

Rapid Communication

Old or Frail: What Tells Us More?

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Background. Selecting elderly persons who need geriatric interventions and making accurate treatment decisions are recurring challenges in geriatrics. Chronological age, although often used, does not seem to be the best selection criterion. Instead, the concept of frailty, which indicates several concurrent losses in resources, can be used.

Methods. The predictive values of chronological age and frailty were investigated in a large community sample of persons aged 65 years and older, randomly drawn from the register of six municipalities in the northern regions of the Netherlands (45% of the original addressees). The participants' generative capacity to sustain well-being (i.e., self-management abilities) was used as the main outcome measure.

Results. When using chronological age instead of frailty, both too many and too few persons were selected. Furthermore, frailty related more strongly (with beta values ranging from $-.25$ to $-.39$) to a decline in the participants' self-management abilities than did chronological age (with beta values ranging from $-.06$ to $-.14$). Chronological age added very little to the explained variances of all outcomes once frailty was included.

Conclusions. Using frailty as the criterion to select older persons at risk for interventions may be better than selecting persons based only on their chronological age.

RECURRING challenges in geriatrics are identifying those elderly persons who need geriatric interventions and making accurate treatment decisions. For those elderly persons for whom neither "care as usual" nor palliative care apply, and who need medical or psychosocial preventive interventions to produce a higher quality of life, finding an accurate and quick selection criterion appears to be especially difficult. An age-based criterion is often used to select elderly persons for these preventive interventions or to determine whether a particular treatment is necessary (1). Elderly persons often are excluded from clinical trials (2,3) and certain treatments (4), for instance, or they receive less appropriate and more conservative diagnostic tests and treatments (5–7) because of their age.

However, chronological age may not be the best selection criterion, because it is not the best predictor of adverse processes or outcomes of interventions and treatments (4,6,8–12). Persons who need treatment may be falsely excluded when selections are made based on age, whereas persons who do not need interventions may be inappropriately included. Therefore, a selection criterion is needed that works better than age, a concept that tells us more about the process of aging, which involves losses in different domains of functioning, a higher risk for chronic conditions, a higher risk for death, and so forth. Chronological age is only a proxy for many adverse processes. Frailty, the risk for adverse outcomes due to losses in different domains of functioning, relates directly to these adverse processes.

Frailty is a loss of resources in several domains of functioning, which leads to a declining reserve capacity for dealing with stressors. Most medical interventions focus on these lost resources, such as mobility loss or a specific disease, but they focus primarily on single resources. However, elderly persons often experience loss of several resources concurrently; that is, they become frailer in a general sense.

Even individual mortality risk, which can be seen as the ultimate outcome of age and frailty (13), can be better predicted by frailty than by chronological age (14). However, no test of frailty versus chronological age has been conducted with self-management abilities as the main outcome measure. The bundle of losses in resources constituting frailty is expected to lead to the loss of self-management abilities. Self-management abilities are skills needed by an elderly person to prevent the loss of resources, to manage the decline and loss of resources, and to sustain well-being (N. Steverink, S. Lindenberg, and J. P. J. Slaets, unpublished data, May 2003; all unpublished data and items from the measurement scales used are available from the first author). These self-management abilities can be regarded as a person's generative capacity to sustain well-being into old age. Arguably, they are even more important as an outcome measure of interventions than is death, because they may be a more relevant concept for older person's daily lives. The primary aim of this study was to determine whether frailty is a better predictor of adverse

Table 1. Characteristics of Respondents Selected by Different Criteria

Characteristic	Criterion:		<i>p</i> [†]
	Years and Older	GFI 4 or Higher	
<i>N</i>	588	428	—
Mean frailty score	3.5	NA*	—
Range of frailty	0–13	NA	—
Percentage below frailty criterion	56%	NA	—
Mean age	NA	76.2	—
Age range	NA	65–98	—
Percentage below age criterion	NA	42%	—
Mean (<i>SE</i>) overall SMA score	20.02 (.15)	19.17 (.16)	<.001
Mean (<i>SE</i>) “Multifunctionality”	21.89 (.26)	21.37 (.29)	.19
Mean (<i>SE</i>) “Variety”	17.86 (.19)	17.22 (.21)	.03
Mean (<i>SE</i>) “Positive Frame”	19.48 (.18)	18.35 (.21)	<.001
Mean (<i>SE</i>) “Investment”	19.44 (.16)	18.48 (.19)	<.001
Mean (<i>SE</i>) “Self-Efficacy”	23.24 (.16)	22.24 (.17)	<.001
Mean (<i>SE</i>) “Taking the Initiative”	18.00 (.17)	17.25 (.18)	.003

Notes: *NA indicates not applicable, because respondents have been selected by this variable.

[†]Ellipses indicate *p* value not computed.

SE = standard error; SMA = self-management ability.

outcomes in elderly persons (and thus a better selection criterion for interventions) than age, using these self-management abilities as the main outcome measure.

METHODS

Participants

In August 2001, a questionnaire was sent to a sample of 3000 community-dwelling elderly persons aged 65 years and older, randomly drawn from the registers of six municipalities in the northern regions of the Netherlands. These municipalities consist of smaller and larger areas and the residents have an income comparable to the national mean. A total of 45% of the addressees returned the questionnaire (*n* = 1338). Many reasons for nonresponse were physical, which may have caused an under-representation of severely frail respondents. The average age was 74.2 years (standard deviation, 6.59 years), and the oldest respondent was 98 years old.

Outcome Measures

Frailty was measured using the Groningen Frailty Indicator (15), a short, easy to administer 15-item screening instrument to determine a person’s level of frailty (K–R 20 = .71). The Groningen Frailty Indicator screens for the loss of functions and resources in 4 domains of functioning: physical (mobility functions, multiple health problems, physical fatigue, vision, hearing), cognitive (cognitive functioning), social (emotional isolation), and psychological (depressed mood and feelings of anxiety), and was found to be a one-dimensional concept. The Groningen Frailty Indicator is shown in the Appendix.

Chronological age was measured as a continuous variable.

Self-management abilities were measured using the Self-Management Ability Scale-30 (H. Schuurmans, N. Steverink, N. Frieswijk, et al., unpublished data, July

2003), which measures the level of self-management ability (SMA), an index for six self-management abilities together (total $\alpha = .84$). These six interdependent self-management abilities are specified in the theory of successful self-management of aging as the core abilities needed to sustain well-being (N. Steverink, S. Lindenberg and J.P.J. Slaets, unpublished data, May 2003). They are (a) multifunctionality of resources (these lead to well-being in several ways simultaneously), (b) variety in resources (such that a person has more than 1 resource to realize well-being), (c) having a positive frame of mind regarding expectations for the future (the person expects to maintain or increase resources, instead of only sustaining further losses), (d) investment behavior (to maintain and achieve possible growth of resources), (e) self-efficacy beliefs (beliefs in one’s competence to realize well-being), and (f) taking the initiative. The scale consists of six subscales, one for each SMA. For the overall SMA score, the average of the six subscale scores was taken.

RESULTS

First, we compared respondents selected by their age (75 years and older) and respondents selected by their levels of frailty. A frailty score of 4 or higher can be regarded as moderately frail according to a panel of geriatric experts (15). The group of respondents selected by age was larger than the group selected by frailty, contained many persons with only a low level of frailty, and had a significantly higher level of all self-management abilities, except for multifunctionality (Table 1). The group of respondents selected by frailty, however, also included persons younger than 75 years. This shows that frailty is a more suitable selection criterion than age when self-management abilities are used as the main outcome measure.

Second, we performed separate stepwise regression analyses using self-management abilities and the overall index SMA as the dependent variables and frailty and chronological age as the predictors. The scores on the Groningen Frailty Indicator and age were centered on their mean to prevent negative effects of multicollinearity. Chronological age and frailty were significantly correlated ($r = .32, p < .001$). Frailty was significantly and negatively related to overall SMA and all self-management abilities (Table 2). Chronological age was also negatively related to SMA and most self-management abilities, except for positive frame of mind. However, as can be seen from the changes in explained variances, chronological age added very little once frailty had been included for all outcomes.

DISCUSSION

As expected, frailty relates more strongly to a decline in self-management abilities than does chronological age. Therefore, using frailty to select older persons at risk is an improvement compared with selecting persons for interventions based only on their chronological age, because it is likely to yield a more accurate selection. To measure frailty, the Groningen Frailty Indicator is a short and easy-to-use instrument, and it seems a reasonable and manageable

Table 2. Stepwise Regression Models Predicting the Different Self-Management Abilities and Overall SMA*

Characteristic	SMA		Multifunctionality		Variety		Positive Frame		Investment		Self-Efficacy		Taking the Initiative	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Frailty, β (<i>p</i>)	-.42 (<.001)	-.39 (<.001)	-.31 (<.001)	-.28 (<.001)	-.26 (<.001)	-.33 (<.001)	-.31 (<.001)	-.31 (<.001)	-.42 (<.001)	-.39 (<.001)	-.33 (<.001)	-.33 (<.001)	-.33 (<.001)	-.29 (<.001)
Age, β (<i>p</i>)	.18	.19	.10	.10	.07	.11	.11	.11	.17	.18	.11	.11	.12	.12
R ²														
ΔR^2														
Sig. ΔF														

Notes: *Age = chronological age. R² indicates the explained variance; ΔR^2 = change in R² by adding a second predictor; Sig. ΔF shows if the difference in F values for the first and second step of the regression analysis is significant.

alternative for using chronological age as a selection criterion for interventions.

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REFERENCES

1. Tinetti ME. Clinical practice. Preventing falls in elderly persons. *N Engl J Med*. 2003;348:42–49.
2. Walter LC, Covinsky KE. Cancer screening in elderly patients: a framework for individualized decision making. *JAMA*. 2001;285:2750–2756.
3. Lee PY, Alexander KP, Hammill BG, Pasquali SK, Peterson ED. Representation of elderly persons and women in published randomized trials of acute coronary syndromes. *JAMA*. 2001;286:708–713.
4. Witz M, Witz S, Shnaker A, Lehmann JM. Carotid surgery in the octogenarians. Should patients' age be a consideration in carotid artery endarterectomy? [Letter]. *Age Ageing*. 2003;32:462–466.
5. Greenfield S, Blanco DM, Elashoff RM, Ganz PA. Patterns of care related to age of breast cancer patients. *JAMA*. 1987;257:2766–2770.
6. Yancik R, Wesley MN, Ries LA, Havlik RJ, Edwards BK, Yates JW. Effect of age and comorbidity in postmenopausal breast cancer patients aged 55 years and older. *JAMA*. 2001;285:885–892.
7. Bergman L, Dekker G, van Kerkhoff EH, Peterse HL, van Dongen JA, van Leeuwen FE. Influence of age and comorbidity on treatment choice and survival in elderly patients with breast cancer. *Breast Cancer Res Treat*. 1991;18:189–198.
8. Lapiere S, Bouffard L, Dubé M, Labelle R, Bastin E. Aspirations and well-being in old age. In: Schmuck P, Sheldon KM, eds. *Life Goals and Well-being*. Göttingen: Hogrefe & Hogrefe; 2001:102–115.
9. Lamberg L. Illness, not age itself, most often the trigger of sleep problems in older adults. *JAMA*. 2003;290:319–323.
10. Rothschild JM, Bates DW, Leape LL. Preventable medical injuries in older patients. *Arch Intern Med*. 2000;160:2717–2728.
11. Weinmann M, Jeremic B, Bamberg M, Bokemeyer C. Treatment of lung cancer in elderly. Part II: Small cell lung cancer. *Lung Cancer*. 2003;40:1–16.
12. Voudris VA, Skoularigis JS, Malakos JS, et al. Long-term clinical outcome of coronary artery stenting in elderly patients. *Coron Artery Dis*. 2002;13:323–329.
13. Morley JE, Perry HM III, Miller DK. Something about frailty. *J Gerontol A Biol Sci Med Sci*. 2002;57A:M698–M704.
14. Mitnitski AB, Mogilner AJ, MacKnight C, Rockwood K. The mortality rate as a function of accumulated deficits in a frailty index. *Mech Ageing Dev*. 2002;123:1457–1460.
15. Steverink N, Slaets JPI, Schuurmans H, Van Lis M. Measuring frailty: developing and testing the GFI (Groningen Frailty Indicator). *Gerontologist*. 2001;41(Special Issue 1):236.

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APPENDIX

The Groningen Frailty Indicator (GFI)

	0	1
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Mobility

Is the patient able to carry out these tasks single handed without any help? (The use of help resources such as walking stick, walking frame, wheelchair, is considered independent)

1. Shopping
2. Walking around outside (around the house or to the neighbors)
3. Dressing and undressing
4. Going to the toilet

Physical Fitness

5. What mark does the patient give himself/herself for physical fitness? (scale 0 to 10)

Vision

6. Does the patient experience problems in daily life due to poor vision?

Hearing

7. Does the patient experience problems in daily life due to being hard of hearing?

Nourishment

8. During the last 6 months has the patient lost a lot of weight unwillingly? (3 kg in 1 month or 6 kg in 2 months)

Morbidity

9. Does the patient take 4 or more different types of medicine?

Cognition (Perception)

10. Does the patient have any complaints about his/her memory or is the patient known to have a dementia syndrome?

Psychosocial

11. Does the patient sometimes experience an emptiness around him/her?
12. Does the patient sometimes miss people around him/her?
13. Does the patient sometimes feel abandoned?
14. Has the patient recently felt downhearted or sad?
15. Has the patient recently felt nervous or anxious?

Sum

Scoring:

Questions 1–4: Independent = 0; dependent = 1

Question 5: 0–6 = 1; 7–10 = 0

Questions 6–9: No = 0; yes = 1

Question 10: No and sometimes = 0; yes = 1

Questions 11–15: No = 0; sometimes and yes = 1