Lifestyle, Aging and Mortality

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Member, IAA Mortality Working Group
Agenda

• Lifestyle / behavior
  – Smoking
  – Obesity
  – Drinking

• Aging
  – Mortality improvement at older ages
Smoking

• The leading preventable cause of death in many countries
  – In some, mostly the result of past smoking, as smoking prevalence has decreased
  – In the U.S., smoking has decreased over the past 40 years

• Prevalence for males almost always higher than for females
  – Contributed to decreasing differences between male and female mortality in recent years

• Direct causes of death include lung cancer, cardiovascular diseases and chronic obstructive pulmonary disease
• In the U.S., about a 30 year lag between peak of aggregate prevalence and peak of mortality due to TBL cancer
• Aggregate female mortality rate due to TBL cancer just recently decreasing
Smoking prevalence by gender and age

American Adults at 2005 and 2014

Smoking Prevalence by Age and Gender

- A continuation of the downward trend in tobacco smoking, with males still higher smoking prevalence
- Flattening age differentials

Source: Centers for Disease Control and Prevention (CDC)
Smoking prevalence by birth cohort – U.S.

Obesity

- Drivers are genetics, nutrition and activity
- Sometimes referred to as a global epidemic

<table>
<thead>
<tr>
<th>NHANES Years</th>
<th>Males, by Age (%)</th>
<th>Females, by Age (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20–39</td>
<td>40–59</td>
</tr>
<tr>
<td>1988–1994</td>
<td>14.8</td>
<td>25.4</td>
</tr>
<tr>
<td>1999–2002</td>
<td>23.0</td>
<td>30.5</td>
</tr>
<tr>
<td>2003–2006</td>
<td>28.0</td>
<td>37.2</td>
</tr>
<tr>
<td>2007–2010</td>
<td>30.3</td>
<td>35.7</td>
</tr>
<tr>
<td>2011–2014</td>
<td>30.3</td>
<td>38.3</td>
</tr>
<tr>
<td>2013–2014</td>
<td>31.6</td>
<td>37.2</td>
</tr>
<tr>
<td>2013–2014: class 3+ obese</td>
<td>6.0</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Source: CDC (US)

Source: FAO
U.S. drinking and problem-drinking has increased

<table>
<thead>
<tr>
<th>Age / Year</th>
<th>12-Month Alcohol Use</th>
<th>12-Month High-Risk Drinking</th>
<th>DSM-IV Alcohol Use Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29</td>
<td>73.1%</td>
<td>80.1%</td>
<td>16.9%</td>
</tr>
<tr>
<td>30-44</td>
<td>71.9</td>
<td>79.5</td>
<td>10.3</td>
</tr>
<tr>
<td>45-64</td>
<td>64.3</td>
<td>71.9</td>
<td>7.5</td>
</tr>
<tr>
<td>65+</td>
<td>45.1</td>
<td>55.2</td>
<td>2.3</td>
</tr>
<tr>
<td>All</td>
<td>65.4</td>
<td>72.7</td>
<td>9.7</td>
</tr>
</tbody>
</table>


- Alcohol drinking has increased in all age categories
- Greatest percentage increases have been at older ages
- Less than 10% of high-risk drinkers are treated
- Age-specific death rates for liver cirrhosis, especially alcohol-related liver cirrhosis, rose dramatically between 2009 and 2013 for the first time since the early 1970s
- Mortality among alcohol-affected drivers who were simultaneously distracted increased between 2005 and 2009 by 63%
Other behavioral factors

- Other adverse lifestyle/behavioral factors
  - Opioid addiction (especially North America)
  - Suicides and homicides
  - Texting while driving
  - Insufficient sleep
  - Limited social interactions
  - Poverty (e.g., inability to afford or unwillingness to take medication)
Aging is the leading cause of death

- Mortality rates inevitably increase by age
  - In some countries, we may be getting closer to bumping up against maximum lifespan
  - But % mortality improvement rate generally decreases by age ("age gradient")
    - Possibly suggesting additive or hybrid changes?

- Older age population is increasing

- Increased frailty with age

- Current medical paradigm ensures better survival but not necessarily less frailty
  - Unsustainable

- Research has almost always been focused on individual diseases, rather than to the aging process
Age-related mortality

• Life expectancy at birth has primarily benefited from younger age mortality improvement
  – Further improvement has to come from the older ages

• But the trend at older ages has not been consistent
  – Differed by country
  – Examples follow
    ▪ Various countries, based on the Human Mortality Data Base and the Human Mortality Data Base by Cause
    ▪ Department of Defense (U.S.) – military pension plan
      o Data provided by the Office of the Actuary of the Department of Defense
Long-term trends
UK and France

- Long-term decrease is obvious
- Percentage decrease generally smaller at older ages

Source: HMDB
Long-term trends - 4 countries – ages 70 and 85

- Similar patterns for these 4 European countries

Source: HMDB; GBRTENW – England & Wales; CHE - Switzerland
Male and female mortality over 50 years

Age gradient apparent; more recent differential by sex may be flipped.

Source: HMD
Causes of death - males
Japan and the U.S. – 70s

Distribution of deaths by cause: Japan Male 2004-2013 ages 70-79
- Neoplasms, 42.6%
- Heart, 13.7%
- Other respiratory, 6.3%
- Digestive, 3.6%
- Circulatory, 1.7%
- Cerebrovascular, 9.9%
- Genitourinary, 2.0%
- Musculoskeletal, 0.5%
- Congenital, 0.1%
- External, 5.1%
- Infectious, 2.2%
- Blood, 0.3%
- Endocrine, 1.8%
- Mental, 0.2%
- Nervous system, 1.7%
- Infectious, 2.3%
- External, 3.3%
- Congenital, 0.1%

Distribution of deaths by cause: USA Male 2004-2013 ages 70-79
- Neoplasms, 32.1%
- Heart, 26.6%
- Other respiratory, 10.0%
- Acute respiratory, 1.9%
- Circulatory, 1.5%
- Cerebrovascular, 4.8%
- Genitourinary, 2.5%
- Musculoskeletal, 0.5%
- Digestive, 3.1%
- Congenital, 0.1%
- External, 3.3%
- Infectious, 2.3%
- Blood, 0.3%
- Endocrine, 4.5%
- Mental, 2.2%
- Nervous system, 4.3%

Source: HMDB by cause
Causes of death - males
Japan and the U.S. – 80s

Distribution of deaths by cause: Japan Male 2004-2013 ages 80-89

Distribution of deaths by cause: USA Male 2004-2013 ages 80-89

Source: HMDB by cause
Mortality improvement – U.S. and Japan – total

Very different pattern by country, but similar within country by age and gender

Source: HMDB by cause
Mortality improvement
5 countries – total and heart

Source: HMDB by cause
Mortality improvement
5 countries – neoplasms

Source: HMDB by cause
• Data separated by military retirees and survivors
• Experience of retirees, split by officers and enlisted, are shown by gender
  – Many fewer females (1% to 2% at ages at least 75)
  – Large numbers: 300K - 450K life years exposed per year for 75-100 year old retirees. As a result data is unsmoothed
  – Health care system noticeably improved in 2001, with little significant effect
  – There has been a persistent crossover in officer/enlisted mortality rates in the low 90s
• Survivors are predominantly (99.8%) female
• The following graphs and tables were derived from data provided by the Office of the Actuary, U.S. Department of Defense
U.S. military pension plan
U.S. military pension plan

Survivors – predominantly females

- 95
- 90
- 85
- 80
- 75

Years: 2001 to 2015
U.S. military pension plan
Mortality improvement

- Officer mortality lower than that of enlisted through low 90s
  - Officers generally of higher income and other socio-economic measures
  - A definite age gradient evident for all categories, although less evident for female retirees (lower credibility)
  - Although not as evident here, over long-term life expectancies leading to greater inequality over time

- Average mortality improvement over 2001-15 (male officers from 2004 and male enlisted from 2007 due to data limitations)

<table>
<thead>
<tr>
<th>age</th>
<th>Officer</th>
<th>Enlisted</th>
<th>age</th>
<th>Officer</th>
<th>Enlisted</th>
<th>age</th>
<th>Officer</th>
<th>Enlisted</th>
<th>Survivors</th>
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<tbody>
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<td>75</td>
<td>3.0%</td>
<td>1.9%</td>
<td>88</td>
<td>0.6%</td>
<td>1.7%</td>
<td>75-79</td>
<td>2.4%</td>
<td>2.4%</td>
<td>1.0%</td>
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<tr>
<td>76</td>
<td>3.6%</td>
<td>1.8%</td>
<td>89</td>
<td>0.6%</td>
<td>1.4%</td>
<td>80-84</td>
<td>-0.9%</td>
<td>-0.4%</td>
<td>0.5%</td>
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<tr>
<td>77</td>
<td>2.2%</td>
<td>2.0%</td>
<td>90</td>
<td>0.2%</td>
<td>0.7%</td>
<td>85-89</td>
<td>1.1%</td>
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<tr>
<td>78</td>
<td>2.4%</td>
<td>1.4%</td>
<td>91</td>
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<td>1.1%</td>
<td>90-94</td>
<td>1.7%</td>
<td>3.1%</td>
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<tr>
<td>79</td>
<td>1.7%</td>
<td>0.8%</td>
<td>92</td>
<td>0.1%</td>
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<td>95-99</td>
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<tr>
<td>80</td>
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<tr>
<td>81</td>
<td>1.1%</td>
<td>0.9%</td>
<td>94</td>
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<td>82</td>
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<td>-1.1%</td>
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<tr>
<td>83</td>
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<td>-0.6%</td>
<td>1.3%</td>
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<td>84</td>
<td>1.1%</td>
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<td>0.9%</td>
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<tr>
<td>86</td>
<td>0.7%</td>
<td>0.5%</td>
<td>99</td>
<td>-0.9%</td>
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<td>87</td>
<td>0.9%</td>
<td>-0.3%</td>
<td>100</td>
<td>-3.8%</td>
<td>1.5%</td>
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Sam is a retired consulting actuary, formerly with PricewaterhouseCoopers, practicing in a wide range of practice areas, including life, health, social and property/casualty insurance. He consulted with numerous insurance companies and government agencies. He has been active in actuarial affairs, serving as chair of numerous committees and task forces of the Society of Actuaries, Casualty Actuarial Society, American Academy of Actuaries and the International Actuarial Association. He also served as president of the Society of Actuaries. He is currently a co-vice chair of the IAA Resources & Environment Working Group and of the IAA Population Issues Working Group.