Projections of the Prevalence and Incidence of Dementias Including Alzheimer's Disease for the Total, Enrolled, and Patient Veteran Populations Age 65 or Over

INTRODUCTION

The Department of Veterans Affairs (VA) Central Office Geriatrics and Extended Care Strategic Healthcare Group (GEC SHG) determined that projections of the numbers of veterans with Dementia which were established in 1989 (Mortimer) needed to be updated and expanded to address the Veterans Health Administration (VHA) enrolled and patient populations. The GEC SHG requested assistance in obtaining these updated projections. This paper, prepared under the auspices of the Office of the Assistant Deputy Under Secretary for Health, complies with this request.

PURPOSE

This analysis provides current and 20-year projected estimates of the number of veterans with dementia including Alzheimer's Disease, within each of the following segments of the veteran population: 1) the general veteran population (i.e. VetPop); 2) the enrolled population (i.e. those enrolled in the VA health care system); and 3) the patient population (i.e. those enrolled and receiving services within the VA health care system - also referred to, at times, as users).

BACKGROUND

Dementia is a general designation for mental deterioration characterized by a loss of intellectual abilities, such as memory, judgment, and abstract thinking, of sufficient degree to interfere with social or occupational functioning. Dementia is one of the major health problems in our aging societies. As the veteran population ages it's important to assess the need for health care services and to plan for those services. For internal planning purposes, the VA has relied upon a 1989 study conducted by a dementia epidemiologist at the Minneapolis Geriatric Research, Education, and Clinical Center (GRECC). This study, which was cited in "Dementia: Guidelines for Diagnosis and Treatment" (VA Document IB 18-3, Oct. 1989) stated that the number of veterans with severe dementia is expected to increase from 400,000 in 1990 to 600,000 in the year 2000 and then to level off through 2030.

To assist with VA's internal planning efforts, the Office of the Assistant Deputy Under Secretary for Health (ADUSH) has performed the following analysis to provide up-to-date current and projected estimates of the number of veterans with dementia including Alzheimer's Disease, within each of the following segments of the veteran population: 1)

the general veteran population (i.e. VetPop); 2) the enrolled population (i.e. those enrolled in the VA health care system); and 3) the patient population (i.e. those enrolled and receiving services within the VA health care system).

METHODOLOGY

Dementia includes significant impairment in social or occupational functioning that represents a decline from a previous level of functioning. Common clinical signs of dementia include cognitive, emotional and behavior disturbances. Alzheimer's Disease (AD) and Vascular Dementia (VaD) are specific kinds of dementia which together represent the vast majority of cases of dementia.[1] According to studies by Kukull and Bowen[2], approximately two-thirds of all dementia cases may be attributed to AD, with VaD representing the next most common form of dementia. Studies by Zekry, Hauw, and Gold[3] cite prevalence rates for VaD as ranging from 2.6 to 51.4 percent of AD rates for elderly subjects, which is consistent with the estimate that 2/3 of all dementia cases may be attributed to AD. Other forms of dementia appear to be rare.

AD is differentiated from other dementias on the basis of its cause, but that cause is not, in fact, well understood. AD is accepted as a distinct disease entity because AD patients manifest specific kinds of abnormalities in the brain (observable only in those who are autopsied or undergo a brain biopsy, a rare procedure) differing from the abnormalities found in other dementias. The rates we have selected for inclusion into our composites are all from studies of living subjects. The definitive test of type of dementia, the autopsy, was therefore unavailable.

Additionally, the studies employed in this analysis utilized various criteria to screen and diagnose dementia. Based upon the diverse and various criteria of these studies and the fact that all studies were of living subjects, we believe that our prevalence and incidence projections represent all dementias, especially at the high level of estimation.

It was necessary to establish the disease prevalence rates – that is, how many people have a disease at a given time - and the incidence rates- the number of new cases. These rates were then applied to the current and projected number of veterans within the general veteran population, the enrolled population, and the patient population to calculate estimated numbers of cases of disease and estimated new cases of disease with each of the forecast years.

[1] Zekry D, Hauw JJ, Gold G. Mixed Dementia: Epidemiology, Diagnosis, and Treatment. JAGS 2002;50:1431-1438,
[2] Kukull and Bowen "Dementia epidemiology", Med. Clin. N. Am, May 2002
[3] Zekry D, Hauw JJ, Gold G. Mixed Dementia: Epidemiology, Diagnosis, and Treatment. JAGS 2002;50:1431-1438,

PHASE I

A robust analysis performed by the General Accounting Office (GAO)[4] was utilized as our initial basis for prevalence rates. The primary justification for inclusion of this study and exclusion of other, competing estimates was the fact that the GAO paper offered rates based upon meta-analysis of a number of relevant studies of various types of dementia. The incidence rates were based on the findings produced by a study conducted by Gao, Hendrie et al. This study was also a meta-analysis and was chosen as our initial source of incidence rates largely for that reason. This application is discussed in more detail below.

1.) Establishment of the Prevalence Rates - The GAO established the rates by meta-analysis of 18 separate studies that were considered relevant by satisfying the following criteria: (1) used widely accepted diagnostic criteria for finding cases of AD and cases of mixed dementia (persons with both AD and another kind of dementia)[5], and (2) included populations that are considered relevant to the United States (e.g., U.S. populations, European population).

The meta-analysis allowed the integration of the prevalence estimates in order to provide age and gender specific estimates of AD prevalence rates. The overall AD prevalence estimates were adjusted further to account for two limitations of the age and gender specific rates presented in the literature. Specifically, the GAO estimated the AD prevalence rates, over all ages and both genders that would be obtained if all studies (1) counted cases of mixed dementia (persons with both AD and another kind of dementia) as cases of AD and (2) corrected the estimates, when necessary, for the expected number of cases missed by insufficiently sensitive screens.

Rates were produced for discrete years of age at 5-year intervals from 65 to 95, by gender for all levels of severity of by a classification of moderate to severe cases and then separately, of mild cases. Mild cases were established by calculating the difference between all levels and the sum of moderate to severe levels. Separate estimates for moderate and severe levels could not be produced due to the omission of these rates in the GAO document. Point estimates for each group were given as well as low and high estimates for a 95% confidence interval. Rates for intervening years were estimated by interpolation. These rates were then adjusted to represent age ranges rather than specific years by being applied to single year of age population counts from the "U.S. Population Estimates by Age, Sex, Race, and Hispanic Origin: 1980 to 1999", for June 1995, from the Population Estimates Program, Population Division, U.S. Census Bureau, and summarized at the interval level. The purpose of this adjustment of year-specific age rates into range-specific rates was to match the population categories reported for VA enrollees. As an approximation necessitated by the data, the age 95 rate was applied to

[4] Alzheimer's Disease, "Estimates of Prevalence in the United States"; GAO/HEHS-98-16; January 1998

[5] See Appendix II of the GAO/HEHS-98-16 Report: G. McKhann and others, "Clinical Diagnosis of Alzheimer's Disease: Report of the NINCDS [National Institute of Neurological and Communicative Disorders and Stroke] – ADRDA [Alzheimer's Disease and Related Disorders Association] Work Group Under the Auspices of the Department of Health and Human Services Task Force on Alzheimer's Disease.

population estimates for ages 96 to 100 and the 85+ category rate was computed for persons aged 85 to 100. As person counts are very low at this extreme age range, these approximations should not significantly skew our results.

2.) Establishment of the Incidence Rates - Various sources produced a wide range of incidence rates. This fact, as well as the advantage of compatibility with the method of estimating prevalence rates in the GAO approach led us to decide to use the incidence rates generated by meta-analysis of multiple studies in "The Relationships Between Age, Sex, and the Incidence of Dementia and Alzheimer Disease: A Meta-analysis" by Gao, Hendrie, et al.[6] This study provided age specific incidence rates for both AD (8 studies included in meta-analysis) and Dementia (12 studies included). These rates were not differentiated by gender as it was found that gender was not a significant factor, consequently the same rates were used for men and women. Rates were given for age groups beginning at age 55 but the rates were so low in the initial decade as to be considered negligible.

PHASE II

Use of prevalence and incidence rates generated by the meta-analyses described above yielded estimates which were significantly lower than previous work. While we believed these estimates to be reasonable, it seemed prudent to seek expert advice on this matter. Consequently, we contacted the National Institute on Aging (NIA) to request their professional expertise and input. They suggested numerous articles for our further consideration. Phase II reflects our consideration of these articles, which are listed in the References under "Phase II".

The prevalence and incidence rates were extracted from NIA's recommended articles. The rates were segmented by study, population, disease, gender and age group and then compared to the rates established under Phase I. While this approach yielded results that were only slightly higher than under Phase I, it is clear that a broader range of demographic groups and categories of dementia are now represented.

PHASE III

We could not find any reasonable justification to prefer one study over another among those recommended by the NIA (Phase II). Additionally we could not substantiate selecting the GAO & Gao, Hendrie, et al., approach set forth in Phase I over Phase II. Therefore, in an attempt to reconcile the results, we developed composite rates for incidence and prevalence by taking into account all the rates utilized in both Phase I and Phase II. Phase III reflects our attempt to reconcile the results from Phase I and II.

A statistical process known as "LOWESS" (LOcally WEighted Scatterplot Smoothing) was used in Phase III to produce the composite rates using as inputs the meta-analyses of prevalence and incidence rates as well as the studies suggested by NIA. LOWESS is a statistical method of defining a smooth curve through the middle of a scatterplot to highlight trends or patterns in the data. LOWESS is similar to a least-squares regression

[6] Gao S, Hendrie HC, et al. The Relationships Between Age, Sex, and the Incidence of Dementia and Alzheimer Disease, A Meta-analysis, Arch Gen Psychiatry/Vol 55. Sept 1998.

line fitting computation except that it develops a curvilinear best fit rather than a linear fit.

LIMITATIONS

Although we believe our approach and methodology is statistically sound and useful for estimating the projections, certain limitations exist, which warrant notation.

The rates we have selected for inclusion into our composites are all from studies of living subjects. The definitive test of type of dementia, the autopsy, was therefore unavailable. For this reason, we believe that our prevalence and incidence projections represent all dementias. If it is desired to separate the rates into Alzheimer's Disease and non-Alzheimer's components, we would recommend using the high rates for all dementias and the middle rates for Alzheimer's Disease only.

Additionally, the NIA addressed three methodological limitations with the GAO study. First, the NIA noted that only 3 of the 18 studies were of U.S. populations. NIA noted concerns with combining the U.S. and non-U.S. populations (i.e. European populations), considering that U.S. data tend to yield higher prevalence rates than do the non-U.S. data. Second, NIA questioned whether or not GAO captured all dementia cases as a result of insufficiently sensitive initial screens and the omission of questionable cases. Third, NIA commented that the meta-analytic method the GAO used could not compensate for the large differences in rates observed across studies.[7] Our efforts to develop projections based on composite rates from Phase I and Phase II were in response to these deficiencies.

VETERAN POPULATION PROJECTIONS - DEFINED

Total General Veteran Population (Fiscal Years ending 2002-2022)
VA' official estimate and projection of the number and characteristics of the veteran population is the VA's VetPop2001Adj (dated 9/30/2002). The 20-year case estimates were established by applying the derived prevalence and incidence rates to the population projections from the VetPop2001Adj. Total veteran population was estimated for years 2002 through 2022 in 5-year age intervals up to the 95 to 99-age interval with an open-ended 100 plus years age group. Consequently, prevalence rates were recomputed for the same set of intervals. Rates for the intervals up to and including 80 to 84 years are unchanged. It should be noted that even though a population may be decreasing in total size, a larger proportion at the highest age levels can explain an increasing number of occurrences of dementia.

[7] See pages 10 & 11 and Appendix IX: Alzheimer's Disease, "Estimates of Prevalence in the United States"; GAO/HEHS-98-16; January 1998

VA Enrolled Population (Fiscal Years ending 2002-2022)
VHA contracts with Milliman USA, Inc., an actuarial firm (subcontractor of CACI, Inc. FEDERAL) to project the veteran enrollment in the VA health care system. Estimates of the enrollee population were taken from Milliman's 2004 projections based upon Scenario 1 of May 7, 2003 incorporating the Secretary's directives for continued suspension of Priority Level 8 enrollment. It should be noted that enrollees are both institutional and non-institutional. Case estimates are the result of applying the derived rates to the Milliman projections for the years 2002-2022.

VA Patient Population (Fiscal Years ending 2002-2022)
Estimates of the patient population were taken from Milliman's 2004 CARES Enrollee Healthcare Projections using Enrollment Level Decision Analysis (ELDA) assumptions. Again, case estimates are the result of applying the derived rates to the Milliman projections for the years 2002-2022.

FINDINGS

The attached exhibits labeled as *"VetPop" "Enrollee"* and *"Patients"* illustrate the 20-year projected estimates of the number of veterans with dementia including Alzheimer's Disease, within each of the following segments of the veteran population: 1) the general veteran population; 2) the enrolled population; and 3) the patient population.

Additionally, we have produced the attached table identified as Table A, which provides a comparison of the ADUSH prevalence projections (using FY 2002) to the 1989 estimates prepared by Mortimer for FY 2001, the two closest years. By comparing the "low rate" between the two studies, this table illustrates that the ADUSH rates are more conservative than those used in 1989. This table, however, also illustrates that the estimates used by ADUSH for the "high rates", are close to the Brookmeyer rates used in the 1989 study but are considerably lower than the rates derived from the Evans study. We would explain this discrepancy by small differences in diagnostic criteria as well as the small and homogeneous but not necessarily representative study population used by Evans. In addition to the above, changes in population estimates, differences in age ranges, and differentiation by gender also account for differences between these results and the results conducted in the 1989 study.

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