

# Cognitive Testing for Underwriting Life Insurance

Presentation  
to the  
Mortality Working Group  
of the  
International Actuarial  
Association

Al Klein  
April 8, 2011



## Agenda

- Cognitive function
  - What is it?
  - What causes cognitive impairment?
  - What are the types of dementia?
- Prevalence of cognitive impairment
- Extra mortality associated with cognitive impairment
- Considerations for using cognitive testing (and an older age underwriting program) for life insurance
- Kinds of cognitive testing that can be done
- Components of a full older underwriting program and current state of programs in the US
- Questions

# Categories of Cognitive Function

- Normal
- MCI (Mild Cognitive Impairment)
- Mild Dementia
- Moderate Dementia
- Severe Dementia

3

## What causes cognitive impairment?

- Adrenal deficiencies
- Alcohol/drug addictions
- Cancer
- Depression
- Drug combinations
- Chronic infections
- Endocrine imbalances
- Head traumas
- Heavy metal poisoning
- High blood pressure
- Hyperthyroid
- Major organ failure
- Metabolic disorders
- Neurological traumas
- Parkinson's disease
- Stress
- Stroke
- Toxic reactions
- Vascular disorders
- Vitamin deficiencies

## What are the types of Dementia?

- Alzheimer's
- Vascular Dementia – Caused by poor blood flow to brain
  - Second leading form
- Dementia with Lewy Bodies – Caused by abnormal protein deposits (Lewy bodies) in nerve cells in the brain stem
- Creutzfeldt-Jacob Dementia – Mad cow disease, caused by a virus that interferes with normal brain function
- Normal Pressure Hydrocephalus – Caused by an accumulation of cerebrospinal fluid in the brain cavities
- Huntington's Disease – Inherited and progressive disease that affects cognition, behavior and movement
- Mixed Dementia – Caused by more than one medical condition
- Others

5

## How prevalent is dementia worldwide?

2005 Alzheimer's Disease International (ADI) Estimates of the prevalence of dementia (%)						
By World Health Organization (WHO) region and age group						
WHO Region Description	60-64	65-69	70-74	75-79	80-84	85+
Western Europe	0.9	1.5	3.6	6.0	12.2	24.8
Eastern Europe (B)	0.9	1.3	3.2	5.8	12.2	24.7
Eastern Europe (C)	0.9	1.3	3.2	5.8	11.8	24.5
North America	0.8	1.7	3.3	6.5	12.8	30.1
South America (D)	0.8	1.7	3.4	7.6	14.8	33.2
South America (E)	0.7	1.5	2.8	6.2	11.1	28.1
Middle East	0.9	1.8	3.5	6.6	13.6	25.5
North Africa, Middle East	1.2	1.9	3.9	6.6	13.9	23.5
Japan, Australia, New Zealand	0.6	1.4	2.6	4.7	10.4	22.1
China and neighbors	0.6	1.7	3.7	7.0	14.4	26.2
Indonesia, Sri Lanka, Thailand	1.0	1.7	3.4	5.7	10.8	17.6
India and neighbors	0.4	0.9	1.8	3.7	7.2	14.4
Sub-Saharan Africa (D)	0.3	0.6	1.3	2.3	4.3	9.7
Sub-Saharan Africa (E)	0.5	1.0	1.9	3.8	7.0	14.9

6

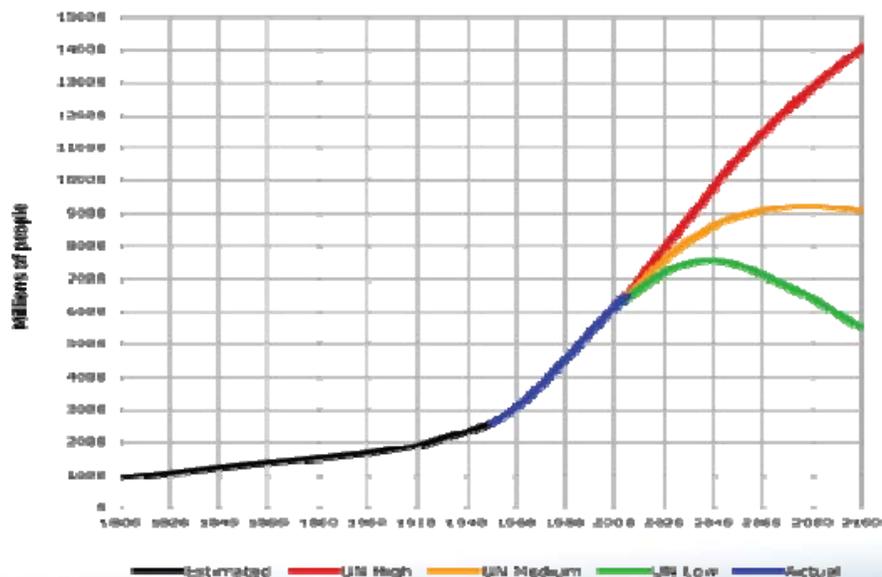
## How prevalent is dementia worldwide? (cont'd)

- Generally more so in developed than developing countries
- Approximately doubles every 5 years (age, not calendar time)
- Has been recent stability, however, predicted to increase in future
  - Canadian study:
    - In 2008, 500K individuals with Alzheimer's Disease
    - In 25 years, expect 1.1M (more than double) to be affected with dementia
    - {Source: Alzheimer's Disease Statistics}
  - Australian study:
    - In 2009, 245K individuals with dementia
    - In 2050, expect more than 1.13M individuals (more than a fourfold increase) to be affected with dementia
    - {Source: The McCusker Alzheimer's Research Foundation}

7

## Worldwide Population Growth

Based on UN 2004 Projections and US Census Bureau Historical Estimates



8

## Extra Mortality from Cognitive Testing

- Recall 5 stages of cognitive function
  - Normal, MCI, Dementia (Mild, Moderate and Severe)
- All of the numbers provided below will vary by age
- People progress through the various stages at different rates
  - Total time from beginning of MCI to death is usually 7-15 years
  - Time in MCI ranges from 5-11 years before dementia
  - Time in various stages of dementia is usually 2-4 years before death
- Extra mortality is about 25% for someone with MCI and double or more for someone with dementia
- Mortality savings from having a cognitive testing program
  - Need to determine savings only from those not caught by other means
  - If you catch just one of these, say for a \$1.2M policy, this would save the company about \$1M (present value of a claim 3 years from now)

9

## Why is having an Older Age Underwriting program for life insurance important?

- Cost savings (just described for cognitive testing)
- Growth in prevalence of cognitive impairment
- More and larger life insurance policies are being written at the older ages
- Sentinel effect
- Avoid anti-selection when other companies have implemented programs

## Goals of Cognitive Function Testing

- Primary goal is have test identify cognitive abilities, good or bad, so applicant can be assigned an appropriate rating
- While some companies are solely concerned with identifying and weeding out those with dementia, it is also important to identify those with early stages of MCI

11

## Choosing a Cognitive Test

- Sensitivity and specificity vary among the tests
  - Sensitivity – Probability that a screening test is positive, given that the subject truly has the disease or impairment
  - Specificity – Probability that a screening test is negative, given that the subject truly does not have the disease or impairment
- All other things being equal (e.g., cost), the higher the sensitivity and specificity the better

12

## Other Considerations in deciding on a Cognitive Test

- What are others doing?
- Intrusiveness of test
- Will the test allow for the distinction of impairment levels?
- Who will perform the test and will it be in person or on the phone?
- Cost of the test
- Understanding of test / Communication
- Reinsurer response

13

## Cognitive Tests

- Clock Draw / Copy
- Delayed Word Recall (DWR)
- Mini Mental Status Examination (MMSE)
- Short Portable Mental Status Questionnaire (SPMSQ)
- Alzheimer's Quick Test
- Correspondence Analysis (CA) Delayed Word Recall
- Minnesota Cognitive Acuity Screen (MCAS)
- Enhanced Mental Skills Tests (EMST)
- Other tests

14

## Limitations

- Many tests are more predictive when looked at over a period of time
  - Declining test scores over time is indicative of a problem
- Actual mortality results not yet available
  - Mortality assumptions developed from clinical studies which may or may not be indicative of results to be expected by insured lives
- Individual company results may vary from the averages

15

## Components of an Older Age Underwriting Program

- Four components to a successful program
  - Cognitive testing
  - Functional testing
  - Supplemental questionnaire
  - Changes to traditional underwriting

16

## Current state of Older Age Underwriting Programs in the US

- Three recent (2010) surveys on older age underwriting practices
  - Milliman and two others
- Slightly less than 50% of respondents had an older age underwriting program according to the other two surveys
  - This was up from previous surveys done by one company
- More than 50% of respondents to Milliman survey had an older age underwriting program
  - Reason for difference could be that Milliman survey was more recently done, but it's more likely that different mix of companies responded to the various surveys

17

## Current state of Older Age Underwriting Programs (cont'd)

- Milliman survey:
  - 32 companies responded, 19 have programs and 13 don't
  - Implementation of these programs ranged from 2001-2010
  - A couple of companies indicated that they have recently revised their programs
  - A number of companies indicated that they plan to implement a program
  - Most common cognitive tests used were DWR and Clock Draw
  - Age testing begins ranged from 55-80, with the most common being 70 or 71

18