

The Framingham Disability Study:

II. Physical Disability among the Aging

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Abstract: The Framingham Disability Study (FDS), a recent component of the Heart Disease Epidemiological Study in Framingham, Massachusetts, was designed to investigate the nature and magnitude of disability among non-institutionalized elderly. From September 1976 through November 1978, 2,654 individuals aged 55 to 84 years from the original Framingham cohort were interviewed in person or by telephone (94 per cent of the potential

participant pool). The findings support the well known relationship between physical disability and age. The magnitude of disability, however, is not as great as conventional wisdom might suggest. This paper presents the physical disability prevalence findings and compares these results to earlier epidemiological investigations of disability in the elderly. (*Am J Public Health* 1981;71:1211-1216.)

Introduction

Disability among the elderly certainly is not a new problem. Since the 1975 report of the U.S. Federal Commission on Chronic Illness, physical disability among the elderly has received increasing public and professional attention.¹ This Commission estimated a rate of 4,402 chronic diseases per 1,000 people 65 years of age or older, compared with a prevalence of 407 chronic diseases per 1,000 people under 16 years of age. The high prevalence of chronic conditions in the elderly, coupled with the dramatic shift occurring in the age structure of American society, accounts for public policy makers' increasing concern about disability among the elderly as a public health problem. Knowledge of chronic diseases or conditions in and of itself, however, does not directly inform us about level of disability. Direct information is still needed on the nature and extent of disability in the elderly population.

In this paper the term disability refers to aberrations in the normal or characteristic performance of an individual. The concept of impairment is used to refer to dysfunction of body parts or organs. We distinguish among four major types of disability: physical, emotional, mental, and social. Central to this analysis is the concept of physical disability: sensory-motor dysfunction of an individual manifested by limitations in such motor activities as walking, lifting heavy objects, etc.

Although the conceptual and semantic confusion around the concept of disability has been reduced, its measurement

has proven more difficult.² No generally agreed upon operationalization of physical disability exists; nor is one necessarily desired. A choice or design of a disability measure depends on the presumed level of disability of the group under study, the setting in which the measurements are taken, and the purpose(s) to which the data will be put. For instance, a different measure of disability might be used for institutionalized elders than for elders living in the community. A precise measure would be needed to detect changes in an individual's level of disability; a cruder indicator could be used to develop population estimates. Certain core items hopefully will overlap across studies to facilitate comparisons; many measures, however, will be applicable only to certain subgroups or circumstances.

The Heart Disease Epidemiological Study in Framingham, Massachusetts, of the National Heart, Lung and Blood Institute has collected medical information related to arteriosclerotic dysfunction from their cohort of men and women for nearly 30 years.³ By the onset of the Framingham Disability Study (FDS), the ages of the surviving members ranged from 55 to 84 years. This cohort has become a unique sample of elders for whom extensive longitudinal medical data are available.

In this paper we present the prevalence findings on level of physical disability and compare these findings to results of other studies of disability in the elderly. A similar investigation of social disability, limitations in the ability to perform social roles or obligations, is reported elsewhere in this issue of *The Journal*.⁴

Methods

The FDS interviewing began in September 1976 (the second half of cycle 14 of the examinations), and ended on November 30, 1978 (approximately the first half of cycle 15 of the examinations). At the time the FDS interviewing

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began, 1,649 of the original cohort of 5,209 had died, 218 had moved away and dropped out of the study, 151 had refused to return for physician screening, and 354 had been missing from the study for no known reason for at least the previous five years.

Of the remaining potential participant pool of 2,837 individuals, 2,654 (94 per cent) were interviewed in person at the clinic or at home by phone. Generalizations can be drawn only for the non-institutionalized members of the Framingham cohort who came into the clinic or who were reached by phone at home. Further details concerning drop-outs, and a demographic description of the sample interviewed will be found elsewhere in this issue of *The Journal*.⁴

In this study, we operationalized physical disability with three approaches: a modified Katz ADL scale,⁵ a portion of Rosow and Breslau's Functional Health scale,⁶ and measures of physical performance adapted from Nagi's work.⁷

Results

Prevalence findings on physical disability of the Framingham cohort are presented in Tables 1 through 3. Each table is organized to display gender, age, and age-specific gender comparisons for each item. Statistical significance is tested by chi-square.

Table 1 displays the prevalence data on respondents' ability to independently perform six activities of daily living (ADL). Almost all respondents perform all six activities without assistance of any kind. For all activities but eating, respondents 75-84 years of age are significantly more likely than their younger counterparts to use help in doing the activity. However, over 90 per cent of respondents 75-84 years of age are still independent in these six ADLs. Overall, most gender differences and age-specific gender differences

on the performance of these six ADLs are within the range of chance fluctuation. A significantly larger proportion of women than men, however, do use help in grooming.

Table 2 illustrates the findings on respondents' ability to perform three gross mobility activities. A substantially smaller proportion of respondents are able to perform these activities compared to the percentage performing the six ADLs. The ability to perform each of these activities is significantly related to age. Only half of those 75-84 years of age are able to perform heavy household work compared with 79 per cent of those in the 55-64 year age group. Seventy-seven per cent of the 75-84 year age group are able to walk a half mile, compared to 96 per cent of the youngest age group. Eight-five per cent of those 75-84 years of age report they can climb stairs, compared to 97 per cent of those 55-64 years of age. Nonetheless, over three-fourths of those 75-84 years of age report they are still able to climb stairs and walk at least a half mile. There are numerous age-specific gender differences in ability to perform heavy household work, walk a half mile, and climb stairs. The most substantial gender differences are observed among the oldest members of the sample.

Table 3 summarizes the findings on perceived difficulty in performing nine physical activities. There is substantial variability in the proportion of respondents able to perform these activities without difficulty, from a low of 59 per cent to a high of 97 per cent. Eighty per cent or more of the total sample are able to extend their arms, lift weights of under ten pounds, sit for long periods, and hold small objects without difficulty. Although, in general, the proportion performing these five activities without difficulty decreases with advancing age, 74 per cent or more of the oldest members of the cohort report no difficulty in performing them. A significantly smaller percentage of women compared to men report they can perform these activities without difficulty. The only

TABLE 1—Percentage Able to Perform Independently Six Activities of Daily Living by Gender and Age^a

Gender and Age (years)	N	Grooming	Bathing	Walking Across Small Room	Transfer From Bed to Chair	Dressing	Eating
		%	%	%	%	%	%
Total	2635	96	98	98	99	99	100
Gender							
Women	1564	96*	98	97	99	99	100
Men	1071	98	99	98	99	99	100
Age							
55-64	1064	99**	99**	98**	100**	100**	100
65-74	1013	97	99	99	100	99	100
75-84	558	91	96	93	98	98	100
Age-Specific Gender							
Women, 55-64	578	99	99	98	99	100	100
Men, 55-64	486	99	100	99	100	99	100
Women, 65-74	620	98	99	99	100	100	100
Men, 65-74	393	96	99	99	100	99	100
Women, 75-84	366	88*	95	92	98	98	100
Men, 75-84	192	96	97	95	97	97	100

*p < .05

**p < .001

^aDependence is defined as needing help from another person and/or using special equipment, such as a cane.

TABLE 2—Percentage Able to Perform Three Gross Mobility Activities by Gender and Age

Gender and Age (years)	Able to Perform Heavy Household Work		Able to Walk Half Mile		Able to Climb Stairs	
	N	%	N	%	N	%
Total	2616	70	2616	91	2646	94
Gender						
Women	1550	63**	1542	88**	1568	92**
Men	1066	80	1074	95	1078	97
Age						
55–64	1059	79**	1062	96**	1067	97**
65–74	1001	71	1003	92	1018	96
75–84	556	50	551	77	561	85
Age-Specific Gender						
Women, 55–64	557	73**	575	96	580	96*
Men, 55–64	482	87	487	97	487	98
Women, 65–74	612	67**	611	90*	622	95
Men, 65–74	389	78	392	95	396	97
Women, 75–84	361	42**	356	72**	366	80**
Men, 75–84	195	66	195	87	195	93

*p < .05

**p < .001

consistent age-specific gender difference for these five items (in the expected direction) is in lifting weights of under 10 pounds.

Between 59 per cent to 73 per cent of the sample report they can stand for 15 or more minutes, move large objects, lift weights of over ten pounds, and stoop, crouch, or kneel without difficulty. The proportion of elders able to perform these four activities without difficulty decreases significantly with advancing age. A consistently smaller percentage of women in all age groups compared to men are able to perform these activities without difficulty.

As a means of summarizing these physical disability findings, we constructed an additive index for each of the three groups of items. Figure 1 displays the percentage of individuals with limitations in each of these three areas by age and by gender.

The ADL items display the least amount of disability; frequencies and the only significant gender difference ($p < .05$) is for those 75–84 years old. The Rosow-Breslau items display greater discriminatory ability as a function of age and gender, and all age and age-specific gender differences in this summary index are statistically significant ($p < .001$). Maxi-

TABLE 3—Percentage Able to Perform Nine Physical Activities without Difficulty by Gender and Age

Gender and Age (years)	Extending Arms Below Shoulders		Extending Arms Above Shoulders		Lifting Weight Under 10 Lbs.		Sitting for 1+ Hour		Holding Small Objects		Standing for 15+ Minutes		Moving Large Objects		Lifting Weight Over 10 Lbs.		Stooping Crouching Kneeling	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Total	2639	97	2625	87	2632	87	2633	86	2635	83	2539	73	2576	66	2587	65	2641	59
Gender																		
Women	1560	96**	1556	84**	1554	82**	1559	84**	1563	82*	1502	69**	1522	56**	1519	52**	1565	52**
Men	1079	98	1069	91	1078	96	1074	90	1072	86	1037	77	1054	82	1068	83	1076	67
Age																		
55–64	1061	97	1054	89*	1064	92**	1059	86	1060	90**	1032	77**	1051	69**	1055	72**	1062	65**
65–74	1017	97	1012	87	1015	88	1014	87	1010	84	984	73	987	66	995	67	1016	58
75–84	561	95	559	84	553	76	560	85	565	74	523	61	538	59	537	48	563	45
Age-Specific Gender																		
Women, 55–64	575	96	572	87	577	88**	573	83**	575	87*	558	74*	568	59**	570	59**	577	60**
Men, 55–64	486	98	482	91	487	96	486	90	485	92	474	81	483	82	485	87	485	71
Women, 65–74	621	95*	620	84**	621	82**	619	85*	620	82	601	71*	607	57**	606	55**	621	53**
Men, 65–74	396	98	392	91	394	96	395	89	390	85	383	77	380	81	389	85	395	67
Women, 75–84	364	94	364	81*	356	67**	367	84	368	74	343	58*	347	48**	343	34**	367	38**
Men, 75–84	197	97	195	89	197	90	193	88	197	74	180	67	191	80	194	72	196	59

*p < .05

**p < .001

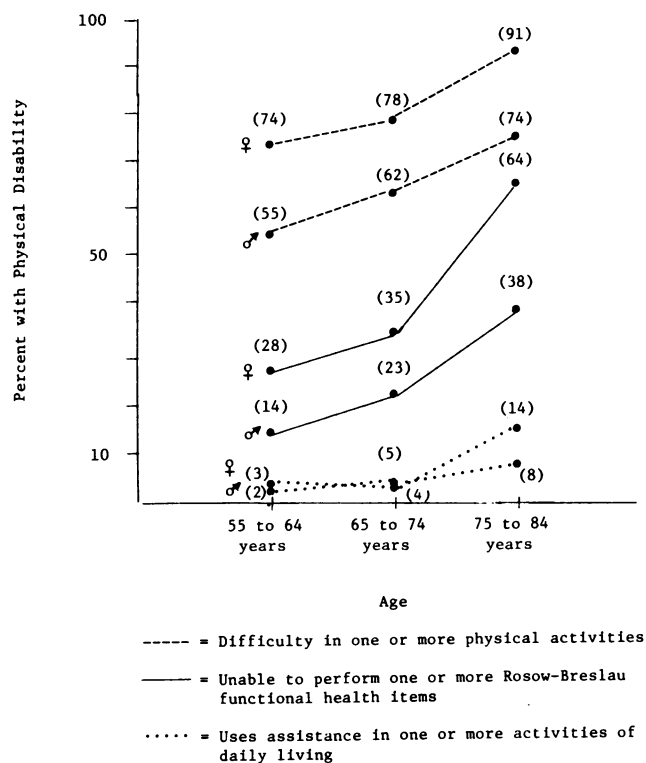


FIGURE 1—Prevalence of Physical Disability by Gender and Age

num discrimination is achieved with our measures of perceived difficulty in performing physical tasks. Age and age-specific gender differences are statistically significant ($p < .001$).

Discussion

Despite growing evidence to the contrary, old age too often is still considered synonymous with illness and disability. We see signs of this attitude all around us: in the expressed fears of public officials charged with planning and implementing public health programs for the aged, in the way health professionals treat older patients, in the public media, and in the attitudes of elders themselves. This attitude may be due in part to the paucity of large scale studies on physical disability in non-institutionalized older adults. Many investigations of older adults have focused on institutionalized elders or elders with specific diseases or problems. There are obvious dangers in generalizing from such investigations.

As our findings illustrate, to be a non-institutionalized elder today is not necessarily to be beset with numerous and complex physical disabilities. Life after age 60 is not a period inexorably marked with massive physical deterioration. Quite the contrary. These data suggest that for the majority of these Framingham elders the later years of life are characterized by substantial physical ability.

We do not suggest that advanced age is not related to increasing physical disability. With few exceptions, FDS

data reveal a consistent increase in physical disability with advancing age. Advancing age is certainly accompanied by an increased risk of physical disability. The magnitude of this risk, however, is not as great as conventional wisdom might suggest.

These FDS data support a second observation: women appear to be more disabled than men, although elderly women are no more likely than elderly men to report functional limitations in traditional ADL activities such as bathing, dressing, transferring, and others. Most gender differences are significant within each age cohort; there is no support for the interpretation that the greater prevalence of physical disability among elderly women compared to elderly men is an artifact of the increased proportions of women living into old, old age. Whether or not these gender differences reflect a differential willingness to report disability or actual differences in disability level cannot be determined from this investigation.

The unique character of this Framingham cohort, however, tempers our propensity to generalize these findings to other populations of elders.⁸ The Framingham cohort is a predominantly White group of elders of relatively high socioeconomic status who have exhibited a remarkable commitment to the study over the years. How do the FDS findings on physical disability compare to investigations on other elderly populations?

One comparison can be made with data from Branch's 1976 Massachusetts Elders survey of non-institutionalized elders living in Massachusetts.⁹ Table 4 compares the disability estimates derived from the Rosow-Breslau items and the six ADL items used with the Massachusetts sample with data from the same items used in the FDS. As the data in Table 4 reveal, point estimates of physical disability from the two studies are quite similar. The few differences that do emerge suggest that the Framingham cohort is somewhat less physically disabled than the Massachusetts sample.

Shanas has conducted an investigation of physical disability in the 65-year-old-and-older non-institutionalized US population.¹⁰ An incapacity index was constructed from answers to six questions: 1) Can you go out-of-doors? 2) Can you walk up and down stairs? 3) Can you get about the house? 4) Can you wash and bathe yourself? 5) Can you dress yourself and put on your shoes? 6) Can you cut your own toenails? On her incapacity index, a score of three or more reflects some major limitations in an elder's capacity for self-care. A score of three or more on the Shanas index resembles the FDS ADL Summary index which assesses the use of assistance to perform one or more ADL.

Shanas estimates that 12 of every 100 elders 65 years of age and older in the United States would achieve a score of three or above on her incapacity index. In comparison, 7 per cent of respondents 65-84 years of age in the FDS reported using assistance to perform one or more of the six ADLs. This comparison suggests that the Framingham cohort is less physically disabled than the US aged population.

Another national comparison can be made with findings from Nagi's analysis of disability in a sample of adults age 18 years and older representing the non-institutionalized US population.⁷ Data on physical disability come from personal

TABLE 4—Comparison of Physical Disability Estimates from Branch's Massachusetts Elders Study with the Framingham Cohort Aged 65 Years and Older^a

Physical Disability Measures	Per Cent Distributions			
	Framingham Sample 65 Years and Older		Massachusetts Sample 65 Years or Older	
	N	%	N	%
Rosow-Breslau Items				
Ability to do heavy household work	2616	64	1623	57
Ability to walk half mile	2616	87	1623	75
Ability to climb stairs	2646	92	1623	90
Modified Katz ADL Items				
Ability to independently:				
Walk across small room	2635	97	1621	99
Groom	2635	95	1621	89
Transfer from bed to chair	2635	99	1621	97
Dress	2635	99	1621	96
Eat	2635	100	1621	99
Bathe	2635	98	1621	94

^aThe FDS data are presented for respondents 65 years of age or more because the Massachusetts sample excluded adults under age 65.

interviews using seven items that we subsequently adopted for use in the FDS. Nagi assessed respondents' perceived difficulty in standing for long periods, lifting weights of approximately ten pounds, going up and down stairs, walking, stooping-bending-kneeling, using hands and fingers, and reaching with either or both arms. Scores derived from the nine-item FDS difficulty index estimate that 72 per cent of the Framingham sample of all ages have none to mild difficulty in the performance of one or more physical activities. In contrast, Nagi estimates that 77 per cent of those 55 years or older in the US have none to some physical limitation in performing his seven activities. These two estimates are quite similar.

All three cross-study comparisons reveal fairly similar estimates of the magnitude of physical disability in very different aged populations: a community, a state, and the nation, but suggest that the Framingham cohort is slightly less disabled than these other populations. However, the maximum age of the Framingham cohort is 84 years, while the other studies had respondents aged 85 years and older. This should be remembered when interpreting these results. The estimates most similar come from studies using very similar measures which underscores our earlier call for consistency in measurement across studies.

The Framingham cohort presents a rare opportunity for longitudinal investigation. What are the key factors related to increasing physical disability in the elderly? What is the role of past medical events, such as a cerebral vascular accident, cardiovascular disease, arthritis, diabetes, and others? Do factors such as time since the onset of a disease or the number of diseases influence the association between disease and disability? Do risk factors such as relative weight, alcohol use, or others have an influence on elders' ability to perform basic life activities? Questions such as

these are currently under study using the wealth of medical data collected on members of this cohort over the past two-and-a-half decades. Hopefully these investigations will yield information that will identify fruitful public health avenues for decreasing the incidence and prevalence of disabling conditions among the aged.

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