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Comfort Food for an Actuary:

Cognitive Testing in Underwriting the Elderly[1]

by Eric D. Golus, Laura Vecchione and Thomas Ashley

There are certain occasions when the knowledge we have gained in our jobs carries over into our personal lives. For instance, developing insurance products certainly helps when it comes time to buy an insurance policy. Recently, one of the authors had the experience of giving his 91-year-old grandmother, Nanny as she is affectionately called, an Extended Delayed Word Recall (DWR) test. This article will show that DWR tests are a powerful predictor of mortality in the elderly. As the population ages and more and more life insurance is being applied for at the older ages, having a DWR test in an underwriting arsenal is like comfort food for an actuary.

Background

Underwriting the elderly is a challenge to the life insurance industry. It can be argued that the underwriting techniques used for applicants in the middle years are not an effective predictor of mortality risk in the elderly. A great deal of medical research has been undertaken over the past 10 years to develop an understanding of factors that are predictive of mortality in the elderly. It has been shown that in community dwelling elderly populations, cognitive dysfunction is a predictor of mortality.[2] We decided to study the use of the DWR test as a potential underwriting tool in an insured population because a DWR test is simple to administer, objectively scored and easily validated.

A DWR test uses a predefined and validated list of 10 words. The examiner presents each word to the subject. The subject repeats the word and then uses it in a sentence, after which the process is repeated. Following this process, the subject is administered other tests during a 5-minute period. When this five-minute period is over, the subject is asked to recall as many of the 10 words as possible. The subject does not have a time limit on the recall period and the resulting test score is the number of words the subject recalls.[3]

Mortality Study Population and Methodology

A mortality study was performed on an insured population age 70 and older where a DWR test was utilized. The mortality study population consisted of applicants underwritten for an employer-sponsored long-term care insurance (LTCI) program between March 1995 and February 2003. Companies that sell LTCI routinely test applicants at ages 70 and older using a variety of cognitive tests for evidence of cognitive dysfunction. We recognize that we used a population underwritten for LTCI, not life insurance. However, we thought this was the best surrogate population available since this population represented a group of (mostly) retired workers who share many of the characteristics we would expect in a population applying for life insurance.

The exposure period for each applicant started at the date of underwriting and continued until March 13, 2003 or death. Each applicant was accepted for LTCI (56

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[1] This article is based on an article that is in press and to be published in the May 2006 issue of the Journal of Insurance Medicine, *J Insur Med* 2006;38(2).

[2] Fried, LP et al. Risk Factors for 5-year Mortality in Older Adults: The Cardiovascular Health Study, *JAMA* 1998;278(8):585-592.

[3] Knopman DS et al., Development and standardization of a new telephonic cognitive screening test: The Minnesota cognitive acuity screen (MCAS). *Neuropsychiatry, Neuropsychology, and Behavioral Neurology*: 2000; 13(4):286-296.

percent of the applicants), declined for medical reasons (36 percent) or declined for cognitive impairment (8 percent). The mortality study included all those who were accepted for LTCI (87 percent of mortality study population) and all those who were declined for cognitive impairment (13 percent) since both of these groups include applicants who we judged to be acceptable for life insurance. Since, in the case of those applicants who were declined for cognitive impairment, a LTCI policy was never issued we used the underwriting date as the beginning of the exposure period for the mortality study population.

Since the LTCI program would not know the vital status for applicants who were either declined for cognitive impairment or who were accepted for LTCI insurance but lapsed their policies, we used the Social Security Death Master File (SSDMF) to determine if and when an applicant had died. This file contains, among other things, the Social Security number and date of death of those people with Social Security numbers, as known to the Social Security Administration as of a given date, in this case March 13, 2003. The Social Security number for each applicant as known to the LTCI program was compared to the SSDMF. Of deaths known to the LTCI program, 94 percent of them were also included on the SSDMF. From this we might infer that our mortality study understated true mortality by 6 percent. While this is true, if we assume that mortality ratios were underestimated to the same degree, then comparisons of mortality ratios would produce a valid result.

We chose 100 percent of the 2001 Valuation Basic Table (VBT), select and ultimate, smoker distinct, sex distinct version as the expected mortality. The 2001 VBT is based on amounts of insurance, while mortality in this study was based on number of deaths. This difference in the mortality basis would also hold if any of the other popular mortality tables were used, including the 1990-1995 SOA Mortality Tables. Advantages of using the 2001 VBT include that (1) it is a smoker distinct table, (2) its observation period is relatively close to the exposure period of the mortality study and (3) it contains more complete elderly mortality data.

After 1996, underwriting standards for the LTCI program were liberalized for various impairments, such as certain cancers and coronary artery disease because of unexpectedly favorable claims experience in the program. Medical underwriting for LTCI historically has been quite different than for life insurance. Few of the applicants would have had a medical exam, blood testing, urine testing or an EKG. Nevertheless, the impressively low mortality ratios for applicants in 1995-1996 were achieved without the underwriting requirements traditionally used in life insurance. Because this population applied for a living benefit, like annuity customers, it is possible that this form of self-selection might produce better mortality than life insurance experience. It is interesting to note that the underwriting year had a major impact on mortality. The change in underwriting standards must account for the difference.

Mortality Study Results

The mortality study results showed that the group recalling 0 to 5 words (poorer scoring group) on the DWR test had a mortality ratio of 136 percent while the group recalling six to 10 words (better scoring group) had a mortality ratio of 35 percent. The mortality ratio for both groups combined was 71 percent.

To get an idea of the credibility of the mortality ratios, 95 percent confidence intervals were determined. They were (126 percent, 146 percent) and (32 percent, 39 percent) for the poorer scoring group and better scoring group, respectively. The relatively narrow range of the confidence intervals showed the results to be credible. The 95 percent confidence interval for the entire population was (67 percent, 75 percent).

Exhibit 1 on page 6 shows the mortality ratios and confidence intervals by DWR test score. (The whiskers on the mortality ratio boxes in the exhibit represent the confidence intervals.) These results are further divided by gender, underwriting age, underwriting year, smoker status and underwriting result in Exhibits 2 to 6, respectively.

Exhibit 1 also shows that the mortality ratio for the poorer scoring group was 385 percent (= 136 percent/35 percent) that of the better scoring group.

Exhibit 2 on page 6 shows that the mortality ratio for the poorer scoring group was 433 percent and 341 percent that of the better scoring group for females and males, respectively. The mortality for males was slightly

continued on page 6

The mortality study results showed that the group recalling 0 to 5 words (poorer scoring group) on the DWR test had a mortality ratio of 136 percent while the group recalling six to 10 words (better scoring group) had a mortality ratio of 35 percent.

Exhibit 1: Mortality Ratio by DWR Test Score

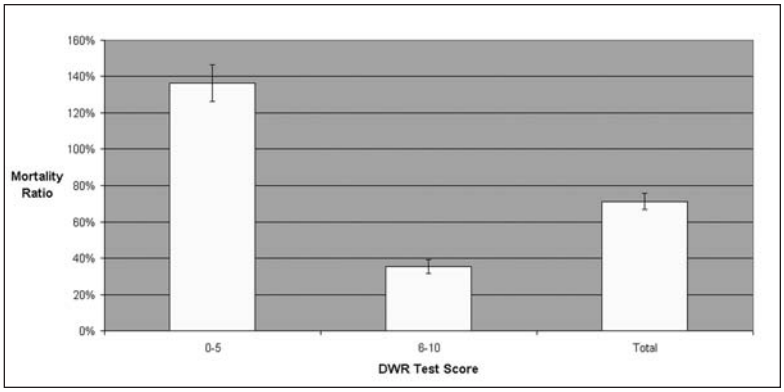


Exhibit 2: Mortality Ratios by DWR Test Score and Gender

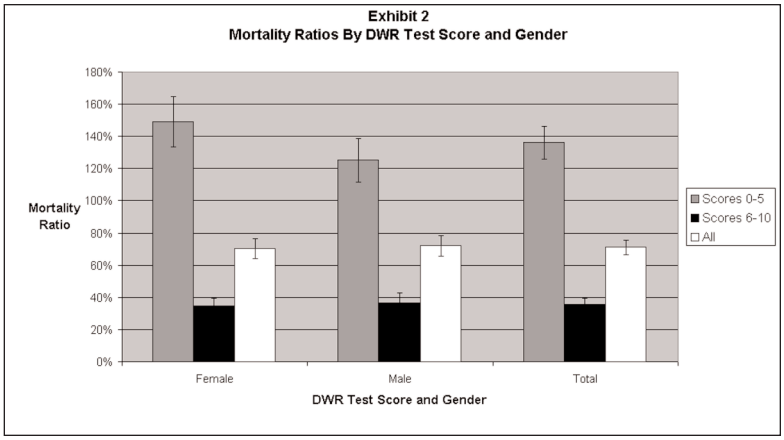
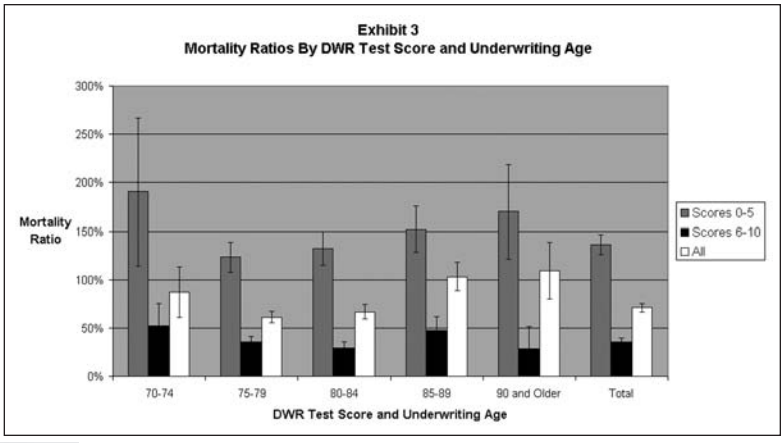


Exhibit 3: Mortality Ratios by DWR Test Score and Underwriting Age



worse than for females for both the better scoring group (ratio of the mortality ratios was 107 percent) and in total (103 percent). The mortality for females was worse than for males for the poorer scoring group (119 percent).

Exhibit 3 to the left shows that at underwriting ages 70 and older, the mortality ratio for the poorer scoring group was between 323 percent (85 to 89) and 593 percent (90 and older) that of the better scoring group.

Exhibit 4 on the next page shows that the mortality ratio for the poorer scoring group was 1261 percent and 250 percent that of the better scoring group for 1995-96 underwriting years and 1997-2003 underwriting years, respectively. The mortality for 1997-2003 underwriting years was worse than for 1995-1996 underwriting years for the following: the poorer scoring group (ratio of the mortality ratios was 181 percent), the better scoring group (911 percent) and in total (265 percent).

Exhibit 5 on the next page shows that the mortality ratio for the poorer scoring group was 387 percent and 343 percent that of the better scoring group for nonsmokers and smokers, respectively. The mortality for smokers was worse than for nonsmokers for the following: the poorer scoring group (ratio of the mortality ratios was 129 percent), the better scoring group (146 percent) and in total (144 percent).

Exhibit 6 on the next page shows that the mortality ratio for the poorer scoring group was 143 percent and 160 percent that of the better scoring group for applicants who were approved and applicants who were declined for cognitive impairment, respectively. The mortality for applicants who were declined for cognitive impairment was worse than for applicants who were approved for the following: the poorer scoring group (ratio of the mortality ratios was 574 percent), the better scoring group (513 percent) and in total (725 percent).

Conclusion

Results for any breakdown of the data that we examined yielded strikingly similar results; the poorer scoring group consistently had more unfavorable mortality outcomes. With the maximum exposure period being slightly over eight years, the mortality effect of a low DWR

test score appears within this relatively short interval.

An important lesson of geriatric medicine is that morbidity and mortality outcomes in the elderly depend more on functional status than clinical diagnosis of disease. Conventional underwriting follows the clinical disease model, measuring risk on the basis of laboratory tests and medical records. To underwrite effectively, the industry needs information on cognitive function.

Medical records alone do not provide this information. Physicians typically misjudge cognitive function. They also neglect to record cognitive status in the record. In one study of office-based care, the record accurately reported only about 20 percent of cases of mild dementia and 80 percent of severe dementia. Overall, the record neglected detection of over 60 percent of dementia cases.[4] Furthermore, dementia is very common. Among adults living independently in the community, at age 85 and up, 40 percent have dementia. At age 75 and up, an additional 15 percent have mild cognitive impairment, an early form of dementia.[5]

Underwriters who depend on the medical record will issue all of those cases and underprice the mortality associated with dementia. To assess risk effectively in the elderly, the industry needs to institute universal screening of cognitive function. Objective testing like DWR gives the underwriter and actuary clinically validated data to identify excess risk.

Further studies on life insurance populations will be needed to accurately pinpoint the relationship of DWR test score to mortality. This mortality study, performed on LTCI applicants, is limited by the difficulties in comparing the underwriting of one product versus another. However, we analyzed the data from many different perspectives and there was a remarkably consistent relationship of mortality improvement at higher DWR test scores. Our mortality study supports other studies suggesting that cognitive impairment is a marker for increased mortality risk.

And as for Nanny, she recalled six out of the 10 words on the DWR Test administered to her. This real world example of something one of the authors had worked on in his job shows the comfort that is attainable with this underwriting technique. And, who better to get some comfort (food) from than a grandmother. ☐

Exhibit 4: Mortality Ratios by DWR Test Score and Underwriting Year

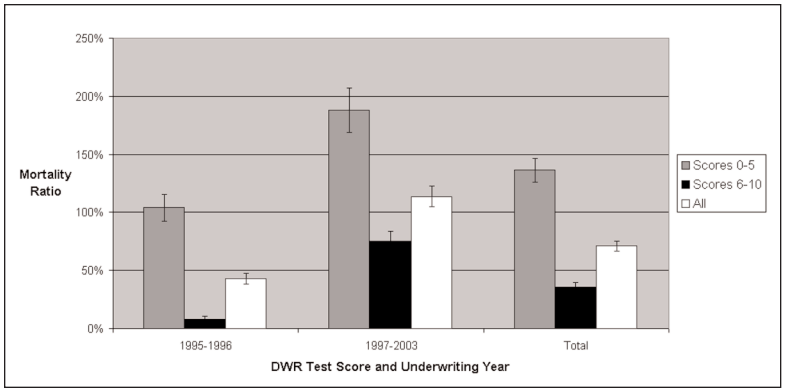


Exhibit 5: Mortality Ratios by DWR Test and Smoker Status

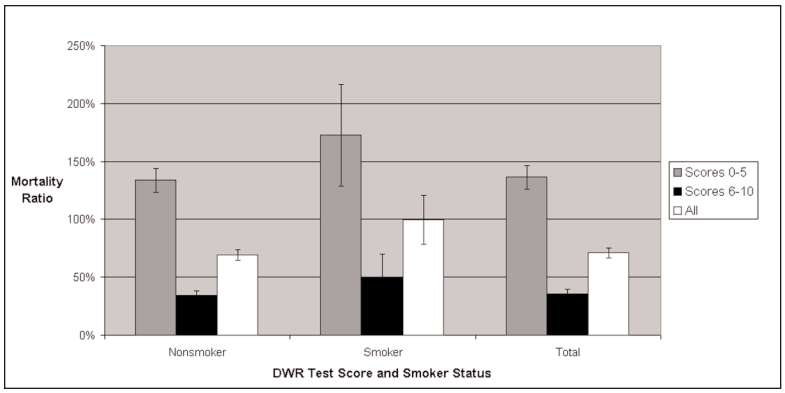
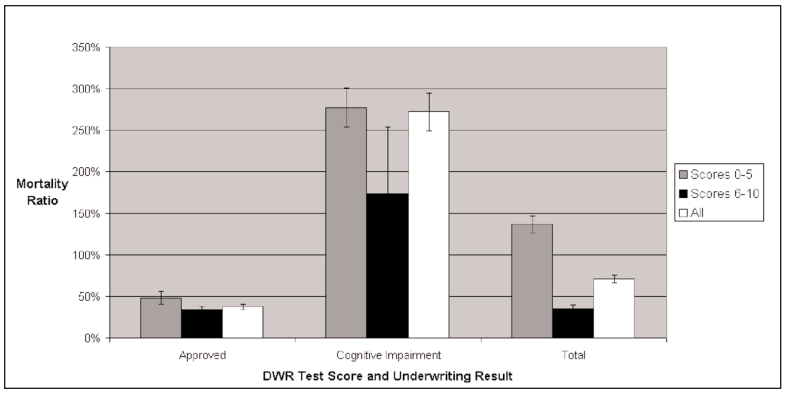


Exhibit 6: Mortality Ratios by DWR Test and Underwriting Result



4 Valcour VG, et al. Arch Intern Med 2000;160:2964-8

5 Neaton JD et al, Arch Intern Med 1992;152:56-64