CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Select 74
January 2012
How many people will live to 100

Dr Nick Niven-Jenkins

or
How can we increase human life span – increase longevity?

Life expectancy is the expected (in the statistical sense) number of years of life remaining at a given age

Some important questions

- What is aging?
- What causes humans to age?
- Can we increase life span?
- If so, what interventions have the greatest effect? - and
- Why is it important?

Biological aging

- Aging is a complex biological process in which gradual changes occur at the molecular, cellular, and organ levels
- This results in a progressive, inevitable, and inescapable decrease in the body's ability to respond appropriately to internal and/or external stressors

Chodzko-Zajko & Ringel, 1987

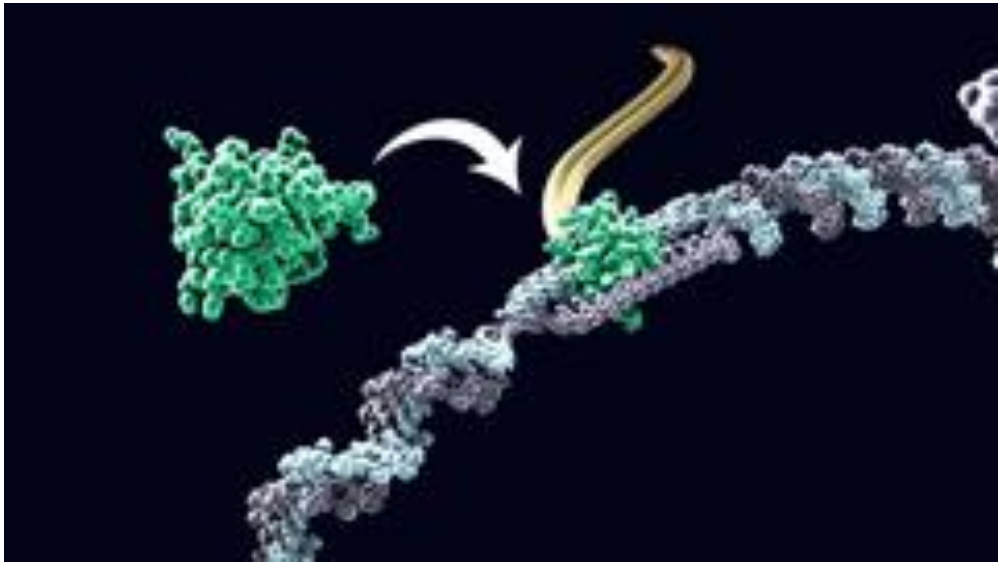
Genetic Cellular Theory of aging

- Substantial evidence suggests that the human life span is under genetic control primarily through programmed cell death
- **Apoptosis** or Type I cell-death
- **Autophagic** or Type II cell-death
- …but also DNA damage by harmful substances, transcription errors, ‘wear and tear’ and cells inability to divide and function with increasing age

Genetic Cellular Theory of Aging

DNA

Transcription using mRNA



Lifespan of human cells

- What is the shortest living cell?
- The white blood cell
- What are the fastest dividing cells?
- Cells of the skin and the lining of the intestine – they produce a new generation in about 20 hours
- Which of the following cells live the longest – liver, sperm, ova or nerve
- Nerve (some live for ever) – sperm (60 days) – liver (1 year) – ovum (40 years)

Lifespan through the ages

Neolithic	20
Bronze Age and Iron Age	26
Classical Greece	28
Classical Rome	28
Medieval Britain	30
Modern Britain (1800s)*	25–40
Early 20th Century	31
2010 world average	67.2

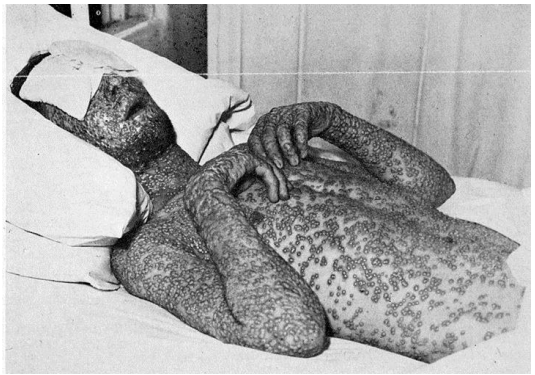
Broad Street cholera outbreak 1854

Causes of death

- 14th century Black Death- Bubonic Plague killed 25 million people worldwide
- Infectious diseases caused most deaths in the 17th and 18th century - TB, Typhus, Diphtheria, cholera etc
- but maternal and neonatal deaths were high because of poor care

What affects life span?

- Genetic/familial issues
- Environmental factors
- Social habits, and
- Medical care

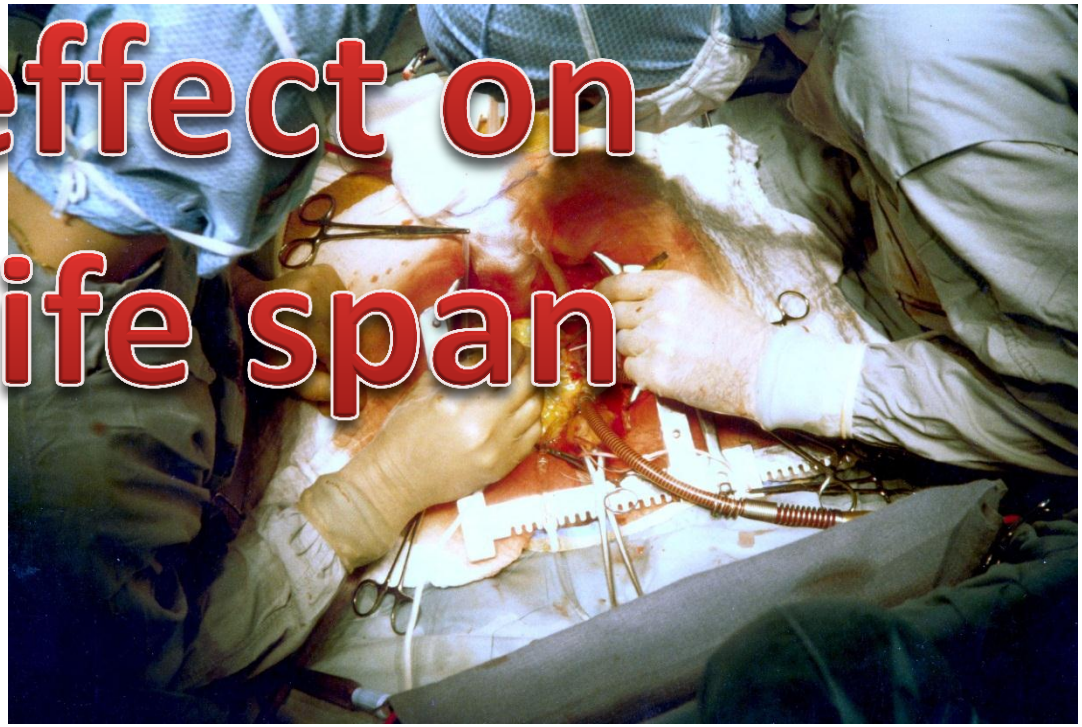


What interventions significantly improve the populations' life span?

Medical care?

- Aspirin
- No
- Antibiotics
- No
- Improved surgical techniques (CABG, transplants etc)
- No
- Cholesterol lowering drugs
- Nope

No significant effect on life span



What interventions improve life span?

What about medical care?

- We often hear that the reason life expectancy has been increased is due to developments in modern medicine
- The saving of lives using medical expertise is an important goal, **but it represents a very small component in the improvement of life span – a marginal effect**
- Because the effect of ‘medical’ interventions is too small to have a measurable impact on the life expectancy of an entire population

Medicine

- There is little population-based data to allow a direct estimate of the contribution of medical care to life extension
- The epidemiology of medical care and its effect on health has received little attention over the years
- Life expectancy had increased by 23 years during the first half of the 20th century
- The conclusion of available evidence is that medical care had contributed little to health or longevity

McKeown's *Role of Medicine*, based on cause-specific mortality reports for the century ending in 1971
Int. J. Epidemiol. (2001) 30 (6): 1260-1263. doi: 10.1093/ije/30.6.1260

So what interventions have improved life span?

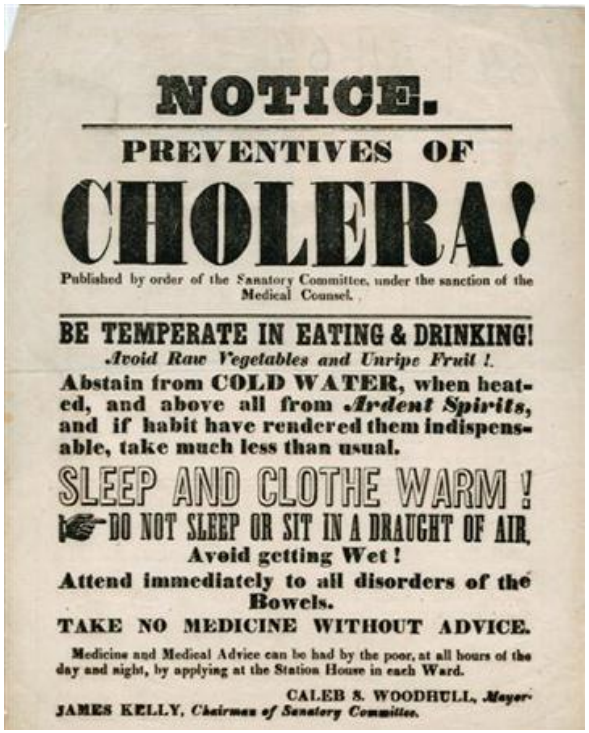
They are mostly ‘public health’* issues

- Sanitation/clean water
- Immunisation (vaccination)
- Good living conditions
- Healthy diet
- Exercise
- Decrease/stopping using drugs, alcohol, smoking
- Safe sex

*Public Health interventions improve health and quality of life through the prevention and treatment of disease and the promotion of healthy behaviours

Sanitation

- During the course of the 19th and 20th century, death rates from acute and infectious diseases continued to fall in the UK
- The Public Health Act of 1875 set up sanitary authorities



NOTICE.

PREVENTIVES OF

CHOLERA!

Published by order of the Sanatory Committee, under the sanction of the Medical Counsel.

BE TEMPERATE IN EATING & DRINKING!

Avoid Raw Vegetables and Unripe Fruit !.

Abstain from COLD WATER, when heated, and above all from *Ardent Spirits*, and if habit have rendered them indispensable, take much less than usual.

SLEEP AND CLOTHE WARM !

DO NOT SLEEP OR SIT IN A DRAUGHT OF AIR.

Avoid getting Wet !

Attend immediately to all disorders of the Bowels.

TAKE NO MEDICINE WITHOUT ADVICE.

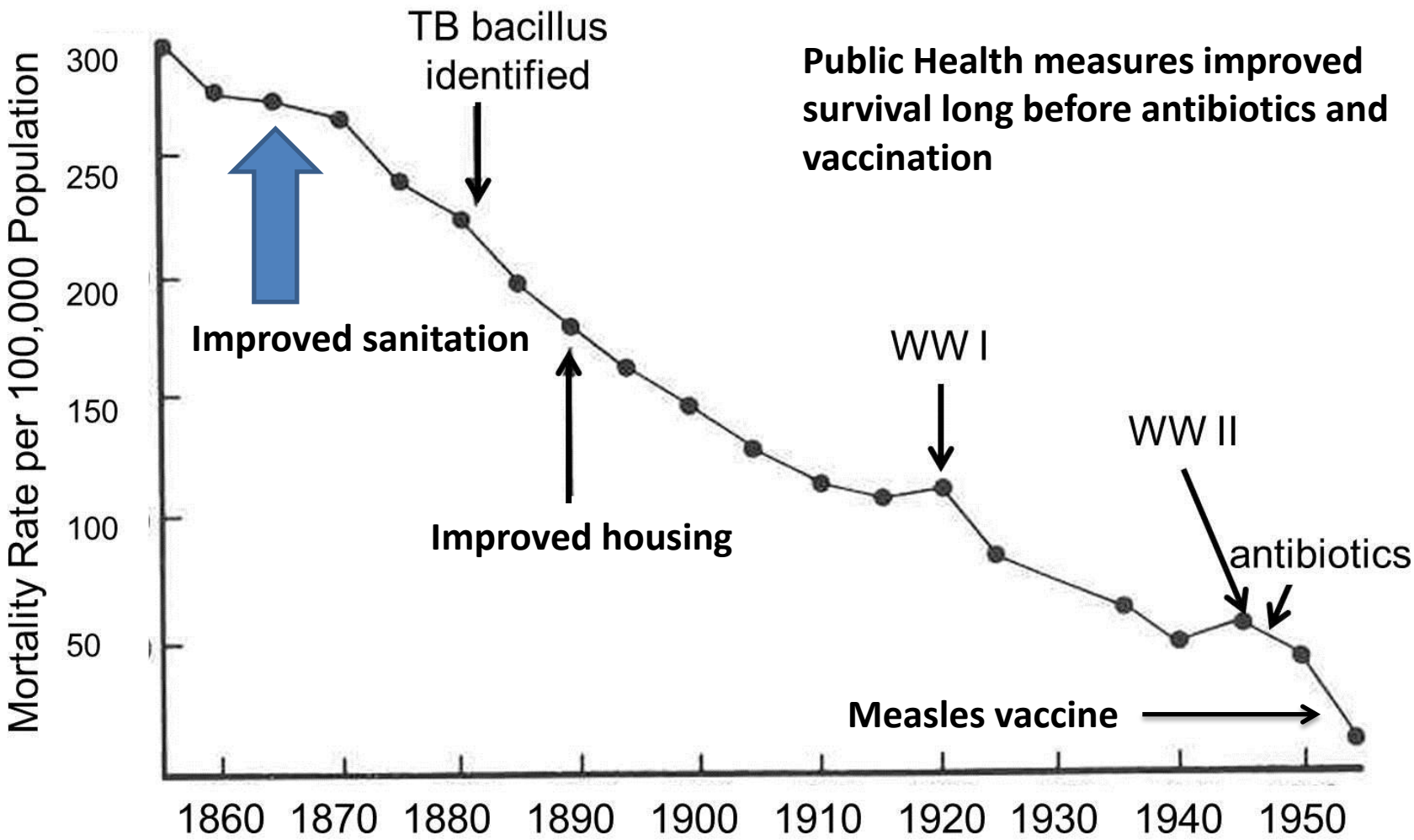
Medicine and Medical Advice can be had by the poor, at all hours of the day and night, by applying at the Station House in each Ward.

CALEB S. WOODHULL, *Mayor.*

JAMES KELLY, *Chairman of Sanatory Committee.*

- Infrastructure development =>
  - better living conditions
  - clean drinking water
  - sewage disposal

Improved survival



Summary

- The two factorss that probably account for 80% of life expectancy improvements are:
- Universal clean drinking water and very high levels of public and person hygiene
- Overall, life expectancy has increased due to 6 major factors *(from most to least importance):*
- **Clean drinking water**
- **Universal sanitation**
- **Significantly improved nutrition**, particularly during infancy and childhood
- Vaccination against most common epidemic diseases
- Access to high-quality trauma (accident and emergency) care
- Improved drugs (particularly, antibiotics)

Improving Public Health

Stress

Unsafe Sex

Alcohol

Smoking

Housing

Drugs

The next epidemic?

5 a day

Healthy Living

We are creating new disorders that decrease life expectancy

Obesity

- Now a major public health issue that will cause early death

Obesity is associated with:

- Ischaemic heart disease/stroke
- Hypertension
- Metabolic Syndrome & Diabetes (Type 2)
- Arthritis

The traditional high fat, low fibre, low fuit & vegetable ‘Western Diet’ is not good for our health including our brain function!

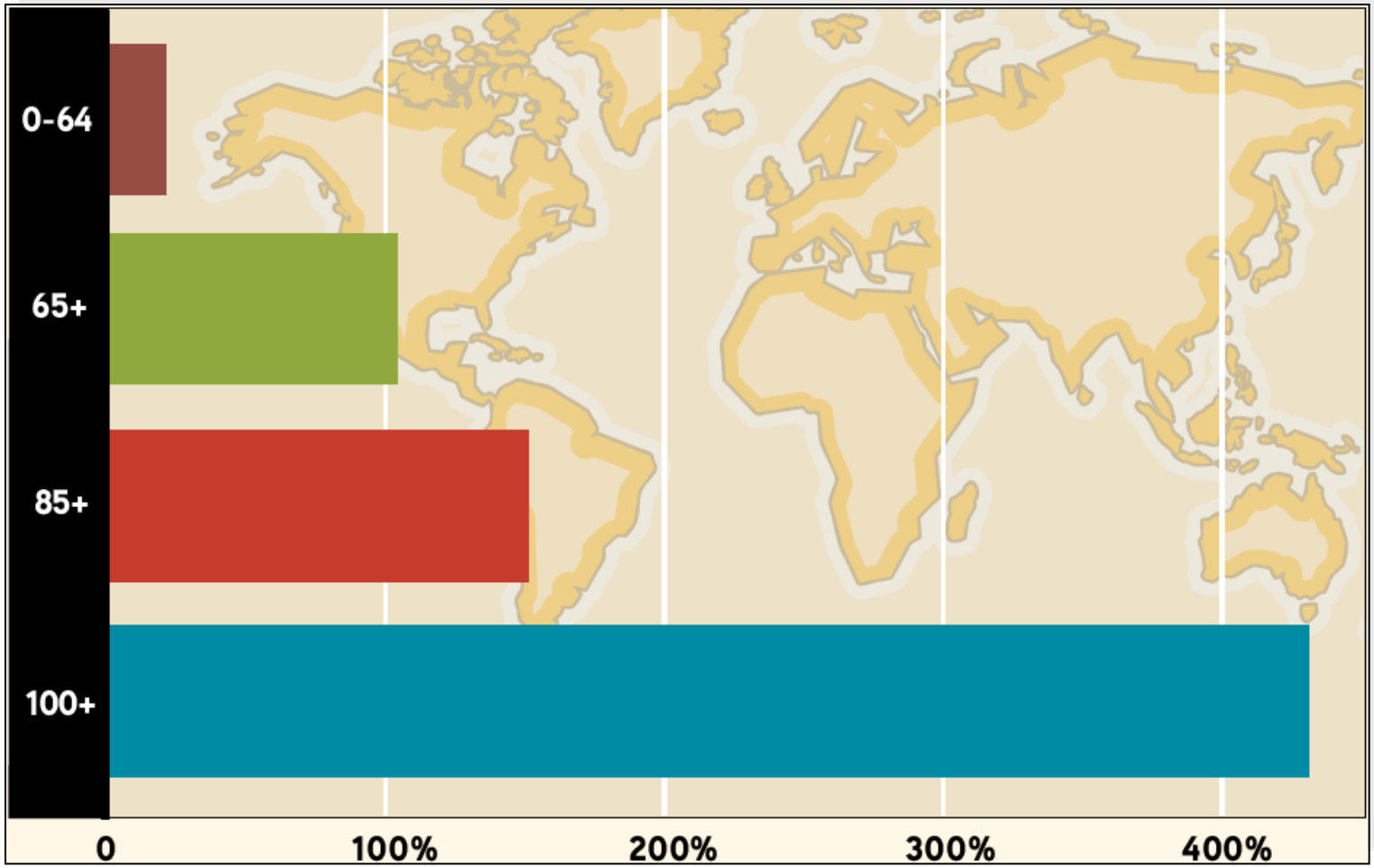
Remember

- Everyday behavior has a tremendous effect on health status
- Many doctors do not provide lifestyle counseling even for patients who are obese and smoke
- Healthy eating and physical activity are essential in preventing & managing disease

HealthyPeople.gov. Healthy People 2020, Determinants of Health. Washington DC: US Department of Health and Human Services, 2011. Available at: http://www.healthypeople.gov/2020/about/DOHAbout.aspx Accessed June 29, 2011.

Older people are living longer!

The worlds oldest members of the population is the fastest growing group



World Population Prospects. The 2004 Revision. New York: United Nations, 2005