Comprehensive Health Status Assessment of Centenarians: Results From the 1999 Large Health Survey of Veteran Enrollees

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Background. Information on the health status of centenarians provides a means for understanding the health care needs of this growing population. Therefore, we examined the health status of a national cohort of centenarian veteran enrollees.

Methods. Ninety-three centenarian veteran enrollees returned a complete health history questionnaire, which included questions about sociodemographic information, age-associated conditions, health behaviors, health-related quality of life as measured by the Veterans SF-36, and change in health status.

Results. Centenarian veteran enrollees are a group with major impairment across multiple dimensions of health-related quality of life despite having a relatively low prevalence of diseases. They had considerable physical limitations as reflected by their physical health summary scores (26.2 ± 8.3). However, their mental health was comparatively good (mental health summary score 44.1 ± 12.5). Compared to younger elderly veterans (ages 85–99), centenarians had a lower prevalence of hypertension, angina or myocardial infarction, diabetes, and chronic low back pain (p < .05). Centenarians had significantly worse physical functioning, role physical, vitality, and social functioning scores than did younger elderly veterans. The two groups did not differ in their general health, bodily pain, role emotional, and mental health scores. Centenarians did not perceive much decline in their physical or mental health during the preceding year.

Conclusions. Centenarian veteran enrollees are a group with a low number of age-associated diseases and good mental health despite substantial physical limitations. These results support future studies of services directed toward improvement of function as opposed to those focused solely on the treatment of diseases.

As the number of centenarians in the population grows (1), information about their health status becomes important to anticipate their medical needs, design effective services, and evaluate health care programs (2). Most studies have characterized the health of centenarians by enumerating their medical conditions (3–7). Although such studies are important, assessment of function and perceived health status is equally central, because elderly people tend to have multiple interrelated medical problems, and their physical and mental functioning are not necessarily a direct reflection of their diagnoses (8). However, only a few research projects have measured the functional status of centenarians. These studies have generally been small, and more information is needed (9,10).

In this study, we used a national cohort of veteran enrollees to examine the health status of centenarians. We addressed three specific questions: 1) What is the level of physical and mental health of centenarian veteran enrollees? 2) How do centenarians perceive changes in their health status? and 3) How do centenarians compare with younger elderly people?

Methods

Data Sources

This study used data from the 1999 Large Health Survey of Veteran Enrollees. Veteran enrollees were all registered with the Veterans Health Administration (VHA) for medical care. From the enrollment file of 3,613,877 veterans, a total of 1.5 million veterans were randomly selected and stratified by Veterans Affairs (VA) facilities. Among the 1.5 million veteran enrollees, 93,951 were excluded from the survey due to death or ineligibility as a result of incorrect names or addresses on file. A health questionnaire was mailed to all recruited patients. Of 1,406,049 veteran enrollees, we identified 273 (0.03%) patients who were 100 years of age and older. The age was corroborated using VA administrative files as well as Medicare data. One hundred two of the 273 centenarian veteran enrollees returned the health history questionnaire, representing a response rate of 37%. Table 1 shows the sociodemographic information, comorbid conditions (International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis codes), and 1-year...
mortality rates (between July 1999 and July 2000) of respondents (n = 102) and nonrespondents (n = 171). Of the 102 respondents, only 9 were eliminated from the analysis because of missing data.

### Patient Information

On the health questionnaire, enrollees were asked to provide information about sociodemographic characteristics, health behaviors, comorbid conditions, health-related quality of life (HRQoL), and change in physical and mental health.

Sociodemographic information included age, sex, level of education (range, 1 to >16 years), race, and marital status. Except for age, all sociodemographic variables were obtained from the health questionnaire. Age was obtained from the Outpatient Treatment File, a VA administrative database.

Questions about lifestyle behaviors included history of smoking ("Have you smoked at least 100 cigarettes in your entire life?"), current smoking status ("Do you now smoke cigarettes every day, some days, or not at all?"), and alcohol use ("Considering all types of alcoholic beverages, how many times during the past month did you have five or more drinks on an occasion?").

On the health questionnaire, enrollees were also asked whether a doctor ever told them that they have any of the following conditions: hypertension, coronary artery disease (myocardial infarction or angina), congestive heart failure, diabetes, arthritis, chronic low back pain, chronic lung disease, stroke, cancer (not including skin cancer; except if melanoma), benign prostatic hypertrophy, spinal cord injury with quadriplegia or paraplegia, depression, post-traumatic stress disorder, or schizophrenia. These conditions were chosen from the medical history questionnaire of the Medical Outcomes Study (14). The Veterans SF-36 was modified for use in the veteran population from the Medical Outcomes Study SF-36, a reliable and valid measure of HRQoL (15, 16). It includes eight important concepts of health (Appendix A): physical functioning, role physical, social functioning, general health perceptions, vitality, bodily pain, role emotional, and mental health. The eight Veterans SF-36 scales were summarized into physical (PCS) and mental component summary (MCS) scales (17). The two summaries, PCS and MCS, were scored using a linear t score transformation that was normed to a general U.S. population with a mean of 50 and a standard deviation of 10 (18).

The health questionnaire also included a section on perceived changes in health status. Patients were asked "compared to one year ago, how would you rate your physical health in general now?" and "compared to one year ago, how would you rate your emotional problems (such as feeling of anxiety, depressed or irritable) now?". The response choices included much better, somewhat better, about the same, somewhat worse, and much worse.

### Statistical Analysis

To answer our first question (What is the level of physical and mental health of centenarian veteran enrollees?), we reported sociodemographic characteristics (sex, race, level of education, marital status), lifestyle behaviors (history of smoking, current smoking status, and alcohol use), comorbidities (the number and prevalence of selected age-associated conditions), and HRQoL (the Veterans SF-36 scores).

To answer the second question (How do centenarians perceive changes in their health status?), we examined the distribution of the perceived changes in their physical health and emotional problems.

To answer the third question (How do centenarians compare with younger elderly people?), we compared the centenarian veteran enrollees with those in a younger age group (85–99 years of age). From the 1999 Large Health Survey of Veteran Enrollees, we identified 28,459 veterans in this age range. We used chi-square tests to report significant differences between age groups for categorical variables (sex, marital status, level of education, service-connected disability, select diagnoses, and perceived change in health status). Student t tests were used to compare the scores from the Veterans SF-36 scales and the two component summary scores between the two age groups.

### Results

The age range of the participants was between 100 and 112 years. Table 2 shows their sociodemographic characteristics: 97% were male, 80% were white, 30% were married, and 79% had 12 or fewer years of education. Results by age group indicated that centenarians were less likely to be married and were less well educated. As expected, there is a trend of increasing widowhood with age.

Table 2 also shows the smoking status and alcohol use among centenarian veteran enrollees. Most centenarians answered that they have not smoked 100 or more cigarettes in their entire life. Only 5% of the centenarians are currently smoking every day or some days. Most centenarians...
reported occasional or no alcohol use. Only 4% of centenarian veteran enrollees have had five drinks on an occasion once or more times per day. Compared to younger elderly people (ages 85–99), centenarians were significantly less likely to have smoked cigarettes or drunk alcohol than were younger elderly people (p < .05).

Table 3 shows the prevalence of self-reported health conditions among centenarian veteran enrollees. Centenarians had an average of 3.3 diagnoses. The most prevalent diagnoses reported by centenarians were arthritis and benign prostatic hypertrophy (66% and 58%, respectively), and the least prevalent conditions were spinal injury and schizophrenia (2% and 1%, respectively). Compared to that among younger elderly people (ages 85–99), the average number of comorbid conditions among centenarians was significantly lower (p = .003). The prevalence of age-associated conditions such as hypertension, angina or myocardial infarction, diabetes, and chronic low back pain significantly decreased with age (p < .05). However, congestive heart failure and benign prostatic hypertrophy increased with age, but the differences were not statistically significant. This profile of self-reported health conditions was similar to the one based on International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis codes (Table 1).

Figure 1 shows that centenarians are a group with major impairment across multiple dimensions of HRQoL. They scored poorly in physical functioning (22.4 ± 30.7), role physical (11.3 ± 33.6), vitality (30.2 ± 20.8), and social functioning (42.2 ± 50.3) scales. Their mental health was relatively good (MCS score of 44.1 ± 12.5) despite their poor physical health (PCS score of 26.2 ± 8.3). Centenarians had significantly worse physical functioning, role physical, vitality, and social functioning scores than did younger elderly veterans (ages 85–99). The two groups did not differ in their general health, bodily pain, role emotional, and mental health scores.
Table 4. Change in Physical Health and Emotional Problems by Age Group

<table>
<thead>
<tr>
<th>Change</th>
<th>Physical Health*</th>
<th>Emotional Problems†</th>
</tr>
</thead>
<tbody>
<tr>
<td>85–99 Years</td>
<td>100 Years or Older</td>
<td>85–99 Years</td>
</tr>
<tr>
<td>Much better</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Somewhat better</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>About the same</td>
<td>42%</td>
<td>61%</td>
</tr>
<tr>
<td>Somewhat worse</td>
<td>34%</td>
<td>20%</td>
</tr>
<tr>
<td>Much worse</td>
<td>15%</td>
<td>8%</td>
</tr>
</tbody>
</table>

*p = .647  p = .771

**Notes:** *Compared to 1 year ago, how would you rate your physical health? †Compared to 1 year ago, how would you rate your emotional problems?

Table 4 shows the perceived changes in physical health and emotional problems (such as feelings of anxiety, depression, or irritability) during the preceding year. Centenarians reported that their physical health was about the same in 44% of instances, somewhat worse in 34% of instances, and much worse in 17% of instances. Sixty percent of centenarians reported that their emotional problems were about the same. Somewhat worse or much worse emotional problems were reported in 21% and 11% of instances, respectively. These rates of change in physical health and emotional problems were not statistically different from those of younger elderly veterans (p > .60).

**DISCUSSION**

As the number of centenarians continues to grow, information on their health status becomes increasingly important. The present study shows that the life of centenarians is affected by substantial limitations in performance of everyday physical activity and considerable disability due to physical problems (e.g., decreased capacity for self-care, physical, social, and role activities). However, centenarians were psychologically resilient despite of their poor physical health. They reported feeling peaceful and calm most of the time as reflected in their high mental health summary scores. For the most part, centenarians did not perceive much deterioration in their physical or mental health during the previous year. It is reassuring that, even at such an advanced age, most centenarians do not report themselves as experiencing progressive decline.

Healthy behaviors and the absence or delayed onset of age-associated conditions have most likely shaped the life of centenarians. Compared to younger elderly people, centenarians were significantly less likely to smoke or drink alcohol. They had significantly lower rates of age-associated morbidities including heart disease, diabetes, hypertension, and cancer than did younger elderly people. Lower prevalence of diseases with increased age has been noted even across younger elderly groups (19). The recent identification of major genotypes and phenotypes for exceptional longevity further support the notion that age-related diseases are delayed in older old males (20).

Although the prevalence of chronic conditions decreased with age, the physical health status of centenarians was worse than that of younger elderly people. This finding suggests a growing frailty or decreased functional reserve among centenarians that is independent of disease (21). Another possible explanation is that those diseases that are present are more severe. Further exploration of these issues is needed to better understand the ways in which disease versus aging itself affects the health status of older people.

In contrast to our study cohort, most studies of centenarians have included predominantly female participants. Female centenarians on average have had more age-associated conditions and worse health than male centenarians have had (22–24). However, our study cohort had higher prevalence rates of age-associated diagnoses such as hypertension, diabetes, myocardial infarction, congestive heart failure, and chronic lung disease when compared to those rates in female participants in the New England Centenarian Study (7). Some of these differences can be explained by the fact that our population was identified from an enrollment file of a health care system, which may include more diseased centenarians.

A 37% response rate from the 273 centenarians is low. Compared to respondents, the higher prevalence of dementia among nonrespondents is a likely explanation for at least some of the lower response rate (25). Another plausible explanation is that the high mortality rate of nonrespondents reflects greater frailty in this group, which is also something that would reduce response rates. This increase is probably due, at least in part, to a higher prevalence of myocardial infarction and dementia.

Although we have sampled the more healthy 37% of centenarians, our results indicate: a) that their physical limitations are disproportionate to their disease prevalence, supporting the point that they have greater frailty related to age; b) that they have good health behaviors, and this probably is related to their good health; and c) that there is a substantial subset of centenarians who do not perceive themselves to be in a state of progressive decline. These findings support future studies of services directed toward improvement of function as opposed to those services focused solely on the treatment of diseases. Furthermore, our findings provide direction for future studies into the patterns and factors that determine the health status of centenarians.

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**REFERENCES**


**APPENDIX A: INTERPRETATION OF THE VETERANS SF-36**

**Physical Functioning**

The Physical Functioning score identifies how much health limits physical activities such as walking, climbing stairs, bending, lifting, and exercise. A low score indicates limitations in performing all activities. A high score indicates the ability to perform all types of physical activities, including vigorous exercise.

**Role Physical**

The Role Physical score identifies how much physical health interferes with work or other daily activities. A low score indicates that physical health creates problems with daily activities including accomplishing less than wanted, limitations in the kind of activities, or difficulty in performing activities. A high score indicates that physical health has not caused problems with work or daily activities.

**Bodily Pain**

The Bodily Pain score identifies the intensity of pain and the effect of pain on normal work both inside and outside the home. A low score indicates very severe and extremely limiting pain. A high score indicates no pain or limitations due to pain.

**General Health**

The General Health score provides an evaluation of health, including current health, health outlook, and resistance to illness. A low score indicates perceived health as poor and likely to get worse. A high score indicates perceived health as excellent.

**Vitality**

The Vitality score identifies the extent to which someone feels tired and worn out. A low score indicates that a person feels tired and worn out all of the time. A high score indicates that a person feels full of pep and energy.

**Social Functioning**

The Social Functioning score identifies the extent to which physical health or emotional problems interfere with normal social activities. A low score indicates extreme and frequent interference. A high score indicates no interference.

**Role Emotional**

The Role Emotional score identifies the extent to which emotional problems interfere with work or other daily activities. A low score indicates that emotional problems interfere with activities, including decreased time spent on activities, accomplishing less, and not working as carefully as usual. A high score indicates no interference with activities due to emotional problems.

**Mental Health**

The Mental Health score identifies general mental health, including depression, anxiety, and behavioral and/or emotional control. A low score indicates that a person feels nervousness and depression all of the time. A high score indicates that a person feels peaceful, happy, and calm.

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