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## Temporal Trends in Self-reported Functional Limitations and Physical Disability Among Community-dwelling Elders: The Framingham Heart Study

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### Abstract

**Objective**—To determine change in the prevalence of functional limitations and physical disability in community-dwelling elders across three decades.

**Methods**—We studied original participants of the Framingham Study, aged 79 to 88 years, at exam 15 (1977–1979, 177 women, 103 men), exam 20 (1988–1990, 159 women, 98 men) and exam 25 (1997 to 1999, 174 women, 119 men). Self-reported 1) functional limitation defined using the Nagi scale and 2) physical disability defined using the Rosow-Breslau and Katz scales.

**Results**—Functional limitations declined across examinations from 74.6% to 60.5% to 37.9% ( $p < 0.001$ ) in women and 54.2%, 37.8%, and 27.8% ( $p < 0.001$ ) in men. Physical disability declined from 74.5% to 48.5% to 34.6% ( $p < 0.001$ ) in women and 42.3% to 33.3% to 22.8% ( $p = 0.009$ ) in men. Women had a greater decline in disability than men ( $p = 0.03$ ). In women, improvements in functional limitations ( $p = 0.05$ ) were greater from exam 20 to 25 whereas for physical disability ( $p = 0.02$ ) improvements were greater from exam 15 to 20. Improvements in function were constant across the three examinations in men.

**Conclusions**—Among community-dwelling elders the prevalence of functional limitations and physical disability declined significantly from the 1970s to the 1990s.

### Keywords

functional limitations; physical disability; trends; elders

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National surveys and epidemiological studies have reported a significant decline in self-reported functional limitations and physical disability in older adults.(1–7) Despite consensus among reports, uncertainty exists with regard to the magnitude, rate, and specific characteristics of the disability decline.(5;6;8) Variations in study samples, evolving measures of functional limitation and disability, and differences in study questions and responses contribute to the

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inconsistencies in disability trends.(5;6) Furthermore, disparities exist in the improvement in function with marked variations according to age, gender, race, and socioeconomic and educational attainment.(1;9;10) Compared to men, women report greater difficulty with physical function and less recovery from disability.(1) Surveys have reported that declines in functional limitations occurred only in women (11) or were larger in women than men (12) while others note that disability declines were about the same in women and men.(3;13) Thus, it remains unclear if the disability gaps between men and women have narrowed or remained stable over time.(4)

The causes for the improved disability trends are not well understood. One possible explanation is the compression of morbidity hypothesis whereby disease and disability are postponed until the end of the lifespan.(14;15) However, the consequences of an increase in life expectancy in the United States in relation to the overall health of older adults continue to be debated. Other divergent paradigms have been proposed to describe the possible health-related consequences of living longer including a rise in chronic disease and disability (16) and a dynamic equilibrium whereby declines in mortality result in increases in chronic disease with lesser severity and disability.(17;18)

We obtained self-reported information on functional limitations and physical disability in surviving members of the original cohort of the Framingham Heart Study in late life (age 79 to 88 years) who attended research examinations over three points in calendar time from the 1970s to the 1990s. We hypothesized that the prevalence of functional limitations and physical disability would decline over calendar time in elders with a greater decline in women than men. Our study cohort is particularly well suited for this investigation as the Framingham Disability Study (19) introduced questionnaires to measure self-reported functional limitations and physical disability beginning in 1976 that were repeated on successive examinations. Moreover this cohort has been well characterized for over fifty years with documentation of validated medical conditions and measurement of risk factors.

## MATERIALS AND METHODS

### Study setting and participants

The Framingham Heart Study was initiated in 1948 when 5209 participants aged 28 to 62 years were enrolled in a prospective cardiovascular disease study.(20;21) Since the study inception participants have been examined biennially including a standardized physician-administered medical history and physical examination, electrocardiogram, noninvasive testing, and measurement of lipids and glucose. Written informed consent was obtained and the Institutional Review Board of Boston University Medical Center approved the content of each examination.

Because we were interested in studying trends in late-life disability we restricted our study sample to participants aged 79 to 88 years (appendix 1). The age restriction ensured age comparability across calendar time points minimizing any confounding effects of age and permitted adequate numbers of both men and women at a given age across the time points. We did not study younger ages as improvements in disability have been reported for adults age 55 to 70 years.(22) Participants with dementia were excluded to enhance the accuracy of the disability data since it is self-reported. Original cohort examinations 15 (August 1977 to November 1979), 20 (January 1988 to June 1990), and 25 (October 1997 to November 1999) were chosen for study as examination 14/15 was the first time functional data was collected and the subsequent examinations were conducted at approximately ten year intervals. Finally, collection of physical function data at exam 15 was limited to non-institutionalized participants; therefore we restricted our sample to participants attending a clinic examination. Hence, our

final study sample consists of three different groups of participants age 79 to 88 years, one group for each chosen examination time point.

### **Main outcome measures: assessment of functional limitations and physical disability**

In the present study, we have defined functional limitations based on the physical performance scale adapted from Nagi (20) and have defined physical disability using the modified Katz Activity of Daily Living Scale (ADL) (22) and the Rosow-Breslau Functional Health Scale. (21) These self-reported measures have been used in other large population-based studies with high test-retest reliability permitting use in longitudinal analyses.(1;23–27) Technicians interviewed each participant using standardized questions and recorded response choices at each exam. The script used for the Katz ADL scale was modified from exam 15 (“Other than when you might have been in the hospital, was there any time during the past 12 months in which you needed help from another person or from some special equipment or device) to exams 20 and 25 (During the course of a normal day, can you do the following activities independently or do you need human assistance or use of a device?). Functional limitation was considered present if a participant reported more than a little difficulty on any of the seven items of the Nagi scale: pulling or pushing large objects like a living room chair; either stooping, crouching or kneeling; reaching or extending arms above shoulder level; reaching or extending arms below shoulder level; either writing or handling or fingering small objects; standing in one place for long periods; and sitting for long periods, say one hour. Response choices included no difficulty, a little difficulty, some difficulty, a lot of difficulty, or don't do under doctor's orders and unable to do (examinations 20 and 25). For physical disability determination, the Rosow-Breslau Functional Health Scale documented the following three gross mobility tasks: walk one half mile, walk up and down stairs to the second floor, and do heavy work around the house. Participants reported whether they were able or unable to do these tasks without help. At examination 25, walking up and down one flight of stairs was asked with the modified Katz ADL scale. The other measure of physical disability, the modified Katz ADL scale included the following five items: bathing, dressing, eating, getting from bed to chair, and walking across a small room. On examinations 20 and 25 getting from bed to chair was changed to transferring (get in and out of a chair) and walking across a small room was changed to walking on a level surface about 50 yards. Participants reported no help needed, independent; needed help from special equipment or device; needed help from another person; or needed help from both a person and special equipment. Disability was defined at each examination as requiring human assistance. If the participant reported not performing the activity during a normal day, then the response was set to missing.

### **Chronic medical conditions, health behaviors, and demographic characteristics**

Hypertension was defined as a blood pressure  $\geq 140/90$  mmHg or use of antihypertensive medication. Body mass index was calculated as weight in kilograms divided by the height in meters squared. Diabetes was defined by a causal blood glucose of  $\geq 200$  mg/dL or use of insulin or oral hypoglycemic agents. An endpoint committee comprised of three senior investigators (or a panel of study neurologists) adjudicated cardiovascular outcomes using all available medical records employing standardized criteria in place since study inception.(28) The Center for Epidemiologic Studies Depression Scale (CES-D) was administered to participants at exams 22 and 25. Depressive symptoms were considered present if the CES-D score was  $\geq 16$ . (29). A current cigarette smoker was defined as regular smoking in the year preceding the exam. Participants were asked if they drank beer, wine, or liquor/spirits at least once per month and the number of drinks on an average week was recorded. Chronic obstructive pulmonary disease (COPD) was considered present if the ratio of the FEV1/FVC was  $< 70\%$  of predicted. At exam 25, spirometry was not performed and the diagnosis of COPD was defined by the physician opinion of chronic bronchitis or chronic symptoms (cough, sputum production). Marital status was updated at all examinations.

## Statistical analysis

The sex-specific prevalence of chronic medical conditions, health behaviors, socio-demographic characteristics as well as the prevalence of functional limitation or physical disability for each item of the Nagi, Rosow-Breslau, and modified Katz scales were calculated as mean value for continuous variables and percent for dichotomous variables at each examination studied. Next, we conducted sex-specific analyses adjusted for age with exam (15,20,25) as the exposure variable to investigate time trends in functional limitations and physical disability as follows: 1) linear regression (PROC GLM in SAS) was used to calculate the least square means and the 95% confidence interval for the number of items on the Nagi scale reported as a limitation and the number of items on the Rosow-Breslau and modified Katz scale reported as an impairment; and 2) logistic regression (PROC LOGISTIC in SAS) was used to calculate the proportion of participants reporting a functional limitation and physical disability. We also created a summary measure of functional limitations and physical disability taking into account all items of the three scales. Next we set out to determine whether the magnitude of absolute change in functional limitations and physical disability varied between men and women and between exam periods (exam 15 to exam 20 vs. exam 20 to exam 25) by comparing differences in mean numbers of items with limitation or impairment (Proc GLM, Z-tests). Because women were noted to report higher levels of functional limitation and physical disability than men, the absolute decline and thus improvement in function and disability might be expected to be greater in women. We therefore tested for any difference in the relative decline in functional limitation and physical disability between men and women using asymptotic normal theory applied to sex-specific logistic regression slopes. All analyses were conducted using SAS/STAT version 9.1.(30)

## RESULTS

Chronic medical conditions, health behaviors, and socio-demographic characteristics of the sample at each examination are shown in Table 1. The prevalence of obesity increased across examinations particularly in men as did the prevalence of cardiovascular disease (men only) and cancer whereas the prevalence of COPD declined in concert with the decline in prevalence of current cigarette smoking. The prevalence of at least one health condition remained constant at about 50 percent for women while in men the prevalence of at least one health condition changed across the three exams from 63.0 percent to 58.7 percent to 75.2 percent. Striking differences in marital status in men and women were noted. Thus, less than 20 percent of men reported living alone, while 72.2 percent of women at exam 20 and 46.2 percent of women at exam 25 lived alone. Most participants reported their health to be good or excellent.

Women reported greater functional limitations and physical disability for almost all items of the Nagi physical performance scale, the Rosow Breslau Functional Health scale, and the modified Katz ADL scale at all examinations (Table 2). Of note, the magnitude of the difference between men and women in the self-reported prevalence of disability or functional limitation for some scale items narrowed over time. For example at examination 15, 39.5 percent of women and 16.5 percent of men reported inability to walk one half mile; however, at examination 25, 16.7 percent of women and 14.3 percent of men were unable to walk one half mile. The use of special equipment or devices increased across exams in both women and men.

Sex-specific trends in functional limitations and physical disability adjusted for age are shown in Table 3. A significant decline in functional limitations and disability was observed in both women and men. For example, at examination 15, 74.6 percent of women reported at least one functional limitation on the Nagi physical performance scale compared to 60.5 percent of women at examination 20 and 37.9 percent of women at examination 25 ( $p < 0.001$ ). Corresponding reports in men at examinations 15, 20, and 25 were 54.2 percent, 37.8 percent, and 27.8 percent ( $p < 0.001$ ). Likewise, self-reported physical disability assessed with the

Rosow-Breslau and modified Katz ADL scales declined across the three examination time periods from 74.5 percent to 48.5 percent to 34.6 percent ( $p < 0.001$ ) respectively in women and 42.3 percent to 33.3 percent to 22.8 percent ( $p = 0.009$ ) respectively in men. The mean number of scale items reported with a limitation or impairment also decreased across exams in both men and women. By exam 25, 63.6% percent of men and half of women reported they were free of any functional limitations and physical disability. Repeating the analyses adjusting for chronic medical conditions defined by the presence or absence of cardiovascular disease, cancer, diabetes, and hip fracture using a score from zero to four did not change the trends.

Next, we examined whether the magnitude of the decline in limitations and physical disability differed between men and women and whether the decline differed across time comparing the change that occurred from exam 15 to exam 20 to the change that occurred from exam 20 to exam 25 using the number of reported scale items with limitation or impairment. Women started with greater limitations and disability compared to men (Table 3) and experienced a greater absolute decline in both functional limitations ( $p=0.008$ ) and physical disability ( $p=0.005$ ) than did men. However, the relative difference in the decline determined by examining the proportion of women versus men reporting any difficulty on the scale was significantly different only for physical disability ( $p=0.03$ ). Absolute improvements in both functional limitations and physical disability were constant across the exam time periods (exam 15 to 20 and exam 20 to 25) in men. In women there was a greater improvement in functional limitation from exam 20 to exam 25 compared with exam 15 to exam 20 ( $p=0.05$ ) whereas the improvement in physical disability was more marked from exam 15 to exam 20 compared with exam 20 to exam 25 ( $p=0.02$ ).

## DISCUSSION

In our sample of community-dwelling elders we found a significant decline in self-reported functional limitations and physical disability in both women and men over three examinations occurring across calendar time from the late 1970s to the late 1990s. At the last exam studied (1997 to 1999) more than half of men and women were free of both functional limitations and disability. This finding suggests continued progress when compared to a report by Liao, et al in which 42 percent of men and 34 percent of women aged 70 years and older were without any limitations or disabilities.(31) Women reported a greater burden of functional limitations and physical disability than men. Hence, the absolute decline in both limitations and disability was significantly greater in women than men; however, the relative difference in the magnitude of decline was significantly different between men and women only for physical disability. Moreover the absolute improvement in function and disability was constant over the examinations in men whereas in women the improvement in disability was greater from exam 15 to exam 20 (late 1970s to late 1980s) than exam 20 to exam 25 (late 1980s to late 1990s). These findings are in contrast to national survey data which suggest that the disability decline has accelerated in more recent years.(32;33) In accordance with those reports, the magnitude of improvement in functional limitations in women was greatest at more recent exams. The decline in disability in our study may in part be related to the notable increase in use of special equipment and devices which facilitate greater independence. This finding is consistent with other reports that noted an increase in the proportion of community-dwelling elders who used equipment but not personal care to bathe.(5) Our work highlights the importance of studying sex-specific trends in disability as well as the need for careful attention to the specific measures used to define disability in order to determine whether any improvements include all types of limitations and impairments.

It is noteworthy that in men, the decline in physical disability and improvement in functional limitations occurred despite an increase in the prevalence of chronic medical conditions whereas in women the improvements occurred in the absence of a change in the prevalence of

chronic medical conditions. Our findings in men may be related to improvements in diagnosis and treatment of chronic conditions that occurred over calendar time. Successful prevention and postponement of disablement in the elderly depend in part on efforts at early diagnosis of illness and subsequent focused interventions.(34) As in our report, national survey data demonstrated an increase in self-reported medical conditions over two points in calendar time (1984 and 1994) yet many of the conditions had less of a debilitating effect.(18) We extend this knowledge by focusing on older adults (mean age 82 years), including not only functional limitations but also physical disability measures, and rather than relying on self-reported medical conditions the conditions in our study were directly measured or validated with medical records. We acknowledge that the medical conditions in our report were not exhaustive. Ferrucci and colleagues have raised the hypothesis that there may be sex-related differences in the lifetime prevalence of lethal versus disabling diseases.(35) Hence, it is possible that important disabling conditions in women not included in our study have become less debilitating over time.(18)

The 2001 World Health Organization International Classification of Functioning, Disability, and Health (ICF) recognizes the importance of environmental and personal factors in the disablement process. For older adults, disability generally refers to the ability to live independently and perform self-care activities. In our sample the prevalence of self-reported mobility disability was significant in both women and men even at the most recent examination. Gross mobility is often the first area in which older adults report difficulty, (24;36) yet little research has been done to determine how environmental factors influence the process and trajectory of disability.(37) The rise in reported special equipment or device use likely contributed to the improvement however other environmental changes such as home modifications may have positively influenced the trends. Personal factors such as gender, age, education, lifestyle habits, and marital status may also play a role in disability.(38) It is notable that most women in our sample were widowed and reported living alone. Prior work has shown the importance of family and social factors to risk of institutionalization after stroke.(39) These same factors may be operational in the disablement process.

### Study limitations

Our study has several limitations that merit comment. We focused on community-dwelling non-demented elders and included only participants attending an on-site clinic examination as participants were not offered examinations in their personal residence or nursing home at the start of this study (exam 15). The proportion of institutionalized elderly declined during the years of our study.(32) This trend would have resulted in an increase in persons with disability in the community and biased our results toward the null. Our sample is white and thus our results may not pertain to other racial or ethnic groups. The decline in disability in recent years was reported to be greater in the black than non-black population.(32) Additionally our sample is fairly well-educated; three-quarters of participants at exam 25 attained a high school or greater education. Educational achievement has been consistently linked to longevity (40) and improvements in late-life function.(4;8;13) Performance-based measures were not included in the examinations studied for this report.

Conceptualizations of disability and individual perceptions of social roles, especially for women, have evolved over time. It is unclear how much of the decline in disability in women in our sample is due to changing self-perceptions of ability to perform tasks (social desirability) versus other factors such as innovations in diagnosis and treatment of chronic illness, improvements in health related behaviors especially smoking cessation and increased physical activity, and the emergence of alternative living arrangements and expanded use of assistive devices allowing older persons to maintain independence.(6) Finally, we acknowledge that

change in the wording of the scale items and response choices may have contributed to the changes in self-reported functional limitations and physical disability in our study.

## Conclusion

In conclusion, we found that for community-dwelling men and women aged 79 to 88 years the prevalence of functional limitations and physical disability declined significantly over three exams from the late 1970s to the late 1990s. The relative magnitude of the decline in physical disability was greater in women than in men. In contrast to the acceleration in the disability decline in recent years noted in national survey data, the decline in limitations and disability was constant over time in men in our sample whereas in women the decline was greatest in the earlier part of our study (exam 15 to exam 20, the late 1970s to late 1980s). The improvement in physical function trends was noted in concert with a marked increase in reported use of special equipment and devices used to maintain independence. Future work is needed to determine the underlying causes contributing to the declines in limitations and disability in old-age so that preventative measures can be put in place to promote and maintain independence to the end of life. It remains uncertain if the improvements in functional limitations and physical disability will continue given the unfavorable direction of the prevalence of obesity and physical activity in the general population, factors known to predict incident disability (41) and declines in physical performance.(42)

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Characteristics of the Study Sample: Community-dwelling Framingham Heart Study Original Cohort

TABLE 1

Characteristic Mean or percent	Exam 15 (1977- 79) N=177	Wome n Exam 20 (1988- 90) N=159	Exam 25 (1997- 99) N=103	Exam 15 (1977- 79) N=103	Men Exam 20 (1988- 99) N=119	Exam 25 (1997- 99) N=119
<b>Mean age, years</b>	<b>82.2</b>	<b>81.9</b>	<b>81.6</b>	<b>81.6</b>	<b>82.1</b>	<b>82.3</b>
Chronic medical conditions*						
Hypertension, %	76.1	81.1	83.3	56.4	85.7	76.5
Hypertension treatment, %	47.9	63.5	60.3	33.0	61.2	55.9
Total cholesterol $\geq$ 240 mg/dL or Rx, %	38.3	24.5	32.8	12.9	11.7	22.9
Diabetes, %	9.8	8.2	5.7	7.4	13.3	10.1
Obesity (BMI $\geq$ 30 kg/m <sup>2</sup> ), %	12.4	15.5	20.7	2.2	12.4	15.3
Cardiovascular disease, %	37.9	28.3	29.3	41.7	44.9	55.5
Cancer, %	11.3	14.5	19.0	15.5	16.3	24.4
Chronic obstructive pulmonary disease, %	9.9	9.6	5.7	18.5	12.5	10.3
Hip fracture, %	5.1	8.8	6.9	1.9	1.0	1.7
Depressive symptoms, %	NA	16.7	10.4	NA	6.1	7.0
At least one medical condition, %	52.7	52.2	51.1	63.0	58.7	75.2
<b>Health behaviors</b>						
Current cigarette smoker, %	4.9	5.7	4.0	15.3	4.1	5.1
Alcohol intake, number drinks/week	1.9	3.6	2.5	6.1	6.4	5.4
<b>Socio-demographic factors</b>						
Marital Status, Married, %	17.8	19.0	30.2	73.4	80.9	73.7
Widowed, %	69.9	63.3	59.3	22.3	14.9	21.2
Single, %	10.4	12.0	8.7	2.1	2.1	3.4
Divorced, %	1.9	5.7	1.8	2.2	2.1	1.7
Education, high school or greater, %	53.2	58.3	78.5	46.5	54.3	76.3
Living situation, lives alone, %	NA	72.2	46.2	NA	17.3	19.3

Characteristic Mean or percent	Exam 15 (1977- 79) N=177	Wome n Exam 20 (1988- 90) N=159	Exam 25 (1997 -99) N=17 4	Exam 15 (1977- 79) N=103	Men Exam 20 (1988- 90) N=98	Exam 25 (1997- 99) N=119
<b>Mean age, years</b>	<b>82.2</b>	<b>81.9</b>		<b>81.6</b>	<b>82.1</b>	<b>82.3</b>
Work status, currently working, %	2.3	6.3	6.3	12.6	14.3	16.0
Subjective health, good or excellent, %	66.9	80.5	79.2	80.0	76.5	84.0

\* Cardiovascular disease= coronary heart disease, stroke, transient ischemic attack, congestive heart failure, or intermittent claudication. Hypertension= blood pressure  $\geq$  140/90 or on antihypertensive medication treatment. Diabetes=causal blood glucose of 200 mg/dl or greater or treatment with oral hypoglycemic agent or insulin. Depressive symptoms assessed at examinations 22 and 25 with the Center for Epidemiologic Studies Depression Scale (CES-D). A score of 16 or greater defined the presence of depressive symptoms. Medical conditions included any of the following five conditions: diabetes, cardiovascular disease, cancer, chronic obstructive pulmonary disease, and hip fracture. NA= not available as data not collected. Rx=medication treatment

Self-reported Prevalence of Functional Limitation or Physical Disability: Framingham Heart Study Original Cohort, Mean Age 82 years

TABLE 2

Scale and Scale Items* (percent)	WOMEN			MEN		
	Exam 15 N=177	Exam 20 N=159	Exam 25 N=174	Exam 15 N=103	Exam 20 N=98	Exam 25 N=119
<b>Nagi Physical Performance Scale</b>						
Pulling or pushing large objects	40.6	31.6	18.3	14.7	11.2	6.7
Either stooping, crouching, or kneeling	48.3	47.8	18.5	23.5	18.4	17.6
Reaching or extending arms above shoulder level	9.7	14.6	7.5	5.9	8.2	4.2
Reaching or extending arms below shoulder level	4.5	3.8	1.1	1.0	2.0	0.8
Writing, handling, or fingering small objects	17.5	11.9	5.7	15.5	11.2	10.1
Standing in place for long periods say 15 minutes	39.0	29.7	15.9	22.3	16.3	12.2
Sitting for long periods say 1 hour	9.7	5.0	4.0	9.9	6.1	0.8
<b>Rosow-Breslau Functional Health Scale</b>						
Heavy work around the house	65.5	39.0	30.5	35.9	31.6	19.3
Walks up and down stairs to second floor <sup>†</sup>	26.0	7.5	6.9	6.8	2.0	0.0
Walk one half mile	39.5	25.2	16.7	16.5	11.2	14.3
<b>Modified Katz Activities of Daily Living Scale</b>						
Bathing/personal grooming	15.3	2.5	2.9	4.9	2.0	0.0
Dressing	1.7	1.9	3.4	2.9	3.1	0.8
Eating	0.0	0.0	1.1	0.0	2.0	0.8
Getting from a bed to a chair <sup>‡</sup>	0.0	1.3	2.9	1.0	3.1	0.0
Walking across small room <sup>‡</sup>	4.5	1.3	0.6	0.0	1.0	0.8
<b>Any special equipment or device use</b>	<b>7.9</b>	<b>13.2</b>	<b>28.2</b>	<b>3.9</b>	<b>4.1</b>	<b>17.6</b>

Nagi physical performance scale limitation= some difficulty, a lot of difficulty, unable to do, do not do on physician order Rosow-Breslau functional health scale disability= unable to do.

Modified Katz ADL scale disability=human assistance needed, minimally dependent; dependent

<sup>†</sup>At exam 25 this question was asked as part of the modified Katz ADL Scale

<sup>‡</sup>At Exams 20 and 25 the question was changed to *transferring (getting in and out of a chair) and walking on a level surface about 50 yards*

**TABLE 3**  
Sex-specific Trends in Self-reported Functional Limitations and Physical Disability Adjusted for Age

Community-dwelling Framingham Heart Study Original Cohort, Mean Age 82 years									
Physical Function Scale	Women					Men			
	Exam 15 N=177	Exam 20 N=159	Exam 25 N=174	Exam p-value	Exam 15 N=103	Exam 20 N=98	Exam 25 N=119	Exam p-value	
<b>Mean or percent 95% confidence interval</b>									
<b>Functional limitation, Nagi Scale</b>									
Number of items with limitation	1.67	1.45	0.70	<0.0	0.93	0.73	0.53	0.03	
	1.46, 1.88	1.23, 1.67	0.48, 0.91	01	0.71, 1.14	0.51, 0.96	0.32, 0.73		
Any difficulty on the scale	74.6	60.5	37.9	<0.0	54.2	37.8	27.8	<0.001	
	66.7, 81.1	51.5, 68.8	29.9, 46.5	01	43.1, 65.0	27.6, 49.2	19.6, 37.9		
<b>Physical disability, Rosow-Breslau &amp; Katz ADL Scales</b>									
Number of items with impairment	1.52	0.81	0.64	<0.0	0.71	0.55	0.35	0.02	
	1.34, 1.70	0.62, 1.00	0.46, 0.82	01	0.52, 0.90	0.36, 0.75	0.17, 0.52		
Any difficulty on the scales	74.5	48.5	34.6	<0.0	42.3	33.3	22.8	0.009	
	66.7, 80.9	39.8, 57.2	27.0, 43.0	01	31.9, 53.3	23.7, 44.4	15.4, 32.3		
<b>Summary, All three scales</b>									
Number of items with limitation or impairment	3.19	2.26	1.34	<0.0	1.64	1.29	0.87	0.009	
	2.86, 3.52	1.91, 2.61	1.00, 1.67	01	1.28, 2.00	0.92, 1.66	0.54, 1.20		
<i>Any difficulty on the scales</i>	88.1	69.6	49.1	<0.0	63.9	48.8	36.4	<0.001	
	81.9, 92.4	60.8, 77.0	40.4, 57.9	01	52.9, 73.5	37.7, 59.8	27.1, 46.9		

**Appendix 1**

Study Sample: Framingham Original Cohort, Aged 79 to 88, Attending Index Examinations 15, 20, and 25

	<b>Exam 15 1977–1979 N</b>	<b>Exam 20 1988–1990 N</b>	<b>Exam 25 1997–1999 N</b>
<b>Eligible: Age 79 to 88 years at the Index Exam Based on Date of Birth</b>	1435	1727	1969
<b>Death Prior to Index Exam</b>	855	1076	1170
<b>Alive at Index Exam</b>	580	651	799
<b>Exclusions, N (percent of living participants)</b>			
Alive, did not attend the index exam	156 (26.9)	269 (41.3)	243 (30.4)
Alive with dementia	5 (0.9)	10 (1.5)	6 (0.8)
Alive, examination took place outside the Framingham Study clinic <sup>†</sup>		58 (8.9)	122 (15.3)
(nursing home, personal residence, or unknown site)		57(8.8)	135 (16.9)
Alive, missing data ( $\geq 1$ item on the 3 physical function scales) <sup>‡</sup>	139 (24.0)		
<b>Final Sample, N (percent of living participants)</b>	280 (48.3)	257 (39.5)	293 (36.7)

<sup>†</sup>Examinations off-site in participants' homes or nursing homes were not available at examination 15.

<sup>‡</sup>The Framingham Disability Study collected physical function data at examination 15.(19;43)