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Minnesota Cognitive Acuity Screen (MCAS)

Cognitive screening for
mortality risk assessment

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Cognitive Impairment

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Significant Driver of LTCI Claims Costs

Number one claimed event in LTCI in the USA

- By frequency, by average cost, by duration
- Pure dementia represents ~25% of new claims
- Cognitive impairment accounts for >40% of new claims
- Cognitive impairment underlies more than 50% of ongoing LTCI claims at 24 months
- Average claim duration creeping above 38 months
- Average LTCI expenditure now more than $88,100

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Survival with Dementia

Dementia: a substantial impact on life expectancy

- Survival from diagnosis: range 4-9 years
- Survival Time, women diagnosed at age[1]
  - Age 65 years: 7.5 years
  - Age 70 years: 5.8 years
  - Age 80 years: 4.4 years
  - Age 90 years and older: 3.9 years
- Men approximately 20-25% shorter survival times
- Canadian study – median survival 6.6 unadjusted years
- No apparent prolonged survival effect from cholinesterase inhibitors

[1]Xie, J, et.al., Survival times in people with dementia. British Medical Journal, Online bmj.39433.616678.25, January 2008.

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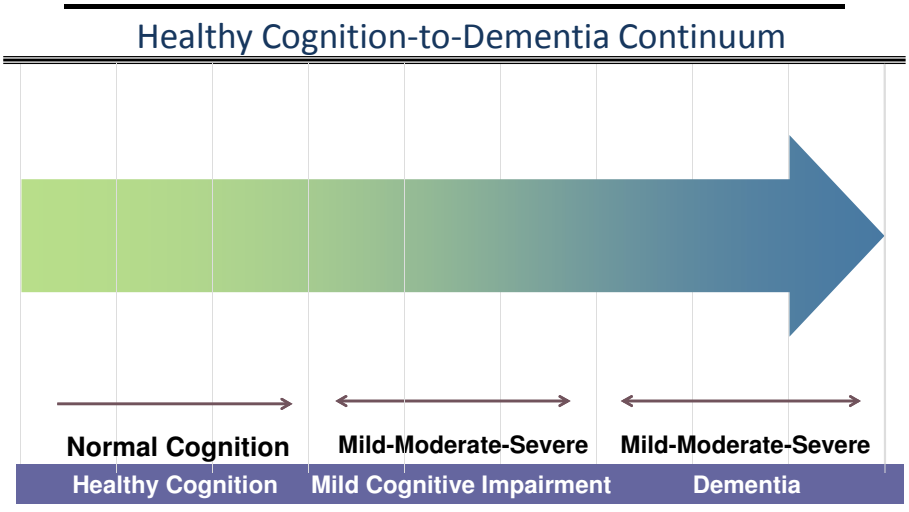
Progression of Disease



Rarely Noted in Medical Records

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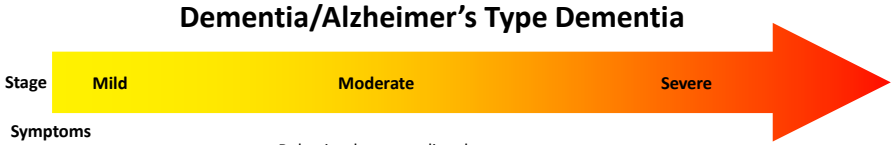
Dementia/Alzheimer's Type Dementia



Symptoms

Mild	Moderate	Severe
Memory loss Language problems Mood swings Personality changes Diminished judgment	Behavioral, personality changes Unable to learn/recall new info Long-term memory affected Wandering, agitation, aggression, confusion Require assistance w/ADL	Gait, incontinence, motor disturbances Unable to perform ADL Bedridden Placement in long-term care facility

Archives of Internal Medicine Study

- 297 outpatients age 65 and older: routine visits
- Internist scores as normal or cognitively impaired
- Researchers performs standard cognitive test
- Data on functional ability obtained from relatives
- 26 of 297 found to have dementia (9%)
- 67% of those with dementia scored as NOT demented by PCPs
- 65% with ADL deficits were NOT documented as impaired in chart

Arch Intern Med 2000;160:2964-2968

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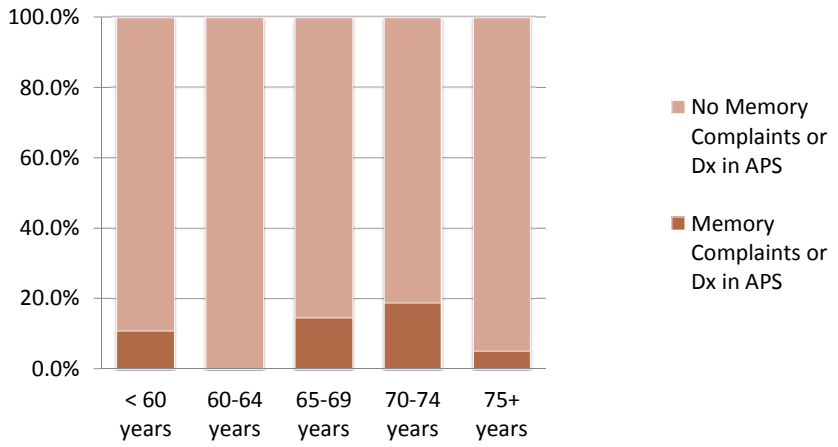
The Underwriting Challenge

Indications of Cognitive Impairment Rarely Noted in Medical Record



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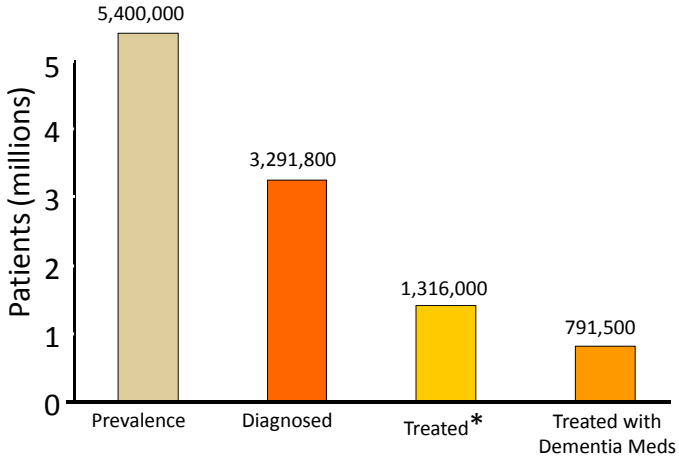
The Underwriting Challenge

Alzheimer's Type Dementia



* Any drug treatment, not limited to acetylcholinesterase inhibitors.

Decision Resources, 2011

Today's Underwriting Challenge

Cognitive Impairment

- Initial signs and symptoms are subtle and insidious
  - Is it normal forgetfulness, MCI or early dementia?
- Long timeline to earliest symptoms
- Family often notice earliest signs of cognitive loss
- Very little clinical screening by physicians
  - Lack of simple effective office screening test
  - Lack of effective therapy for early disease
- Reluctance to record diagnosis in medical record

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Minnesota Cognitive Acuity Screen (MCAS)

10 years of experience with cognitive screening and its impact on mortality

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Minnesota Cognitive Acuity Screen (MCAS)

- A leading cognitive test in the US Insurance market with over 1.1 million test performed to date
  - A simple, non-threatening, telephone or in-person interview designed to detect cognitive impairment in its earliest stages
  - Developed and statistically validated in 1998 in a blinded trial by a team of physicians and scientists
  - Revalidated in University-based blinded trials in 2009, 2010, 2011, 2012 and 2013
  - Research published in peer reviewed *Neuropsychiatry, Neuropsychology and Behavioral Neurology, Journal of Alzheimer and Dementia, On the Risk, Journal of Geriatric Psychiatry and Neurology* and presented at numerous scientific conferences.
  - Published results showing that the MCAS significantly distinguishes the relative mortality risks of individuals applying for insurance[1]

[1]Hauser, P. The Minnesota Cognitive Acuity Screen (MCAS) – Valuable Predictor of Mortality. On the Risk 2010;26(1):54-58.

MCAS

- Designed and developed for use in insurance underwriting and claims
  - Designed to efficiently and reliably provide insurers with accurate, conveniently obtained and cost-effective information in-person or over the phone
  - Identifies mild to moderate cognitive impairment 97.5% sensitivity and 98.5% specificity
  - Identifies those with MCI who are destined to convert to dementia and exhibit functional decline
  - Rigorously scripted, trained and quality controlled; internal checks for “cheating”, no educational or age bias
  - Multiple insurance conversions from other cognitive tests without difficulties over past 13 years

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MCAS Subtests

- The MCAS has validated sensitivity for detecting the earliest types of cognitive changes that would occur in patients who are destined to have Alzheimer’s type dementia or who have mild forms of AD

Subtest	Measures
Orientation	*Short and long term memory*
Attention	*Immediate recall*
Delayed Word Recall	*Short term memory*
Comprehension	*Ability to concentrate and follow directions*
Repetition	*Speech and language skills*
Naming	*Word finding skills*
Computation	*Basic math skills*
Judgment	*Ability to reason and use good judgment*
Verbal Fluency	*Word finding ability and complex thinking*

- Each subtest has been demonstrated to add to the statistical power of the overall screen. The MCAS questions relate to basic orientation, problem solving, memory and reasoning skills.

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MCAS and LTCI

Proven value in LTCI underwriting

5-year retrospective study of a large LTCI carrier >250,000 insureds under age 72 years, more than 3 years post underwriting

- Majority of MCAS testing via phone history interview
- Based upon age and specific triggers to the MCAS
- Less than 1 in 10,000 initial cognitive claims
  - Less than 0.008% prevalence
  - Population-based prevalence estimated between 1.1 – 3.0%*
- MCAS False Negative Rate of 1 per 13,000 administrations

"The MCAS shows improved expected profitability compared to any other cognitive screen on the basis of claims savings and increased premiums alone (i.e. ignoring expense savings)" *Milliman USA*

* Report to the Secretary of Health and Human Services: Alzheimer's Disease, Estimates of Prevalence in the United States. 2010

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The Minnesota Cognitive Acuity Screen (MCAS) and Mortality

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MCAS Mortality Research

LTCG Mortality Study

- The purpose of study: to examine mortality of MCAS test recipients to determine whether MCAS scores are predictive of mortality outcomes.
- Understand the protective value of Cognitive Testing in life insurance underwriting.

Study Design

- 10 years of MCAS testing, over 575,000 tests
- Match to Social Security Master Death Files (SSMDF)
- Analyze MCAS impact on Mortality (Mortality Ratios)

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Mortality Data

- For each MCAS test subject, studied the probability of death from the test date to the earlier of:
  - Death
  - End of study period
  - Subsequent test
  - 38,467 deaths between 1999-2011
- Applicants matched against Social Security Death Master File (SSDMF) to identify deaths
- Subjects without a matching record in the SSDMF were assumed to live until the end of the study (June 2011)

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Characteristics of Test Population

	Exposure Years (%)	Deaths (%)
Total	2,375,482 (100)	38,297 (100)
Gender		
Male	955,968 (40)	19,084 (50)
Female	1,419,513 (60)	19,213 (50)
Age at Test		
<60	445,855 (19)	1,568 (4)
60-64	396,208 (17)	2,927 (8)
65-69	581,019 (24)	5,990 (16)
70-74	468,806 (20)	8,215 (21)
75+	483,594 (20)	19,597 (51)

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Characteristics of Test Population

Duration	Exposure Years (%)	Deaths (%)
1	529,036 (22)	3,059 (8)
2	444,504 (19)	4,223 (11)
3	372,849 (16)	4,722 (12)
4	301,998 (13)	4,918 (13)
5	225,963 (10)	4,771 (12)
6	165,005 (7)	4,421 (12)
7	127,667 (5)	3,996 (10)
8	89,895 (4)	3,169 (8)
9	59,697 (3)	2,356 (6)
10	36,977 (2)	1,506 (4)

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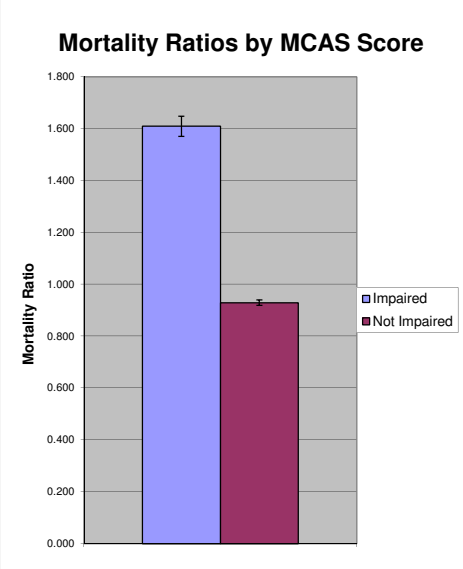
Study Methodology

- Calculated an expected number of deaths based on the gender, age at testing and duration since testing of each subject and the 2008 Valuation Basic Table (smoking unknown, select and ultimate, age last birthday)
- Compared actual deaths to expected deaths to generate mortality ratios.
- Analyzed the relative mortality ratios of various subpopulations.

Mortality Study Results

- 95% of exposure in study is "Not Impaired" = MCAS score > 0.0
- Impaired: Significantly worse mortality than expected
- Not Impaired: Slightly better mortality than expected
- 95% confidence intervals are relatively narrow due to large number of deaths included in study



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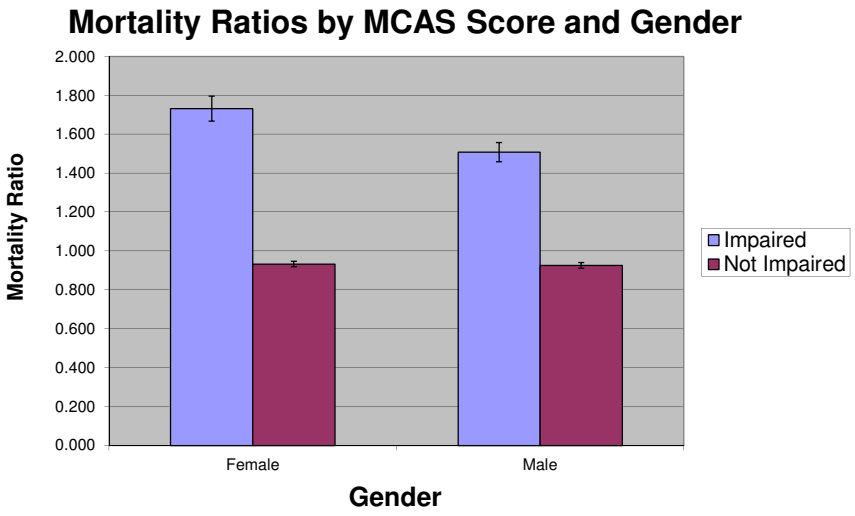
Results by Gender



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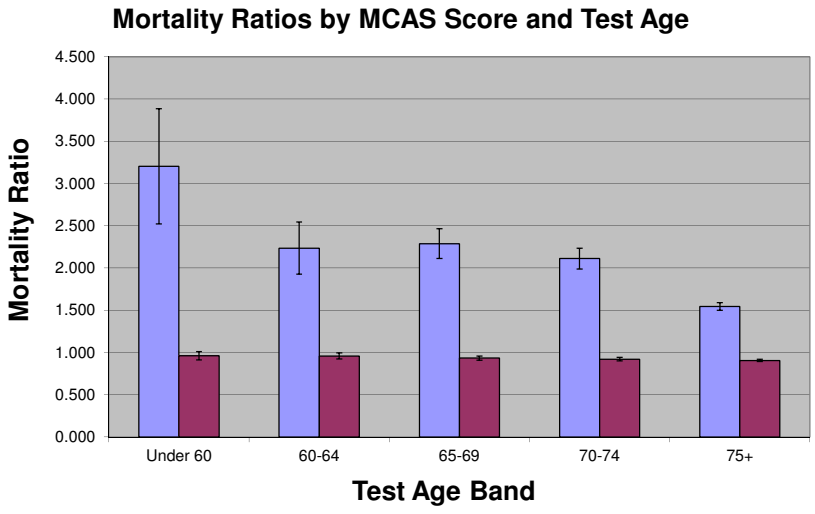
Mortality Results by Age



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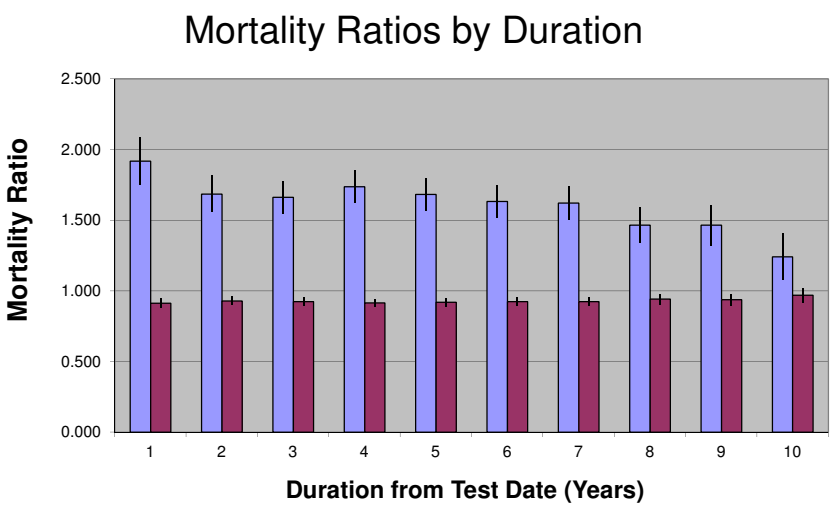
Mortality Results by Duration



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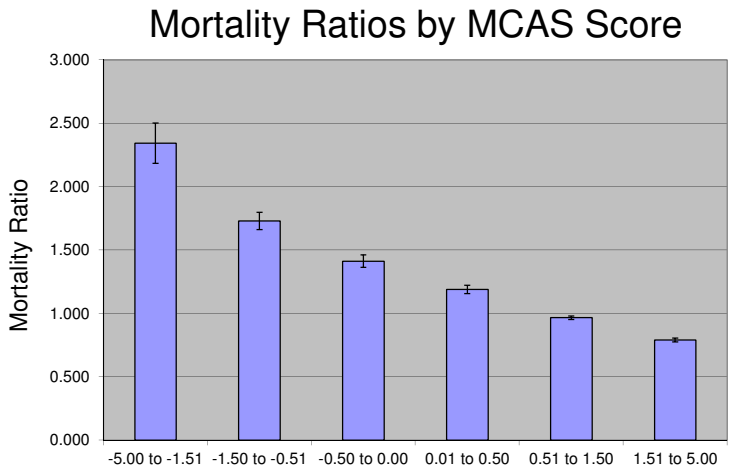
Mortality Results by MCAS Score



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Study Results and Conclusions

- MCAS test scores are useful in stratifying relative mortality risk of applicants.
- Relative mortality is:
  - Significantly worse than expected for Impaired lives
  - Slightly better than expected for Non-Impaired lives
- Mortality differentials exist by:
  - Age and gender
  - Duration - differentials wear off slightly by duration from test date but persist to later durations
- Finer gradations may be useful for life underwriting (ratings) versus LTCI "Impaired" versus "Non-Impaired"

Protective Value

- Value of Cognitive Screening is positive if:
  - Cost of the test < Mortality savings
- Mortality savings = Excess mortality * Insurance amount * Prevalence * Sensitivity * Exclusivity factor, where
  - Excess mortality = present value of excess death benefits per $1,000 of face amount
  - Insurance amount = death benefit amount in $1,000s
  - Prevalence = impairment prevalence of the population applying for insurance
  - Sensitivity = how good the test is at finding impaired risks
  - Exclusivity factor = how often is this test the only means to uncover or illuminate an impairment that would cause the underwriter to rate up or decline the application

Demonstration consistent with Bergstrom and Freitas, "A Protective Value Study of the MIB Inquiry Service" *On the Risk, Journal of the Academy of Life Underwriting* (March 2000); 16(1), 32-37.

Protective Value

Sample Model: 10 Year NPV for male age 67

- PV(Impaired death benefits) = $150.34 per $1000 of face amount
- PV(Not Impaired death benefits) = $73.88 per $1000 of face amount
- Impaired prevalence = 3.76%
- Sensitivity = 97.5%
- Exclusivity unknown = z

Demonstration consistent with Bergstrom and Freitas, "A Protective Value Study of the MIB Inquiry Service" *On the Risk, Journal of the Academy of Life Underwriting* (March 2000); 16(1), 32-37.

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Protective Value

- For $500,000 face amount
  - PV(mortality savings) = ($150.34 - $73.88) * $500 * 3.76% * 97.5% * z
  - Where z is the exclusivity factor
  - If cost = $40, z > 2.89% implies positive protective value
- Exclusivity must be higher for smaller face amounts and younger ages (and is smaller for larger face amounts and older ages)
- Studied all cause mortality, therefore exclusivity must be measured relative to all underwriting information, not only information about cognitive impairments

Minimum Exclusivity Requirements

	Face Amount		
Test Age	$250k	$500k	$1 million
57	24.9%	12.5%	6.2%
62	15.3%	7.7%	3.8%
67	5.9%	2.9%	1.5%
72	2.7%	1.4%	0.7%
77	1.6%	0.8%	0.4%

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Additional Results and Conclusions

- MCAS test results likely have positive protective value for high face amounts and older ages
- Age-specific prevalence rates of dementia and insurance amount must be considered
- Exclusivity of the MCAS must be high because other sources of data to identify early cognitive impairment are often lacking
- Another reminder that cognitive impairment impacts life expectancy

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Older Age Underwriting

Why is a cognitive testing critical for older age underwriting important?

- A major risk factor for premature mortality
- Growth in prevalence of cognitive impairment as age increases
- Little information available in medical records
- More and larger life insurance policies are being written at the older ages
- Asymmetrical information, biomarkers, genetics
- Important to protect against anti-selection when other companies have implemented programs (Sentinel effect)
- Don't forget about frailty, function, etc.

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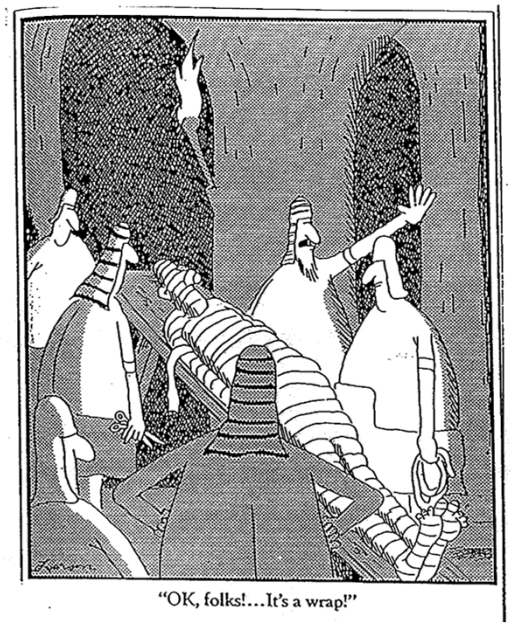

"OK, folks!…It's a wrap!"

Questions and Discussion

www.LTCG.com