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Health and Functional Status of Adults in the United States at 90 Years of Age

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From 2010 to 2050, the number of people in the United States aged 90 years and older is projected to more than quadruple and comprise over 10% of the 65 years and older population.[1] There is limited information, however, about the health and functional status of such individuals. The Cardiovascular Health Study, which began in 1989, is a federally-funded observational community-based study of risk factors for cardiovascular disease in people age 65 and older. The "healthy participant" bias in the study has attenuated over time, and retention has remained high throughout follow-up, even for the oldest participants.[2,3] We describe the health and functional status of participants at age 90 years.

METHODS

The Cardiovascular Health Study is a prospective observational study of 5,888 black and white adults ≥ 65 years recruited in two waves (1989–90 and 1992–93) from Medicare eligibility lists in Forsyth County, North Carolina; Sacramento County, California; Washington County, Maryland; and Pittsburgh, Pennsylvania. Participants completed study visits annually through 1999 and in 2005–06; follow-up phone calls were conducted every six months through July 16th, 2015. We assessed cognitive function with the Modified Mini Mental State Exam (3MSE); if the 3MSE could not be administered, we used the Telephone Interview for Cognitive Status or the Informant Questionnaire on Cognitive Decline in the Elderly.[4] We assessed depressive symptoms with a modified 10-item Centers for Epidemiologic Studies Depression (CES-D) scale, and adjudicated cardiovascular events.[5] Dementia was identified from multiple sources: 1) the Cardiovascular Health Study Cognition Study, an ancillary study of participants in which dementia was adjudicated, 2) medications indicated for Alzheimer's disease and dementia, and 3) ICD-9 codes.

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RESULTS

Of 5,888 CHS participants, 2,062 (35.0%) survived to age 90 years as of July 16th, 2015. There were 1,889 (91.6% of those surviving) participants with available measures, and of these, 65.5% were women.

The majority of women (59.0%) and men (62.0%) reported being in good or better health and being without depressive symptoms (76.6% and 77.8%, respectively) at age 90 years. (Table 1) The mean 3MSE scores were close to 80 points; below this level indicates cognitive impairment. Women were taking a mean of 6.5 medications (SD 3.9) and men were taking 5.7 (SD 3.7); the five most common types of drugs were medications for high blood pressure, aspirin, lipid-lowering agents, thyroid medications, and antidepressants. The majority of women (75.6%) and men (58.7%) reported difficulty walking half a mile, although fewer reported difficulty walking up 10 steps (60.6% and 42.3%, respectively). The majority also reported difficulty on one or more instrumental activities of daily living, such as preparing food and performing light housework, (74.8% and 59.4% for women and men, respectively), and fewer reported difficulty on one or more activities of daily living, such as bathing and dressing (52.7% and 37.8%, respectively).

Nearly half of women (47.0%) and men (52.8%) had cardiovascular disease by age 90 years, the most prevalent type was coronary heart disease. (Table 2) More men than women had a history of cancer, and more women had dementia. The majority (73.0%) of participants had one or more of the chronic diseases assessed by age 90 years. (Table 2)

DISCUSSION

In the community-based Cardiovascular Health Study, we found that participants surviving to age 90 years were likely to have a high burden of disability and morbidity, yet report that their health status was good. Consistent with other studies, we found that a greater proportion of disability among women and men, as observed closer to age 65, persisted at age 90.[6] Notably, at age 90 participants were taking a mean of 6.5 medications, which may be a consequence of the high prevalence of multiple chronic conditions as well as the availability of medications for many of these conditions. Limitations of our study include the potential for missing data among persons in the worst health, possible reporting bias in the self-reported measures, and limited racial/ethnic diversity. Better understanding of the health and functional status of nonagenarians in the United States should facilitate planning for long-term care services that respond to and accommodate the high burden of morbidity and disability, and improve lives.

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Table 1

Characteristics of participants in the Cardiovascular Health Study at their first visit at age 90+

	Women		Men	
Characteristic	**N***	**Mean (SD) or N (%)**	**N***	**Mean (SD) or N (%)**
Age	1,237	90.3 (0.5)	652	90.4 (0.6)
Site	1,237		652	
Forsyth County, NC		300 (24.3%)		139 (21.3%)
Sacramento County, CA		370 (29.9%)		187 (28.7%)
Washington County, MD		264 (21.3%)		135 (20.7%)
Pittsburgh, PA		303 (24.5%)		191 (29.3%)
Black Race	1,237	189 (15.3%)	652	74 (11.3%)
Self-Rated Health	1,222		632	
Excellent		46 (3.8%)		33 (5.2%)
Very Good		206 (16.9%)		118 (18.7%)
Good		469 (38.4%)		241 (38.1%)
Fair		398 (32.6%)		196 (31.0%)
Poor		103 (8.4%)		44 (7.0%)
Depression Score (CESD)	509	5.1 (4.8)	306	4.8 (4.6)
Depressive Symptoms†	509	119 (23.4%)	306	68 (22.2%)
Cognitive Function (3MSE)	718	77.6 (18.9)	376	80.1 (17.4)
Cognitive Impairment‡	718	269 (37.5%)	376	114 (30.3%)
Prescription Medications	1,184	6.5 (3.9)	633	5.7 (3.7)
Antihypertensive		862 (72.8%)		413 (65.2%)
Aspirin		445 (37.5%)		233 (36.8%)
Lipid-Lowering		290 (24.5%)		171 (27.0%)
Thyroid		256 (21.6%)		72 (11.4%)
Antidepressant		184 (15.5%)		61 (9.6%)
Difficulty walking half a mile	1,113	841 (75.6%)	591	347 (58.7%)
Difficulty walking 10 steps	1,084	657 (60.6%)	581	246 (42.3%)
IADL Limitations§	1,120		593	
0		282 (25.2%)		235 (39.6%)
1		258 (23.0%)		143 (24.1%)
2		145 (12.9%)		67 (11.3%)
3		102 (9.1%)		38 (6.4%)
4		87 (7.8%)		41 (6.9%)
5		89 (7.9%)		25 (4.2%)
6		157 (14.0%)		44 (7.4%)
ADL Limitations‖	1,128		595	
0		533 (47.3%)		370 (62.2%)

	Women		Men	
Characteristic	**N***	**Mean (SD) or N (%)**	**N***	**Mean (SD) or N (%)**
1		170 (15.1%)		84 (14.1%)
2		120 (10.6%)		56 (9.4%)
3		74 (6.6%)		33 (5.5%)
4		65 (5.8%)		17 (2.9%)
5		97 (8.6%)		17 (2.9%)
6		69 (6.1%)		18 (3.0%)

Abbreviations: CESD, Center for Epidemiologic Studies Depression; 3MSE, Modified Mini-Mental State Exam; IADL, instrumental activities of daily living; ADL, activities of daily living.

*Available sample size for measure

†CESD ≥8 indicates depressive symptoms; CESD range 0–24; 25^{th}–75^{th} percentiles for CESD: women 2–7, men 1–7.

‡3MSE < 80 indicates cognitive impairment; 3MSE range 0–100; 25^{th}–75^{th} percentiles for 3MSE: women 71.3–91.4, men 75.0–91.4

§Participants reported difficulty or unable to do the following: telephone use, shopping, preparing food, light household work, heavy household work, and managing money

‖Participants reported difficulty or unable to do the following: bathing, eating, dressing, using the toilet, getting out of bed or chair, and walking around home.

Table 2

Chronic disease among participants in the Cardiovascular Health Study at their first visit at age 90+

	Women N=1,237	Men N=652	Total N=1,889
Disease		**N (%)**	
Any Cardiovascular Disease [*]	582 (47.0%)	344 (52.8%)	926 (49.0%)
Coronary Heart Disease	386 (31.2%)	252 (38.7%)	638 (33.8%)
Angina	369 (29.8%)	236 (36.2%)	605 (32%)
Myocardial Infarction	169 (13.7%)	141 (21.6%)	310 (16.4%)
Revascularization	97 (7.8%)	124 (19.0%)	221 (11.7%)
Cerebrovascular Disease [*]	206 (16.7%)	91 (14.0%)	297 (15.7%)
Stroke	157 (12.7%)	59 (9.0%)	216 (11.4%)
Transient Ischemic Attack	62 (5.0%)	42 (6.4%)	104 (5.5%)
Claudication	36 (2.9%)	30 (4.6%)	66 (3.5%)
Heart Failure	260 (21.0%)	137 (21.0%)	397 (21.0%)
Diabetes [†]	164 (13.3%)	84 (12.9%)	248 (13.1%)
Cancer [‡§‖]	154 (12.4%)	127 (19.5%)	281 (14.9%)
Chronic Obstructive Pulmonary Disease [‡]	209 (16.9%)	101 (15.5%)	310 (16.4%)
Dementia [†‡¶]	353 (28.5%)	140 (21.5%)	493 (26.1%)
Any Chronic Disease [*]	895 (72.4%)	484 (74.2%)	1,379 (73.0%)

[*] Component diseases may sum to more than total because participants may have more than one

[†] Determined by use of medication indicated for this condition

[‡] Determined by ICD-9 hospitalization codes from hospital records and Centers for Medicare & Medicaid Services data during CHS follow-up

[§] Prevalent cancer was determined by self-report at baseline

[‖] The most common cancer types included breast in 54 women, prostate in 63 men, and colorectal in 41 women and 23 men

[¶] Determined by the CHS Cognition Study