AFIR/ERM – PBSS – LIFE Colloquium

Lyon, France
June 24-26, 2013

The Future of Mortality

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Milliman

My background

- I am an actuary, not a doctor
- As an actuary and an individual, I am interested in finding ways to live longer
- I am curious and seek answers, even if they may differ from traditional thinking

2

Future of Mortality agenda

- Begin by providing:
  - Sources of data and current techniques
  - Mortality improvement assumptions from two sources
- Suggest other considerations for predicting mortality
  - The basics
  - Some new ideas
- Discuss current situation that will impact future mortality
  - The bad – what is going wrong today?
  - The good – what do we know today that will improve mortality in the future and what may happen in the future?
- Provide conclusion and summary

3

Goals of presentation

- Quickly provide sources of data and techniques used today
  - Probably heard of many, can research new ones
- Primary focus of presentation will be to:
  - Provide ideas for better predicting future mortality, with a concentration on things that are happening today that will likely impact future mortality as well as what may happen in the future
  - Provide current scientific knowledge
- At the end of the presentation, if you are not better at predicting future mortality, my hope is that you will have at least learned how to live longer and healthier!

4

Sources of mortality data

- Centers for Disease Control and Prevention
  - US life tables
  - *www.**cdc**.gov/nchs/products/**life_tables***
- Social Security
  - US population life tables and projections
  - www.socialsecurity.gov/OACT/STATS/index.html
- Society of Actuaries Table Manager
  - Life and population data from 40 countries
  - www.soa.org
- World Health Organization
  - Civil registration systems from 130 countries
  - www.who.int/en/
- Continuous Mortality Investigations Library
  - UK life, annuity, pension, income protection, critical illness
  - www.actuaries.org.uk/mortality
- Human Mortality Database
  - Population data from 37 countries
  - www.mortality.org
- Human Life-Table Database
  - Population life tables from 67 countries
  - www.lifetable.de

5

Sources of mortality data (cont'd)

- Population
  - Australia – Bureau of Statistics Australia
  - Canada – Statistics Canada
  - France – National Institute of Statistics and Economic Studies
  - Italy – National Statistics Institute
  - UK – Office of National Statistics
- Insured
  - Australia – Institute of Actuaries Australia
  - Austria – Actuarial Association of Austria
  - Germany – German Institute of Actuaries
  - India – Indian Institute of Actuaries

6

Techniques for projecting future mortality

- Cairns-Blake-Dowd
- Currie Age-Period Cohort
- Delphi study
- Environmental scanning
- GLM (Generalized linear models)
- Gompertz
- Heat map – Thank you to Aon Hewitt for slide 12
- Heligman-Pollard
- Hunt-Blake
- Lee-Carter – Japan, Italy, Sweden, US
- Lorenz Curve and Gini Index
- Makeham - Sweden
- Perks/Kannisto
- Poisson log-bilenear - Slovenia
- P-Spline
- Renshaw-Haberman
- Weibull

7

Two recent studies on mortality improvement assumptions from the Society of Actuaries

- Slide 11 is from the report entitled: "Report of the Society of Actuaries Mortality Improvement Survey Subcommittee" by the Mortality and Underwriting Survey Committee, March 2012
  - Separate reports for annuities and life insurance
  - Another report on reinsurer assumptions, not used here
  - Life: http://www.soa.org/Research/Experience-Study/Bus-Practice-Surveys/research-mort-imp-life-direct.aspx
  - Annuities: http://www.soa.org/Research/Experience-Study/Bus-Practice-Surveys/research-mort-annuity-survey.aspx
- Slide 12 is from the report entitled: "Global Mortality Improvement Experience and Projection Techniques" by Towers Watson, June 2011
  - http://www.soa.org/research/research-projects/life-insurance/research-global-mortality-improve.aspx
- Please refer to original sources for full understanding of results

8

Mortality improvement assumptions

Mortality Improvement Survey - March 2012, Percentage Improvement

Annuity - Male Age 65				**Annuity - Female Age 65**			
Canada	Duration			**Canada**	Duration		
9 co.	1	11	21	9 co.	1	11	21
Minimum	1.00	1.00	0.70	Minimum	0.50	0.12	0.50
Mean	1.54	1.37	0.94	Mean	0.95	0.78	0.77
Maximum	2.19	2.10	1.05	Maximum	1.50	1.30	0.94
US	Duration			**US**	Duration		
39 co.	1	11	21	39 co.	1	11	21
Minimum	0.50	0.00	0.00	Minimum	0.25	0.00	0.00
Mean	1.35	1.17	0.83	Mean	0.93	0.81	0.64
Maximum	2.10	2.10	1.75	Maximum	1.75	1.75	1.56
Life - Male Prfd NT Age 65				**Life - Female Prfd NT Age 65**			
Canada	Duration			**Canada**	Duration		
14 co.	1	11	21	14 co.	1	11	21
Minimum	0.00	0.00	0.00	Minimum	0.00	0.00	0.00
Mean	1.08	0.76	0.25	Mean	0.90	0.76	0.25
Maximum	2.50	1.50	1.00	Maximum	2.00	1.50	1.00
US	Duration			**US**	Duration		
70 co.	1	11	21	70 co.	1	11	21
Minimum	0.00	0.00	-0.40	Minimum	0.00	0.00	-0.40
Mean	0.78	0.68	0.20	Mean	0.57	0.47	0.15
Maximum	1.50	1.50	1.10	Maximum	1.50	1.00	1.00

9

Mort. improvement assumptions and projections

Global Mortality Improvement - June 2011, % Improvement

Estimate from Human Mort Database 2000-2007, **Ages 65-85**				
	Male		**Female**	
Australia	1.70		1.60	
Canada	1.70		1.40	
UK	1.80		1.60	
US	1.50		1.40	
Estimate from Human Mort Database 2000-2007, **Ages 65-74**				
	Male		**Female**	
Australia	4.70		3.10	
Canada	3.00		1.20	
Hungary	2.50		2.00	
Israel	3.20	(2000-2008)	3.60	(2000-2008)
UK	3.60	(2000-2009)	3.00	(2000-2009)
US	2.50		2.00	
Best Estimate of US Mort Improvement 2011-2025, **Ages 65-74**				
	Male		**Female**	
US population	1.50		1.00	
Individual Life NS	2.00		1.50	
Individual Annuity	1.50		1.00	

10

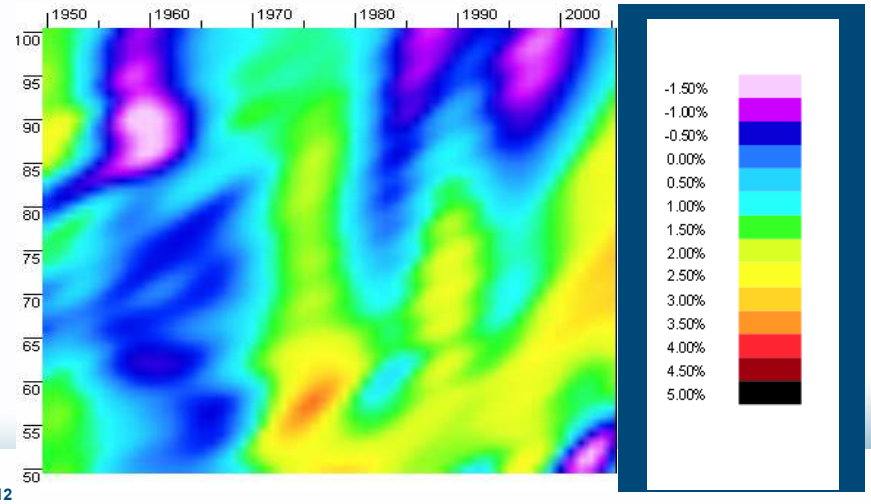
Considerations for predicting future mortality (Traditional)

- Population vs. insurance
- Relevance and credibility of source of data
- Generational vs. durational improvement
- Differences by age, gender, and other factors
- Projection techniques
  - Actuarial
  - Extrapolation
  - Predictive modeling
  - Relational
  - Cause-specific
  - Disease-specific

11

Current mortality projection techniques

- Improvements, based on SSA male mortality rates
  - Ages 50 – 100; calendar years 1950 – 2005



12

Mortality improvement considerations (Non-traditional)

- Building a forward-looking model
- What caused past mortality improvements?
  - Have they already been reflected or will they continue into the future?
- Examples of past improvements in mortality:
  - Reduction in smoking
  - Decreases in deaths at birth
  - Safety improvements (e.g., reduction in speed limit)
- What future mortality improvements can we expect?
- Example of future mortality improvement – Medical advances
  - How long will it take for the improvements to become effective?
  - Will everyone benefit or only a segment of the population?
  - Will those who can benefit learn about it and can they afford it?
- Demographic considerations

13

England and Wales

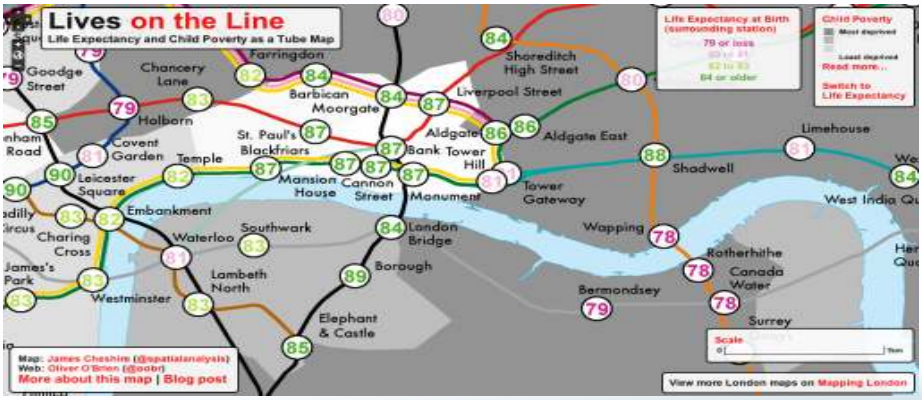
Pensioner mortality by postcode:
Red have more than double the mortality of blue

Source: Postcode mortality tool,
http://www.towerswatson.com/assets/pdf/4959/TW-EU-2011-21346.pdf

14

London Tube Map

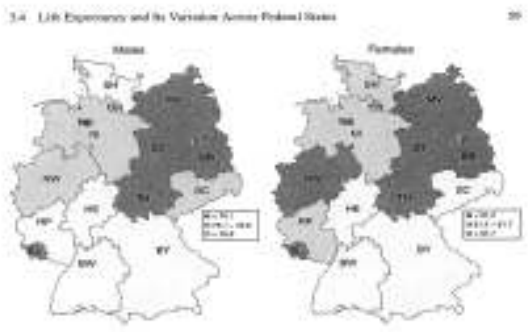
Life expectancy at birth and child poverty. Map by James Cheshire, University College London, June 2012.



- Source: Lives on the Line, http://www.bbc.co.uk/news/uk-england-london-18917932

Germany

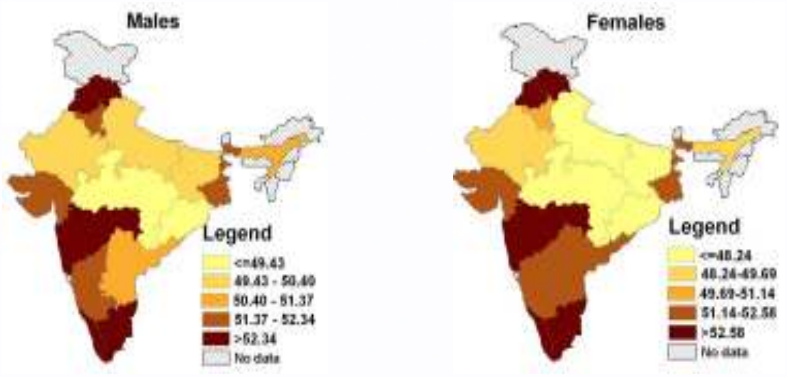
Life expectancy by federal state, 2004-2006



Source: *Regional Mortality Differences in Germany*, Mortality Differentials Across Germany's Federal States, http://www.demogr.mpg.de/books/drm/010/3.pdf

India

Age 0-60 life expectancy by state, 2000-2004

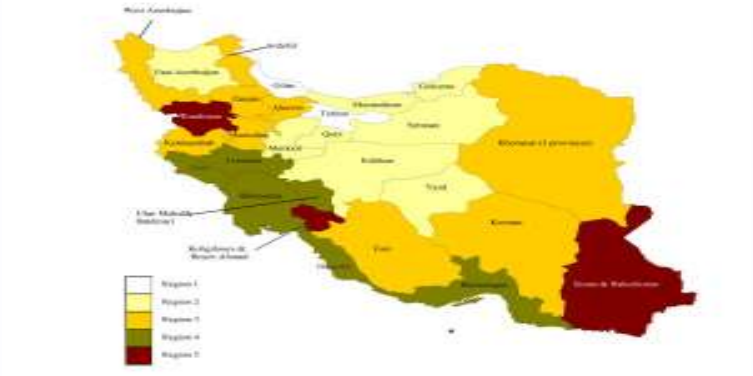


Source: *Trends in Geographical Mortality Differentials in India*, http://www.demogr.mpg.de/papers/working/wp-2009-013.pdf

17

Iran

Region 1 provinces have lowest fertility and mortality and Region 5 have highest

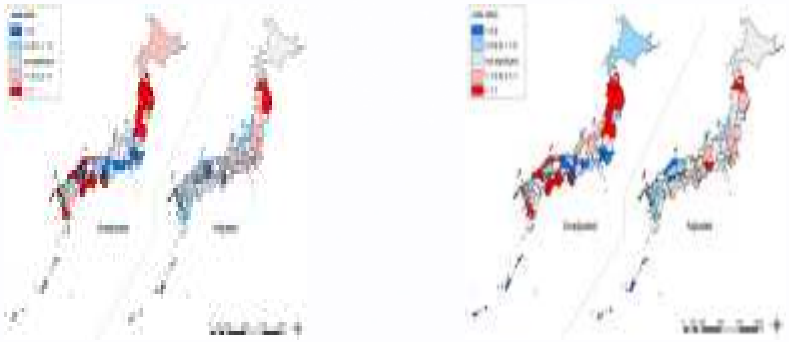


Source: *Differential Mortality in Iran*, http://www.pophealthmetrics.com/content/5/1/7

18

Japan

Unadjusted and age-adjusted all-cause mortality across 47 prefectures, 2005

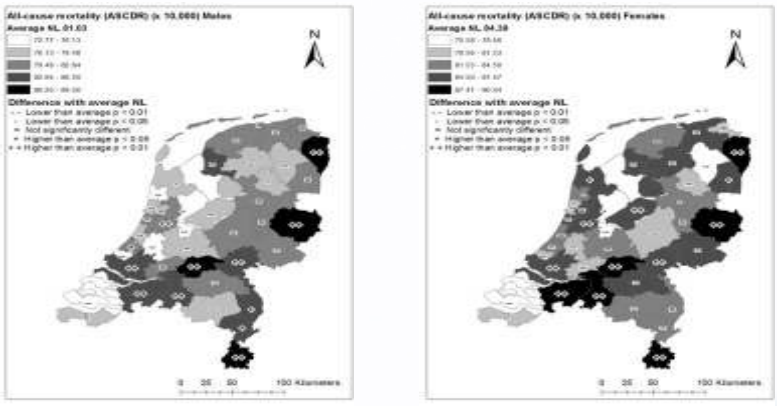


Source: *Geographic Inequalities in All-Cause Mortality in Japan: Compositional or Contextual?*, http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0039876

19

Netherlands

Age-standardized all-cause mortality rates by region, 2004-2008

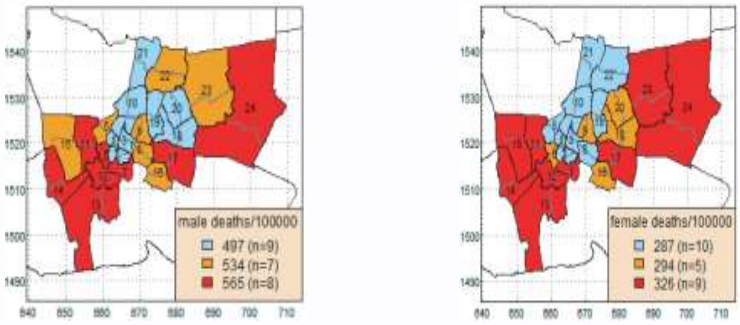


Source: *The Contribution of Smoking to Regional Mortality Differences in the Netherlands*, http://www.demographic-research.org/volumes/vol27/9/27-9.pdf

20

Thailand

All-cause mortality for ages less than 85, 1999-2001

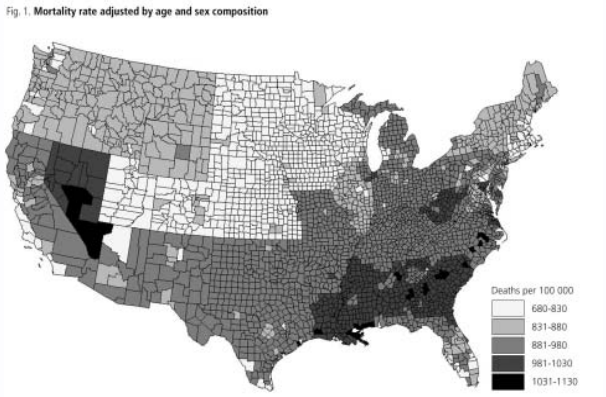


Source: *Geographical Variations in All Cause Mortality in Thailand*, Figure 2, http://www.tm.mahidol.ac.th/seameo/2010-41-5/22-4745.pdf

21

United States

Age- and sex-adjusted mortality rates, 1990-1992



Source: *Death rate variation in US subpopulations*, http://www.scielosp.org/pdf/bwho/v80n1/v80n1a04.pdf

22

United States

Change in life expectancy between two counties in Florida

Chicago Tribune, March 29,2013

23

Increasing mortality

- US Women
  - "A new study offers more compelling evidence that life expectancy for some U.S. women is actually falling, a disturbing trend that experts can't explain. The latest research found that women age 75 and younger are dying at higher rates than previous years in nearly half of the nations counties—many of them rural and in the South and West. Curiously, for men, life expectancy has held steady or improved in nearly all counties… The phenomenon of some women losing ground appears to have begun in the late 1980s, though studies have begun to spotlight it only in the last few years… The study, released Monday by the journal *Health Affairs*, found declining life expectancy for women in about 43 percent of the nation's counties… found that nationwide, the rate of women dying younger than would be expected fell from 324 to 318 deaths per 100,000. But in 1,344 counties, the average premature death rate rose, from 317 to about 333 per 100,000. Death rates rose for men in only about 100 counties."
    - *Fox News / Associated Press*, March 5, 2013

24

The future – Mortality deterioration

- The basics
  - Natural disaster
  - War
  - Terrorist attack
  - Pandemic, epidemic
  - Obesity, diabetes
- Some new ideas
  - Availability and affordability of medical care
  - Exposure to chemicals and hormones
  - More

25

Exposure to chemicals and hormones

- Drinks
  - "Toxic metal stays in water – A cancer causing substance, found at levels much higher than a California health standard, slips past city's treatment system"
    - *Chicago Tribune*, August 7, 2011
  - "Higher lead levels found in city water – US EPA sampling casts doubt on test methods that have consistently put Chicago in the clear"
    - *Chicago Tribune*, January 31, 2012
  - "Why You May Be Drinking Soda That Contains a Dangerous Flame Retardant Banned in Europe and Japan"
    - *Environmental Health News*, January 2, 2012
  - "Arsenic in your juice – How much is too much? Federal limits don't exist"
    - *Consumer Reports*, January 2012

26

Exposures to chemicals and hormones (cont'd)

- Early puberty
  - "Almost one-quarter of African-American girls have reached a stage of breast development marking the onset of puberty by age 7, as have almost 15% of Hispanic girls and more than 10% of white girls. These percentages are significantly higher than in 1997, when a landmark study first reported that girls were beginning puberty much younger than they had in the mid-20th century. There are numerous potential explanations. Chief among them is the increase in average weight among children. Factors may include a Western diet that is increasingly high in sugar and fat, declining physical activity rates in children and exposure to chemicals in the environment that act on hormones called endocrine disruptors. Kids today are exposed to plastic much more than they were 10 or 20 years ago. Early maturation in a large population of girls may also affect future breast cancer rates."
    - *Chicago Tribune*, August 9, 2010

27

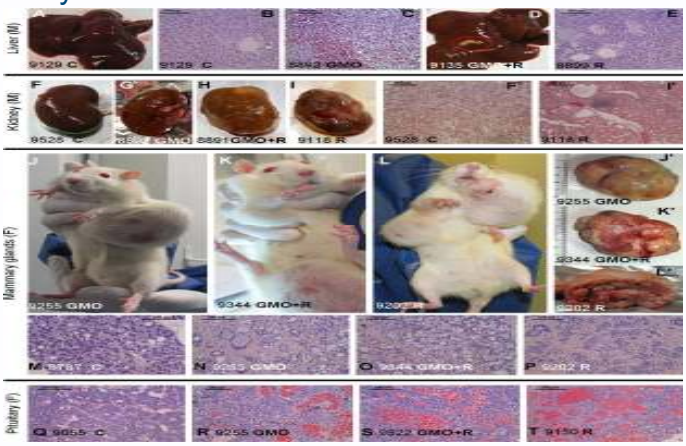
Exposure to chemicals

- Parkinson's
  - Parkinson's Alley – Recent studies have found statistical links between pesticide use and an outbreak of Parkinson's disease in California farm towns. Researchers even know which chemicals are the likely culprits. What's the government doing about it? Not much.
    - *Sierra*, January/February 2012

28

Exposure to chemicals (cont'd)

- Genetically modified corn



- Séralini, G.-E., et al. Long-term Toxicity of a Roundup Herbicide and a Roundup-tolerant Genetically Modified Maize. *Food and Chemical Toxicology*, 2012, http://dx.doi.org/10.1016/j.fct.2012.08.005

29

Obesity

- Example 1
  - "The decrease in children's regular physical activity, combined with an abundance of fast, cheap, super-sized high-calorie foods, has created an obesity epidemic and raised the incidence of additional risk factors for heart disease—high blood pressure, high cholesterol and diabetes—even before they reach adulthood. In fact, ailments that were once diagnosed only in adults are now showing up in adolescents and older teens."
    - *www.time.com/adsections*, Weighing America's Future

30

Obesity (cont'd)

- Example 2
  - "Experts in the food industry have found additional, sneakier ways to increase what they call the 'craveability' of food products. They've learned how to combine ingredients, including chemical enhancers (such as artificial sweeteners, hickory smoke flavor and cheese flavorings) to create a complex series of flavors and textures that magnify the sensory appeal. As soon as that fleeting taste and oral stimulation fade, you reach for more. Can't a person use willpower to resist such foods? Not necessarily. What's really happening is that their brain circuitry has been 'hijacked'."
    - *Bottom Line Health*, November 2009

31

Statins

- Example 1
  - "The lipid hypothesis—the consumption of saturated fat causes heart disease. This infamous hypothesis was proposed by Ancel Keys in 1953 based on statistics of consumption of saturated fat in six countries. Keys neglected to disclose that he had selected six countries out of a total of 22 whose data were available to him. His misuse of the data was exposed by Yerushalmy and Hilleboe in 1957 when they published the graph of the full data set. When the full data is used, the biological gradient disappears—as does the strength of the association. The lipid hypothesis was consequently modified so the dietary cholesterol became the villain instead of saturated fat. Many years of research followed but Ancel Keys finally admitted in 1997 that 'There's no connection whatsoever between cholesterol in food and cholesterol in blood. And we've known all along. Cholesterol in the diet doesn't matter unless you happen to be a chicken or rabbit.' … In fact, many people with heart disease have low levels of cholesterol. In the January 2009 edition of *American Heart Journal* it was reported that, of the 136,905 people admitted to 541 hospitals in the United States with heart attack whose lipid levels were recorded, nearly 75% had 'normal' LDL cholesterol levels, which is below 130 mg/dl… What is the use of being saved from heart disease only to die from some other cause? Even worse, higher cholesterol levels appear to be protective against cancer in the longer term and statins have significant and probably under-reported side-effects… I will continue to enjoy a full English breakfast, shorn of the guilt that this may affect the health of my heart. At my age (50+), and free of heart disease with a cholesterol level higher than the recommended level, I am quite happy not to increase the five-year probability of avoiding a heart attack from 98.2% to 98.8% by taking a statin for five years. The probability that I will avoid the nasty side effects is 100%."
    - Heart of the Matter by Garth Lane, *The Actuary* (UK), August 2011

32

Statins

- Example 2
  - "Statin use increases the risk of diabetes in some women by almost 80 percent! Data was analyzed from the Women's Health Institute, a long-term survey of more than 153,000 postmenopausal women aged 50-79 years… The drugs being taken included all the big ones: simvastatin (Zocor), lovastatin (Altocor, Altoprev, Mevacor), pravastatin (Pravachol), fluvastatin (Lescol), and atorvastatin (Lipitor). Overall, the risk of diabetes associated with statin therapy was an astonishing 48 percent! The biggest jumps were seen in white (49 percent), Hispanic (57 percent), and Asian women (78 percent). Those numbers are shocking. But here's an even bigger stunner: The study found that women with the lowest body mass index had a higher risk of diabetes compared with obese women… It is not understood exactly how statin drugs cause diabetes. Based on the research, they may alter glucose metabolism of the liver or muscles… previous studies have also shown that statin use also increases the risk of diabetes in men… the mainstream media hyped up the 2008 Jupiter trial involving statin drugs, praising the ability of the statin drug known as rouvastatin (Crestor) to reduce the risk for heart attack and stroke in people who had normal cholesterol and high levels of C-reactive protein. (Never mind that, in reality, only one person out of 120 actually would benefit from the drug.)"
    - *Health Revelations,* 2012

33

Statins

- Example 3

Cholesterol Group	N	Exp_Yrs Sum	Deaths Sum	2001 VBT Expected	Deaths/ 2001 VBT A/E	Standardized A/E	Cox HR
059-140	987	13,385	156	58.4	267%	155%	155%
141-160	1,836	25,515	281	148.0	190%	110%	113%
161-180	2,675	36,256	518	248.6	208%	121%	120%
181-200	3,171	42,873	686	397.7	172%	100%	100%
201-220	2,884	38,366	750	451.3	166%	96%	95%
221-250	3,158	40,813	979	573.3	171%	99%	96%
251-275	1,288	16,360	452	256.3	176%	102%	99%
276-300	659	8,309	254	142.4	178%	103%	101%
301-325	248	3,038	95	52.1	182%	106%	103%
326-UP	188	2,286	86	37.5	229%	133%	130%

- The Similarities Between Life Table Analysis and Multivariate Cox Models by Doug Ingle, *On the Risk*, March 2013

34

Infections

- **Carbapenem-resistant enterobacteriaceae (CRE) Infection**
  - "CRE infections are most commonly seen in people with exposure to healthcare settings like hospitals and long-term care facilities, such as skilled nursing facilities, and long-term acute care hospitals. In healthcare settings, CRE infections occur among sick patients who are receiving treatment for other conditions. Patients whose care requires devices like ventilators (breathing machines), urinary (bladder) catheters, or intravenous (vein) catheters, and patients who are taking long courses of certain antibiotics are among those at risk for CRE infections. Some CRE bacteria have become resistant to almost all available antibiotics and can be deadly—one report cites they can contribute to death in up to 50% of patients who become infected."
    - *Centers for Disease Control and Prevention*, March 5, 2013

35

Mis-information that could lead to death

- Liver drug
  - "You might be surprised to know that the leading cause of **acute liver failure** in the United States is not *alcohol* abuse nor *viral* hepatitis. The number one reason Americans suffer acute **liver** failure is a **drug** the **FDA** has allowed to be sold for decades *after* its lethal toxicities were known. Acetaminophen's deadly effects extend beyond the liver. Regular users of acetaminophen may double their risk of *kidney cancer*."
    - *Life Extension*, July 2010
- Folic acid
  - "Recently accumulating research has found that supplemental folic acid may actually accelerate cognitive decline in some older individuals. It's also being linked to increased risk of colon and rectal cancers, increased risk of childhood asthma born to folic-acid supplemented mothers, and accelerated growth of pre-existing cancers. Unfortunately, not only journalists, but even medical professionals haven't figured out that folic acid is not the same as the naturally occurring vitamin folate."
    - *Nutrition & Healing*, June 2010

36

Mis-information that could lead to death (cont'd)

- Sunscreen
  - "Stop using sunscreen and here's another reason… It was found to have high levels of harmful chemicals, like the carcinogen oxybenzone – which causes cancer during light exposure."
    - *Retirement Millionaire*, August 2010
- Prostate cancer drugs
  - "…having an enlarged prostate, a condition known as benign prostatic hyperplasia (BPH), is so common that there are currently millions of men taking prescription drugs to treat the problem… Unfortunately, it turns out that those millions of men may be unknowingly trading their bothersome prostate symptoms for something much, much worse. Shockingly, research has now revealed that BPH drugs increase your risk of developing an aggressive form of prostate cancer!... These medications include Proscar (finasteride), Avodart (dutasteride), and Jalyn (dutasteride and tamsulosin). This warning also extends to the popular medication Propecia used for male pattern hair loss."
    - *Health Revelations*, March 2013

37

Natural disasters

- Example 1 – BP Gulf Oil disaster
  - "A new chemical dispersant is being used in the cleanup effort [editor: BP Gulf disaster] – it's toxic, it's largely experimental, and it's being sprayed in abundance in the ocean. It's unclear at this point what exactly its long-term impact on life [is]. The active ingredient of the toxic chemical dispersant is a neurotoxin pesticide that is acutely toxic to both human and aquatic life, causes cancer, causes damage to internal organs such as the liver and kidneys simply by absorbing through the skin and may cause reproductive side effects. The main ingredient of Corexit is 2-Butoxyethanol, which is known to cause cancer and birth defects and has been found to cause genetic mutations and is a delayed chronic health hazard as well as an environmental hazardous material. Corexit also contains Arsenic, Cadmium, Chromium, Mercury, and Cyanide."
    - http://preventdisease.com/news/10/070110_airborne_measures.shtml

38

Natural disasters (cont'd)

- Example 2 – Climate change
  - "More American children are getting asthma and allergies, and more seniors are suffering heat stroke. Food and utility prices are rising. Flooding is overrunning bridges, swamping subways and closing airport runways. People are losing jobs in drought-related factory closings. Cataclysmic storms are wiping out sprawling neighborhoods. Towns are sinking… these scenes are already playing out somewhere in the United States, and they're expected to get worse in the years ahead… So wet regions will be wetter, causing flash flooding. Dry ones will get drier, resulting in drought. Heat, of course, is another consequence. So a heat wave that used to occur once every 100 years now happens every five years… While Norfolk is second only to New Orleans for sea-level rise, partly because its land is naturally sinking, other coastal US cities – Boston; Charleston, SC; Miami; New York; Seattle; San Francisco; Tampa – are vulnerable too."
    - *USA Today Weekend*, March 1-3, 2013

39

Natural disasters (cont'd)

- Example 3 – Volcano under Yellowstone
  - "A super volcano is the most destructive force on this planet… Not all super volcanoes have been found, but one of the largest is in Yellowstone Park, USA. Scientists searching for the caldera in the park could not see it because it was so huge - only when satellite images were taken did the scale of the caldera become apparent - the whole park, 85 km by 45 km, is one massive reservoir of magma… When will it next erupt? Scientist have discovered that the ground in Yellowstone is 74 cm higher than in was in 1923 —indicating a massive swelling underneath the park… The volcano erupts with a near-clockwork cycle of every 600,000 years. The last eruption was more than 640,000 years ago – we are overdue … What would be the effect of an eruption? Immediately before the eruption, there would be large earthquakes in the Yellowstone region. The ground would swell further with most of Yellowstone being uplifted. One earthquake would finally break the layer of rock that holds the magma in—and all the pressure … would be unleashed in a cataclysmic event. Magma would be flung … into the atmosphere. Within a thousand kilometers, virtually all life would be killed by falling ash, lava flows and the sheer explosive force of the eruption. Volcanic ash would coat places as far away as Iowa and the Gulf of Mexico… lava would … coat the whole of the USA with a layer 5 inches thick… It would be the loudest noise heard by man for 75,000 years, the time of the last super volcano eruption. Within minutes of the eruption tens of thousands would be dead. The long-term effects would be even more devastating… ash … could block out light from the sun, making global temperatures plummet. This is called a nuclear winter… the world's plant life would be killed by the ash and drop in temperature. Also, virtually the entire of the grain harvest of the Great Plains would disappear in hours … Similar effects around the world would cause massive food shortages. If the temperatures plummet by the 21 degrees they did after the Sumatra eruption the Yellowstone super volcano eruption could truly be an extinction level event. "
    - http://rense.com/general31/overdue.htm

40

Natural disasters (cont'd)

- Example 3 – Volcano under Yellowstone (cont'd)
  - "It is also known that one end of Yellowstone Lake is 100 feet higher than it used to be and flooding the land at the other end and killing the trees. Trees in various parts of the park are dying because their roots are cooking from the heat under the ground. Water is now boiling along the trails. If there is an eruption, we would need at least a year's worth of supplies because no food could be grown, farm lands would be useless, temperatures would drop by as much as 15 degrees. Within 3 months, the entire world would be covered by clouds. Millions of people would die—most within the surrounding 100 miles. 600 miles from the caldera is not safe at all. FEMA could not handle this big an event. The U.S. economy would come to a halt. Grocery stores would empty out, airlines, trains, buses, and roads would stop."
    - http://www.earhmountainview.com/yellowstone/yellowstone.htm

41

Recent headlines

- "Gene linked to immune system may cause Parkinson's disease"
  - *Chicago Tribune*, August 16, 2010
- "Cancer and Diabetes: Lifestyle and Connections"
  - *www.aicr.org*
- "Diabetes and Dementia"
  - *Time*, September 6, 2010
- "Scientists find startling new links between Alzheimer's disease and Down Syndrome"
  - *Alzheimer's Disease Research Review*, Summer, 2010
- "Diabetes and Hypertension: Linked to Glaucoma?"
  - *National Glaucoma Research Report*, Winter 2012
- "Do Glaucoma, Erectile Dysfunction Have a Common Cause?"
  - *Medscape Medical News*, February 7, 2012

42

The future – Mortality improvement

- The basics
  - Medical advances
  - Healthy lifestyles – Diet, exercise
- Some new ideas
  - Healthy lifestyles – Diet, exercise
  - Anti-aging research
  - Stay active – mentally, physically, socially
  - Know what is really good for you
  - More

43

How to live longer

- *The Blue Zones* by Dan Buettner
  - Move naturally – Be active without having to think about it
  - Hara hachi bu
  - Avoid meat and processed foods
  - Drink red wine
  - Have a purpose
  - Take time to relieve stress
  - Participate in a spiritual community
  - Make family a priority
  - Surround yourself with those who share the same values

44

How to live longer (cont'd)

- *The Immortality Edge* by Michael Fossel, Greta Blackburn, Dave Woynarowski
- Goal is to improve length of telomeres, four things are recommended:
  - Supplements
    - Many are recommended, including omega-3 fish oil
  - Exercise
    - Aerobic and anaerobic exercise, stretching, and short bursts of heavy exercise
  - Stress reduction
    - Meditation
  - Diet
    - Paleolithic diet

45

Foods that are telomere friendly (from *The Immortality Edge*)

- Almonds
- Apples
- Avocados
- Beans
- Beets
- Blueberries
- Broccoli
- Cabbage
- Eggs
- Garlic
- Grapefruit
- Kale
- Meat
- Olive Oil
- Oranges
- Sea vegetables
- Sweet potatoes
- Tea
- Tomatos
- Wild salmon

46

Foods that can help protect against cancer

- Cayenne pepper
- Fermented foods
- Fruits (citrus)
- Pomegranate
- Tea (green, white, oolong)
- Tomato
- Turmeric
- Vegetables (cruciferous)

47

Eating right

- Recent study of over 120,000 people for 20 years
- Some gained weight and some lost weight
- Foods most responsible:
  - Potato chips: 1.69 pound gain
  - Potatoes: 1.28 pound gain
  - Sugar-sweetened beverages: 1.00 pound gain
  - Vegetables: 0.22 pound loss
  - Whole grains: 0.37 pound loss
  - Fruits: 0.49 pound loss
  - Nuts: 0.57 pound loss
  - Yogurt: 0.82 pound loss
- Source: *Alternatives*, September 2011

48

Don't want to eat right – There is still help!

- Eat sauerkraut with your hotdog
  - May stop nitrates from converting to carcinogens
- Eat grapes after a high-fat meal
  - Prevents some of the negative effects of triglycerides from meal
- Drink red wine with steak
  - Can cut down body's absorption of toxins that lead to heart disease
- Eat rosemary after pizza (or any high-carb food)
  - Reduces harmful chemicals that increase risk of cancer and heart disease by 60%
- Have vinegar after a high-carb meal
  - Can prevent spikes in blood sugar
- Eat dark chocolate after salty foods
  - Can lower blood pressure in as little as two hours

- Source: *Healthy Style*, July/August 2010

49

What about a nutrient?

- Astaxanthin
  - Red pigment molecule that is a member of carotenoid family
  - Found in microalgae
- What can astaxanthin do?
  - Prevent cancer
  - Protect against cardiovascular disease
  - Help manage diabetes by improving insulin sensitivity
  - Boost immune system
  - Slow brain aging
  - Protect against eye diseases
  - Protect and rejuvenate skin

50

Other research – Intestinal flora

- "At long last, in just the past few years, the importance of proper intestinal flora and probiotics are getting the attention they deserve. Research is confirming the *direct* connection between a disruption of gut flora and everything from heart and blood sugar issues to mental health problems… When you treat the whole person instead of just treating a disease or symptom, an imbalance in the intestinal tract stands out like an elephant in the room."
- *Alternatives*, February 2013

51

Other research – Reprogrammed cells

- "In a powerful demonstration of reprogrammed cells' potential to treat human disease and injury, scientists at the University of Wisconsin at Madison turned a rhesus monkey's skin cells into early brain cells, then implanted them successfully in the monkey's brain. The experiment, published Thursday in the journal *Cell Reports*, worked so well that the reprogrammed cells grafted onto the brain appeared indistinguishable from the cells already there… possibility that doctors might someday replace the neurons lost to Parkinson's or the cells damaged in spinal cord injuries… they mark an important moment in the discussion of what has been called personalized medicine—the idea that a patient's own cells can be used to treat a broad spectrum of ailments."
- *Chicago Tribune*, March 18, 2013

52

Other research

- Early cancer detection
  - ONCOblot
- Calorie restriction – Work by Luigi Fontana
  - Testing in mice and human not same
  - IGF-1 gene impacted by calorie restriction
  - Exercise is limited
  - Immune functions and bone density improve
  - Metabolic improvements?
- Longevity enzyme – Work by David Sinclair
  - Resveratrol appears to activate protein that promotes health and longevity
  - Sirtuins, particularly SIRT1
  - Longevity gene pathways activated by adversity

53

Other tips

- Do:
  - Give blood
  - Laugh
  - Eat eggs
  - Avoid sugar, processed foods
- Don't:
  - Avoid fats
  - Take an aspirin a day

54

Conclusion and summary

- Two distinct groups of people:
  - Those that know how to take care of themselves
  - Those that don't
- How to care of yourself (**PLEASE**):
  - **P** – Purpose: Have a Purpose in life
    - If you don't know where you are going, you will never get there!
  - **L** – Love: Love your family and friends - All you need is love!
  - **E** – Eat: Be aware of what you Eat
    - An apple a day keeps the doctor away!
  - **A** – Active: Be Active - Use it or lose it!
  - **S** – Screenings: Get periodic health Screenings - Better safe than sorry!
  - **E** – Enjoy: Avoid stress, laugh, and Enjoy life! - Don't worry, be happy!
- And one more story …
- I hope you all live long, healthy and prosperous lives!

55

QUESTIONS? PLEASE!

56

Bio – Al Klein, FSA, MAAA

- Al is a consulting actuary with Milliman's Lake Forest / Chicago office. He joined the firm in 2009.
- Al's primary responsibilities include performing industry experience studies and helping clients with life and annuity product development and reinsurance-related issues. His expertise includes mortality- and underwriting-related issues, including older age, simplified issue, and preferred.
- Prior to joining Milliman, Al most recently worked for a large stock life insurance company where he was responsible for experience studies across all lines of business. He has also worked for other life insurance companies, a reinsurer, and consultant, where he has been responsible for strategic planning, product development, and traditional reinsurance aspects of the business.
- Al is a frequent speaker at industry meetings and is currently involved with a number of industry activities, including:
  - SOA representative for the Mortality Working Group (MWG) of the International Actuarial Association
  - MWG Underwriting Sub-group chair – goal is to study underwriting done around the world
  - SOA Mortality and Underwriting Survey Committee
  - Joint American Academy of Actuaries (AAA) / Society of Actuaries (SOA) Preferred Mortality Oversight Group
  - Joint AAA / SOA Underwriting Criteria Team
  - 2014 SOA Valuation Basic Table (VBT) Older Age Subgroup
  - SOA Longevity Game Development Team
  - Longer Life Foundation Advisory Board
- Al received a Bachelor of Science degree in Actuarial Science and Finance from the University of Illinois, Urbana.

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57

