour of the assets. Increasing frailty tips the scales until the assets and deficits are evenly balanced. At that point even a small additional deficit may tip the balance in favour of the deficits, and the person will no longer be able to maintain his or her independence in the community.

The model is dynamic, and changes in status can be recognized by adjusting the weights of the various assets and deficits. Like other definitions of frailty, this one has not yet been tested comprehensively, although studies examining discrete aspects of the model suggest that it is valid and applicable in Britain and North America.

Evidence for the dynamic model

The comprehensiveness of this definition of frailty supports the content validity of the model. Criterion validity will be established if the model can predict relevant and nonarbitrary outcomes. Four outcomes are important: death, use of acute health care services and use of long-term care services either at home or in institutions. Several variables are valuable in predicting these outcomes.

Physical ability appears to be an important asset and impaired ability an important deficit in establishing frailty.[18] Dependence on others for the activities of daily living has been a consistent predictor of admission to an institution (over time and in various locations[27-31]), home care use,[32] higher mortality rates,[33-41] admission to hospital and prolonged stays in hospital.[34] Although some elderly people who become dependent on others recover functional capacity, most do not, especially if they depend on others for more than one aspect of their activities of daily living[33,38,39] or for a long period.[42]

Other aspects of functional capacity have not been as consistently studied,[28] but restricted mobility appears to be important even when it does not interfere with the activities of daily living.[32,43] Similarly, independent mobility outside the home was associated with a lower risk of death and of admission to a nursing home or hospital in people 80 years of age and older.[44] The same study showed that elderly people who exercised regularly were less likely than those who did not to lose functional independence over a 2-year period.[45]

Self-rated health is another key aspect of functional capacity. Mossey and Shapiro[46] reported that poor self-rated health (determined in response to the question, "For your age would you say, in general, your health is excellent, good, fair, poor or bad?") predicted both early and late death in the Manitoba Longitudinal Study of Aging. This finding was confirmed in other studies[35,47-49] and has held over time.[50] Poor self-rated health has also been correlated with entry into a nursing home and prolonged stays in hospital.[34] Good self-rated health appears to be an asset even when the activities of daily living are impaired.[36]

Social resources are clearly important to frail elderly people, but the mechanisms of their effects vary. Most dependent elderly people living at home are cared for by spouses, other relatives and friends.[51] Blazer[52] reported that several measures of social support are independent estimators of the likelihood of impending death. Despite extensive study of the nature of caregiving and the stress on caregivers[53-56] the relations among caregiving, stress on the caregiver and an elderly person's subsequent admission to an institution have only recently been documented;[57] stress on the caregiver was shown to be an important independent predictor of admission to an institution.

Other socioeconomic factors vary in their reported effect on functional ability, admission to an institution and death. Branch and Ku[38] reported that poverty was an independent predictor of dependence, admission to an institution and death among elderly residents of Massachusetts. Similarly, high levels of education[44] and family income[58,59] are reported to have favourable effects on the health of aging people.

The health care system itself is not an unequivocal asset; a higher number of days in hospital in a given year is associated with increased risk of death, readmission to hospital and admission to an institution.[34] These variables are clearly interconnected, i.e., of all ill elderly people admitted to hospital some will subsequently enter nursing homes or die. Compared with specialized geriatric interventions, regular hospital care is associated with a greater loss of function[60-62] and may be associated with a greater risk of death and dependence.[1,63,64] However, the contribution of these interventions to the functioning of elderly people has been inconsistent, and the extent to which various types of hospital care should be viewed as assets or deficits remains a rich area for further research.[1,63]

If dependence on others for the activities of daily living, prolonged stays in hospital, and increased risks of death and admission to an institution constitute frailty, then most patients with dementia are frail. Cognitive impairment is an independent risk factor for admission to an institution[28,31] and for home care.[32] The interaction between dementia, particularly in its early stages, and frailty remains unclear.[65-70]

Prevalence of frailty

Tennstedt, Sullivan and McKinlay[20] defined frailty as use of care and dependence in one aspect of the activities of daily living or dependence in two aspects of the activities of daily living or mental deterioration or decreased outside mobility. By this definition 18.9% of the Massachusetts population 70 years of age and older were considered frail. Abernathy and Lentjes[71] estimated dependence rates for residents of Calgary 65 years of age and older from data on home and health care use. They reported that 14.2% to 15.2% of the elderly population

required formal services, but this measure likely underestimated the prevalence of frailty, because many frail elderly people do not use formal services.[22,32,51] On the basis of unpublished data from the Saskatchewan Health Status Survey of the Elderly, in which frailty was defined as impairment in one or more aspects of the activities of daily living or cognitive impairment or poor self-rated health, the estimated prevalence of frailty was 27%; of those considered frail, 17% (or 5% of the elderly population) were at high risk of breakdown.[72]

Frailty redefined

The elderly are not homogeneous in their need for or use of health care services. In everyday clinical practice we recognize the difference between "biologically old" people (often called "frail") and those who are "chronologically old." On the basis of Brocklehurst's model of breakdown[26] we can define frail elderly persons as those in whom the assets maintaining health and the deficits threatening it are in precarious balance. In practical terms this definition takes in those who depend on others for the activities of daily living or who are at high risk of becoming dependent. Until the risk of such dependence is better understood, the definition of frailty as dependence on others for the activities of daily living is easier to use and allows us to draw insights from most of the literature. What are the implications of adopting this definition?

Perhaps the most important implication is to no longer exclude people who are very disabled as too impaired to be "frail." As such, we caution against defining frail elderly people as only those who are seen to benefit from specialized geriatric interventions, particularly since the failure to demonstrate an effect of interventions may result from the measures chosen to evaluate effectiveness.[73]

Implications for preventing frailty

Preventing frailty and its consequences is a challenge to an aging society, and there are important obstacles to such prevention. One is the need for a more precise characterization of the clinical syndrome of frailty[2] and its natural history.[6] Multiple, interacting diseases are common in frailty; the prevalence of such comorbidity increases as disability increases,[74] but it is unclear how this relation should be interpreted. For example, some diseases (e.g., stroke, myocardial infarction, renal failure) may have similar mechanisms and may all be expressed as frailty. Likewise, frailty may be a final common path in the expression of unrelated diseases. In either event frailty may be merely a state through which many elderly people pass toward the end of life. Recent evidence supporting this view suggests that most people who live for 75 years or longer become disabled before dying;[75,76] however, other reports have not supported this finding.[77] Given the apparent failure of some programs (e.g., home care[78]) and the mixed success of others (e.g., prevention of falls[79]) that attempt to address the consequences of frailty, there has been a recent call to refocus attention on preventing diseases that cause disability in later life.[80] It is unclear whether primary prevention of frailty through behaviour and lifestyle modification will produce the same dramatic results achieved by immunization and improved hygiene and nutrition,[74] although such initiatives appear reasonable[45,81] and merit detailed research and evaluation.

There is much to be done in the meantime in the areas of secondary and tertiary prevention.[82] Such work can also, we believe, benefit from the concept of frailty. Interventions should be targeted to the frail,[1,63] and evaluation of these interventions should focus on the consequences of frailty. This shift could mean, for example, focusing on function rather than survival or on quality of life rather than longevity.[1,13,83] Evaluation should be iterative,[84] so that community-based preventive programs can be refined; we believe that it is too early to develop all-or-nothing tests for programs for the care of frail elderly people. In the long term evaluation that leads to the refinement of programs may result in improved outcomes, as demonstrated by the success of a British Columbia health promotion program for frail elderly people.[85]

Implications for practice

Because multiple, interacting factors determine the health needs of frail elderly people, comprehensive assessment is clearly needed when such people become ill;[1] an understanding of their ability to carry out the activities of daily living is also important. In addition, the need to assess mobility, functional capacity and the social situation is a rationale for multidisciplinary teams, which are crucial to successful intervention.[1]

The dynamic nature of the balance approach is also useful in assessing the contribution of routine aspects of hospital care to the equilibrium and thus to patient care. For example, for a patient with pneumonia the illness is a deficit. Treatment with antibiotics is an asset, but if the patient must be restrained so that the treatment can be given intravenously, deficits accrue.

An important implication of this approach for the health care of the elderly is the suggestion that geriatric medicine should be concerned with the care, especially the acute care, of frail elderly people. Given the current pattern of expertise and resources, this concern cannot and should not be proprietary. Rather, geriatric medicine should focus on educating practitioners to care for frail elderly people, demonstrating exemplary care and conducting research into the determinants, prevention and management of frailty.

Recognizing the special needs of frail elderly people also has implications for the care of well elderly peo-

ple who become ill. Although some well elderly people become frail after acute illness, many remain robust.[49,60,62] In fact, if adjustments are made for severity of disease and multiple diseases among patients admitted to intensive care units, elderly patients have outcomes similar to those of younger patients,[86–88] and they may be more satisfied with the outcomes of care.[88]

Implications for public policy

Differentiating between well elderly and frail elderly groups can help in making public policy; such policy should recognize and to some extent legitimize the needs of frail elderly people and promote care better aimed at meeting these needs. The distinction also provides insights into current problems. For example, Ugnat and Naylor[89] recently reported that waiting lists for coronary artery bypass grafting (CABG) in Ontario increased between 1981 and 1989 largely because of an increase in this procedure for elderly patients. An important question is, therefore, whether this use of CABG is appropriate, but it can only be answered by comparing outcomes among different age groups, and between well and frail elderly people. Without this distinction we risk denying expensive but appropriate care to some patients, while providing less expensive but inappropriate routine care to others.

Implications for future research

Research on primary prevention strategies, on the definition of the frailty syndrome and on its management is needed. In addition, because few studies have examined all or most of the components of the "breakdown" model work is needed in this area. The contention that approximately one elderly person in five is frail should be tested and age-specific rates of frailty determined. Given the high incidence of death, admission to hospital and use of long-term care among frail elderly people, such data are obviously important to health care planners.

Illness behaviour in frail elderly people should be compared with that in well elderly people, particularly if some presentations (e.g., delirium, falls, incontinence) are considered markers of frailty. Research on the interaction among the variables in the breakdown model is also important in designing secondary and tertiary prevention programs. Important interactions occur; for example, in one study dependence on others for the activities of daily living predicted the use of formal services only for those living alone.[20] Strong relations between social support and subsequent self-rated health[90] and among self-rated health, dysfunction and mortality have been found.[91]

A working definition of frailty, such as the one proposed here, allows practising physicians to target their services for elderly people, provides insights for policy makers into the needs of the elderly population and gives researchers a means to investigate the syndrome. It should also clarify the role of geriatricians as an expert resource in the care of frail elderly people.

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Feb. 24–27, 1994: 12th Annual International Symposium on Man and His Environment in Health and Disease
Dallas
Study credits available.
International Symposium, American Environmental Health Foundation, 200–8345 Walnut Hill Lane, Dallas, TX 75231-4262; tel (214) 373-5163

Feb. 26–27, 1994: Endoscopy 1994: Southern California Society for Gastrointestinal Endoscopy Symposium
Los Angeles
Joyce M. Fried, University of California at Los Angeles School of Medicine, Office of the Dean, 19833 Le Conte Ave., Los Angeles, CA 90024-1722; fax (310) 206-5046

Feb. 28–Mar. 2, 1994: Consensus Development Conference on the Effect of Corticosteroids for Fetal Maturation on Perinatal Outcomes (cosponsored by the National Institute of Child Health and Human Development and the US National Institutes of Health Office of Medical Applications of Research)
Bethesda, Md.
Debra Steward, Technical Resources, Inc., 3202 Tower Oaks Blvd., Rockville, MD 20852; tel (301) 770-0610, fax (301) 468-2245

Mar. 2–5, 1994: Brain Corticosteroid Receptors: Studies on the Mechanism, Function and Neurotoxicity of Corticosteroid Action
Arlington, Va.
Geraldine Busacco, conference director, New York Academy of Sciences, 2 E 63rd St., New York, NY 10021; tel (212) 838-0230, fax (212) 838-5640

Mar. 3–8, 1994: Association for Applied Psychophysiology and Biofeedback 25th Annual Meeting
Atlanta
Connie Maslow, director of meetings, Association for Applied Psychophysiology and Biofeedback, Ste. 304, 10200 W 44th Ave., Wheat Ridge, CO 80033; tel (303) 422-8436, fax (303) 422-8894

Mar. 7–8, 1994: Regional Management Conference — Beyond Restructuring: Focusing on Care and Cost (cosponsored by the National Capital Chapter of the Canadian College of Health Service Executives)
Ottawa
Professional Services, Canadian College of Health Service Executives, 402–350 Sparks St., Ottawa, ON K1R 7S8; tel (800) 363-9056 or (613) 235-7218, fax (613) 235-5451

Mar. 14–18, 1994: Medical Manipulation Conference
Kimberley, Ont.
Speakers: Drs. John V. Basmajian, D. Frazer and A. Franklin
Back Pain Association, 103–300 St. Clair Ave. W, Toronto, ON M4V 1S4; tel (416) 920-7337, fax (416) 920-1381

Mar. 17–18, 1994: Controversies in Breastfeeding III: Are We Breastfeeding-Friendly? An Interdisciplinary Approach (sponsored by the La Leche League of Manitoba)
Winnipeg
Keynote speakers: Drs. Allan Cunningham and Penny Van Esterik
Study credits available.
Leslie Sanders, 321 Marlton Cres., Winnipeg, MB R3R 1A6; tel (204) 832-4180

Mar. 19–20, 1994: HealthCare Ethics Forum '94 (cosponsored by the Society of Critical Care Medicine)
Washington
American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656; tel (800) 899-2226, fax (714) 362-2020

Mar. 23–25, 1994: 4th International Conference on Innovations in Community Psychiatry
York, England
International Institute of Community Psychiatry, PO Box B135, Huddersfield HD1 1YG, UK; tel 011-44-484-532102, fax 011-44-484-425699

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