Living Well to 100
Henry Brodaty
TWO CERTAINTIES OF LIFE

![Red thumbs-down sign with "NO NEW TAXES!"

![Grave with "HERE LIES EVERYONE"

100,000BC - 2017AD
A THIRD CERTAINTY
The world’s centenarian population projected to grow rapidly

Number of persons ages 100 and older


PEW RESEARCH CENTER

Centenarians around the world

Number of centenarians in China and Japan expected to surpass number in U.S.

- **Number of persons ages 100 and older**
- **Number of persons ages 100 and older per 10,000**

Source: United Nations, Department of Economic and Social Affairs, ‘World Population Prospects: 2015 Revision’

PEW RESEARCH CENTER
Centenarians in Australia and NZ

- Over the past ~20yrs Australian centenarians ↑ 254%¹
- Australia (2016): = 3500 ²
- NZ³: (1996) 258
  (2001) 399
  (2006) 534
  (2013) 558 …<50 were ≥ 105yrs

“I have a heart condition which restricts me to a very slow type of life,” he said. “I used to go to libraries, museums, exhibitions in the city. Reading is my main occupation, besides cooking and cleaning.”

“I am still interested in what’s happening around the world.”

Exceptional longevity of the residents – have been identified in Costa Rica, Sardinia, the Greek island of Ikaria and Okinawa in Japan. These communities prioritise family and are socially engaged. They tend not to smoke, have diets high in vegetables and legumes and engage in physical activity. Researchers at UNSW’s Centre for Epidemiology and Population Health study the health and lifestyle of centenarians.

600 4870 41,100
People turned 100 in 2016 Centenarians in 2016 Centenarians by 2050

People always tell him he is effecting healthy old age is actually a lifelong enterprise. You’re really looking at your risk factors, your diet, your weight, exercise, cognitive activity."

Along with research by former La Trobe University lecturer John McCormack, who interviewed 180 centenarians, the study helps dispel assumptions that anyone living to such an old age will inevitably be dependent on aged care and public health services. "It’s a negative stereotype that anyone at that age is decrepit,” Dr McCormack said.

He found a history of physical work and not being overweight were the most common characteristics among centenarians and
Australian Centenarian Projections

Source: ABS cat. no. 3105.0.65.001, 3101.0 and Treasury projections
Centenarians in New Zealand

Four Kapiti Coast centenarians

The number of centenarians is projected to climb from 300 in 1999 to 12,000 in 2051 and 18,000 by 2101.
Why are numbers increasing?

- Global rise in centenarians driven by reductions in mortality below 100 years
- No improvement in mortality amongst centenarians themselves in past 30 years
- Annual risk of death plateaus to 50% at 103 years for men and 107 yrs for women

Modig et al. (2017) Journal of Internal Medicine
Chances of Reaching 100
(from UK data)

- Baby girl born today in a developed country = ~ 35%
- Baby boy born today in a developed country = ~ 28%

http://visual.ons.gov.uk/what-are-your-chances-of-living-to-100/
Centenarian Hotspots

- Lomo Linda, CALIFORNIA
- Sardinia, ITALY
- Okinawa, JAPAN
- Nicoya, COSTA RICA
- Ikaria, GREECE
Blue Zone: Okinawa, Japan

- General female life expectancy = 87yrs
- Increase in centenarians:
  - 30 (1975) ↑ 1000 (2016)
- ~35% function independently
- Factors influencing longevity:
  - Diet?
  - Genetics?
  - Physical activity?

Willcox et al. (2016), Mechanisms of Ageing & Development
Okinawa: Reasons for Longevity

• A lean diet with fewer calories:
  • Vegetables
  • Tofu
  • Miso soup
  • A little fish or meat

• Confucian-inspired adage:
  • "hara hachi bu" = until your stomach is 80% full
Okinawans grow much of their own food.

Their gardens = cabinets of preventive medicine:

- Herbs, spices, fruits, vegetables
- Chinese radishes, garlic, scallions, cabbage, turmeric, tomatoes

Okinawan woman harvests seaweed – a staple

National Geographic, Nov 2005
Japanese Centenarians: Autonomy

Autonomy associated with:

- ↑ visual acuity
- Preserved masticatory ability
- Being male
- Exercise
- Spontaneous regular waking
- No drinking history
- No Hx severe falls ≥ 95yrs
- ↑ frequency of protein intake
Japanese Centenarians: Autonomy

Autonomy not associated with:

- Seaweed intake
- Smoking status
Villagrande Strisaili holds world record for male longevity\(^1\)

- \(~ 47\) male & \(44\) female centenarians in 2011\(^2\)
- **Factors influencing longevity:**\(^2\)
  - Genetics?
  - Family support?
  - Community support?

\(^1\)Piras et al. (2015); \(^2\)Poulain et al. (2011)
Blue Zone: Ikaria, Greece

GREECE (HELLAS)

IKARIA ISLAND

AGIOS KIRIKOS
Blue Zone: Ikaria, Greece

- Life span = ~ 8yrs longer than other developed nations\(^1\)
- 1% live > 90 years\(^2\)
- 20% less cancer, 50% less heart disease\(^1\)
- Low rates of dementia\(^1,2\)
- Daily physical activities, healthy eating habits, avoidance of smoking, frequent socialising, mid-day naps and low rates of depression\(^3\)

\(^1\)Buettner & Skemp (2016); \(^2\)Stefanadis (2011); \(^3\)Panagiotakos (2011)
Power 9 Principles of the Blue Zones

1. Move Naturally
   - Right Outlook
     2. Know your purpose
     3. Down shift
   - Eat Wisely
     4. 80% rule
     5. Plant slant
     6. Wine@5
   - Belong
     7. Family first
     8. Belong
     9. Right tribe

Power 9 Principles of the Blue Zones

1. Moderate, regular physical activity
2. Life purpose
3. Stress reduction
4. Moderate calories intake
5. Plant-based diet
6. Moderate alcohol, esp wine
7. Engage in family life
8. Engage spiritually/religion
9. Engage in social life

© 2008 Blue Zones, LLC All Rights Reserved
Lifestyle

Seven protective factors
• Not being a smoker or stopping young
• Adaptive coping style
• Absence of alcohol abuse
• Healthy weight
• Stable marriage
• Some exercise
• Years of education

Would you want to live to 100?

What does your answer depend on?

- Cognition?
- Physical health?
- Mental health?
- Family?
- Friends?
- Quality of life?
- Finances?
Cognition in Centenarians

- Cognition intact in many centenarians\(^1,2\)
- ↑ variability in performance\(^3\)
- Common impairments:
  - Basic attention (DS forwards)\(^2\)
  - Working memory (DS backwards)\(^2\)
  - Processing speed\(^1\)
  - Verbal skills (e.g. verbal reasoning)\(^2\)
  - Immediate & delayed verbal recall\(^1\)

\(^1\)Piras et al. (2015); \(^2\)Hagberg et al. (2001); \(^3\)Miller et al. (2010)
Centenarians: MMSE

Figure 1. MMSE scores by age cohorts.

Mean MMSE total score

80–84 85–90 98–99 100–101 102+

Age Cohort

Error bars: +/- 1 SE

Centenarians: Severe Impairment Battery

Figure 2. SIB scores by age cohorts.

Mean Severe Impairment Battery total score

Age Cohort

Error bars: +/- 1 SE

Dementia in Centenarians

- ~ half of centenarians are dementia free\textsuperscript{1,2,3}
- Prevalence of dementia:
  ~ 40-60\%\textsuperscript{1,2,3,4}
- Incidence of dementia:
  ~ 41\% per yr \textsuperscript{4}
- Incidence similar for men and women\textsuperscript{4}

\textsuperscript{1}Richmond et al. (2011); \textsuperscript{2}Andersen-Ranberg et al. (2001);
\textsuperscript{3}Sachdev et al. (2013);
\textsuperscript{4}Corrada et al. (2010); \textsuperscript{4}CHeBA data
Cognitive Impairment & dementia across older ages

• Prevalence of cognitive impairment ↑ with age
  • 39.7% (95-99 age group)
  • 69.5% (100-104 age group)
  • 80% (105+ group)

• Prevalence of dementia increases
  • 37.9% (95-99 age group)
  • 59.9% (100-104 age group)
  • 73.5% (105+ group)
## Centenarian studies globally

<table>
<thead>
<tr>
<th>Location</th>
<th>Dementia</th>
<th>Normal Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>27</td>
<td>22.5</td>
</tr>
<tr>
<td>North Italy</td>
<td>62</td>
<td>20.6</td>
</tr>
<tr>
<td>Tokyo</td>
<td>62</td>
<td>24.3</td>
</tr>
<tr>
<td>Heidelberg</td>
<td>52</td>
<td>25</td>
</tr>
<tr>
<td>Danmark</td>
<td>51</td>
<td>25</td>
</tr>
<tr>
<td>New England</td>
<td>76</td>
<td>16.2</td>
</tr>
<tr>
<td>Korea</td>
<td>62</td>
<td>6.7</td>
</tr>
<tr>
<td>Finland</td>
<td>56</td>
<td>44</td>
</tr>
<tr>
<td>Sydney</td>
<td>54</td>
<td>&lt; 30</td>
</tr>
</tbody>
</table>

Is incidence of dementia/cognitive impairment declining?

- Review 14 studies ... trends in dementia prevalence (9 studies) and incidence (5)
- Sweden, Spain, UK, Netherlands, France, USA, Japan and Nigeria.
- All (except Japan) ➔ stable or declining prevalence and incidence of dementia
- Some effects in males; others females only
- No single risk or protective factor fully explains observed trends, but .....
Is incidence of dementia/cognitive impairment declining?

- ....major societal changes and improvements in
  - living conditions, early childhood
  - education
  - healthcare, cardiovascular
- might have favourably influenced physical, mental and cognitive health throughout life, and
- be responsible for ↓ risk of dementia in later life

Wu YT et al Nature Neurology Reviews 2017
Figure 1. Crude Dementia Incidence in the Einstein Aging Study Cohort as a Function of Date of Birth and Age

Sensory Functioning in Centenarians

- Significant visual impairment ~31%\(^1\)
- Significant hearing impairment ~14%\(^1\)
- No problems with vision ~ 37%\(^2\)
- No problems with hearing ~ 27%\(^2\)

\(^1\) Engberg et al. (2008); \(^2\) Gondo et al. (2006)
Centenarians: General Functioning

- ~46% men & 25% women don’t take any prescription medications\(^1\)
- +ve health self-rating ~ 54%\(^2\)
- No major disease/disability ~29%\(^2\)
- Active social companionship ~73%\(^2\)
- Active community engagement ~ 20%\(^2\)
- ADLs and IADLs often impaired\(^3\)

\(^1\)Hazra et al. (2016); \(^2\)Araújo et al. (2016); \(^3\)Sachdev et al. (2013)
(a) Functional Impairment by Age Group

ChEA data
Australian Living Circumstances:
Centenarians and Near Centenarians

- Private dwelling in community ~56%
- Retirement village ~3%
- Low-level care ~19%
- Nursing home ~23%

Sachdev et al. (2013), International Psychogeriatrics
<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently have someone to confide in</td>
<td>156</td>
<td>48.7</td>
</tr>
<tr>
<td>Volunteers ‘several times a year’</td>
<td>12</td>
<td>6.2</td>
</tr>
<tr>
<td>Volunteers ‘several times a month’</td>
<td>13</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Sachdev et al, 2013
Centenarians: Home Support

- RDNS institute analysed health records of 123 centenarians & ≥ 1000 95-99yrs
- Near centenarians required ~72 home visits over two years
- Centenarians required only ~58 home visits over two years

119 individuals aged 95-107 in NY
Average of 4.85 ± 2.32 illnesses...however 67% reported good to excellent health
17% reported no difficulty with daily activities
~80% = no depression (GDS<8)
~66% = moderate-high Satisfaction with Life (SWL)

Jopp et al. (2016) BMC Geriatrics, 16:1; DOI 10.1186/s12877-015-0167-0
Predictors of Mental Health: Centenarians and Near Centenarians

- ↑ Subjective health, Nº living children & ADLs = ↑SWL\(^1\)
- ↑ Subjective health, IADLs & support from relatives = ↓depression Sx\(^1\)
- Living in NH, > depression Sx\(^2\)

\(^1\)Jopp et al. (2016); \(^2\)Margrett et al. (2010)
Centenarians & Anxiety

- ~45% = clinically significant anxiety (GAI-SF≥3)
- ↑anxiety Sx ∝
  - ↓health perception
  - ↑medical conditions
  - ↑financial concerns
  - ↑loneliness

Ribeiro et al. (2015), International Psychogeriatrics
Mental Health of Australian Centenarians

- Convenience sample of 118 centenarians (RACFs and community)
- Centenarians had regular contact with friends (59%), neighbours (62%), family (72%)
- 54% were religious
- Mean MMSE = 21.5
- Anxiety = 10% (HADS)
- Depression = 14% (HADS)

Richmond et al. (2011) JAGS 59:1080–1086
Personality Traits of Centenarians

- Study of 165 centenarians in Italy
- Personality traits assessed
- Extroverted = 65.4%
- Open-minded = 50%
- Emotional stability = 34.5%
- Centenarians with ↑extroversion described themselves as “very energetic, dynamic, active and loquacious”

Successful Ageing in Centenarians

• Of 602 Italian centenarians, 20% were free of invalidating chronic diseases, were autonomous and maintained good physical and cognitive capacities.

• However, they had not maintained any social or productive activities.

Motta M et al Successful aging in centenarians: myths and reality
Do elixirs of youth exist?
Immortal Hydra?

Non-senescence may be optimal because lifetime reproduction may be enhanced more by extending adult life spans than by increasing daily fertility

doi: 10.1073/pnas.1521002112
<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Name</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoch</td>
<td>365 yrs</td>
<td>Seth</td>
<td>912 yrs</td>
</tr>
<tr>
<td>Lamech</td>
<td>777 yrs</td>
<td>Adam</td>
<td>930 yrs</td>
</tr>
<tr>
<td>Mahalalel</td>
<td>895 yrs</td>
<td>Noah</td>
<td>950 yrs</td>
</tr>
<tr>
<td>Enosh</td>
<td>905 yrs</td>
<td>Jared</td>
<td>962 yrs</td>
</tr>
<tr>
<td>Kenan</td>
<td>910 yrs</td>
<td>Methuselah</td>
<td>969 yrs</td>
</tr>
</tbody>
</table>

- 10 oldest people on record (according to modern standards) have an age range from 115 to 122 years
Quests for eternal life

- Ancient Greek myth
- Sorceress Medea injected King Aeson with a mixture of ram’s blood, snake’s skin, roots, herbs & other ingredients which gave him energy and youthful vitality
- Pope Innocent VIII (1432-1492)
- Requested injection of blood of young men
- He died almost immediately
Quest for eternal life

- 19th century Dr. Charles Edouard Brown-Sequard claimed old men could be made young by the injections of mashed up dog testicles.
Quest for eternal life

- 20th century John Romulus Brinkley advocated transplanting goat testicles into men

Goat testicles at Beijing market
A “cure” for ageing?

• Anti-ageing medicine, antioxidants, hormones - No evidence that these decrease rate of ageing\(^1,2\)

• Lifestyle modification

• Exercise, balanced diet contribute to maintaining health, may delay age-related diseases. No evidence of modifying the ageing process\(^1\)

\(^1\) Olshansky SJ, et al. (2002). Sci Am, 286, 78–81
Search for eternal youth

• Sirtuins – ? mediate longer life of lab rats & mice on v. low-calorie diet
• Resveratrol – reported activate sirtuin
• 2008: GlaxoSmithKline paid $720 m to develop drugs to mimic resveratrol
• 2011: study published that questions role of sirtuins in promoting longevity

Current searches for youth elixirs

- Calorie restriction
- Sirtuins – “longevity genes”
- Resveratrol
- NAD (nicotinamide adenine dinucleotide)
- NMN (nicotinamide mononucleotide) → mice leaner, >energy, run further
- Human trials just started*

*Harvard Magazine, Sept 2017

David Sinclair
Eternal life?

• “What do the ancient purveyors of physical immortality all have in common?
• They are all dead.”

S. Jay Olshansky, (3/12/2004)
Conclusions

• Number of centenarians ↑
• Variable decline cognit^n & function
• Rates of dementia ?≈50% (∝ def^n)
• Moderate anxiety; low depression
• High Satisfaction with Life
• Search for elixir of youth continues
Thank you

www.cheba.unsw.edu.au
www.dementiaresearch.org.au

Thanks to Perminder Sachdev, Louisa Gibson and Sydney Centenarian Study team