“Oupa and ousma, how come you have HIV?”

Getting old on antiretrovirals

Cardiovascular, neoplastic and ageing related illness

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University of the Witwatersrand

Thanks to: Clinical Care Updates, AIDSmap, CROI, June Fabian, Steve Deeks, Merk, Braamie Veriawa, Jeff Wing, RP Knipping, AB Newman, Charles Feldman
How old would you be if you didn't know how old you were?

~Satchel Paige
What I have learned

• Ageing is fascinating – concepts of ‘successful ageing’
• Medical common sense important
• A lot of this data is NOT from developing world....
Aging Snapshot

- People over 65 represent the second highest average net worth of any age group\(^1\)
- If you include people over 50:\(^2\)
  - Own more than 70% of nation’s wealth
  - Represent 50% of discretionary spending
  - Represent 66% of all stockholders
  - Own 40% of all mutual funds ($1 Trillion)
  - Hold 50% of all IRA & Keogh funds
  - Earn almost $2 Trillion in annual income
- As a population, people over 65 are twice as generous in their charitable giving as younger age groups\(^3\)

\(^1\)Source: Grantmakers in Aging: Funding Across the Ages
\(^2\) www.agewave.com
\(^3\) NewTithing Group
Section 1: New concepts around ageing
The old paradigm of ageing...

- Human lifespan is increasing
- Burden of morbidity is increasing
- Genetics important
- Need newer treatments! “Fountain of Youth” – and there’s a solution to every disease
The biology of ageing...

• “Eish! With ARVs, you get fat and you get old”
  – Johannesburg Hospital patient
The biology of ageing...

- Ageing: telomeres shorten with each cell division
- Increased chromosomal abnormalities, DNA cross linking, increases strand breaks, decline in DNA methylation, post-translational changes of protein increase, mitochondrial structure deteriorates, loss of telomeric sequences
- Don’t see in animals in the wild!
- ONLY thing that delays ageing is starvation – documented from single cell organisms to humans
- In HIV and diabetes – ??acceleration??

“Eish! With ARVs, you get fat and you get old” – Johannesburg Hospital patient
Genetics of longevity

• Longevity is heritable - up to 25%
• Progeroid syndromes have known genetic causes
• Maximal lifespan can be altered up to 6 fold
  • C. Elegans and Drosophila - mutations in the pathways for insulin signaling
• Children of centenarians have better health and their siblings have better survival
• ?ART – NRTI’s make it worse?
What about humans?

- Mean life expectancy in developed countries is about 70 to 90 years.
- Record for longevity is 122 years.
  
- (50% reached 8 years in Late Palaeolithic (30 000BC); 26 years in Neolithic 2000BC)

- BUT: ‘Average life expectancy’ very dependent on definitions, and child mortality.
Decline in Function

- Genetically determined vitality until age 40
- Age @ progeny reproducible age
- No selective pressure to preserve
- Gradual decline in organ reserve
- When demand exceeds supply, infirmity (relative) or death (absolute) ensues
- NB The slope of the curve is modifiable through lifestyle change
### Physiology of ageing (1)

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<tr>
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Adapted from Harrisons Principles of Internal Medicine
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<td>General</td>
<td>Body fat ↑ ↓ body water</td>
<td>Change in distribution of drugs</td>
<td>Obesity, middle aged spread</td>
<td>Few HIV drug studies on older patients</td>
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<td>Endocrine</td>
<td>↓ vit D activation, thyroxine clearance, testosterone, ↑ glucose intolerance</td>
<td>Osteopaenia, increased glucose if stressed, less T4 if deficient</td>
<td>Fractures, impotence, diabetes</td>
<td>?impact of TDF on bone; of PIs, EFV and 3TC on glucose Impotence</td>
</tr>
</tbody>
</table>

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Sugar now an issue?
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<td>Respiratory</td>
<td>Decreased lung elasticity, increased chest wall stiffness</td>
<td>V:Q mismatch, decreased PaO2</td>
<td>Breathlessness</td>
<td>? Consequences of prior PCP, TB, other lung infections</td>
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<td>GIT</td>
<td>↓ liver function, ↓ gastric acidity, ↓ colonic motility</td>
<td>Altered drug metabolism</td>
<td>Constipation, Decreased Ca absorption, fractures, Cirrhosis</td>
<td>Few HIV drug studies on older patients; cirrhosis with hep B a worry</td>
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<td>↓ bone marrow/thymic reserve ↓ T-cell function</td>
<td>Less ability to deal with infection Altered immune surveillance</td>
<td>More severe consequences of infection</td>
<td>CD4 recovery less robust ? Greater attention to immunisation/ OI prophylaxis ? More auto-immune illness</td>
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<td>Dose modification</td>
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<td>Nervous system</td>
<td>Brain atrophy Decreased stage 4 sleep Reflexes slower</td>
<td>Osteopaenia Forgetfulness Insomnia</td>
<td>Depression Adherence</td>
<td>Magic Johnson</td>
</tr>
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“In the absence of disease, the decline in homeostatic reserve causes no symptoms and imposes few restrictions on activities of daily living, regardless of age” - Harrisons
Life expectancy reaches all-time high

Declines in death rates from most major causes have pushed Americans’ life expectancy to a record 77.6 years.

Estimated life expectancy, 1943-2003

By race and gender, 2003

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>80.5</td>
<td>75.4</td>
</tr>
<tr>
<td>Black</td>
<td>76.1</td>
<td>69.2</td>
</tr>
</tbody>
</table>

SOURCE: Centers for Disease Control and Prevention

Population survival curves

- Increase in average life expectancy but not life span
- Disease vs. aging effects

Life span

Life Expectancy 1900-1970's
The New Epidemic: Chronic Disease

- During the 19th century, death was due to infection, the first epidemic
- Life expectancy @ birth went from 49 years to 76 years
- Chronic disease replaced infectious disease
- 1977 Gruenberg published “The Failures of Success”
- Infections killed, chronic diseases lingered $$$
Changing Life-Expectancy

Infectious diseases eradicated

Chronic diseases

AGE AT DEATH
The Perfect Life: Vitality & Brief Infirmity

![Graph showing the number of persons at different ages at death, with peaks for vitality and infirmity.](image-url)
Section 2: How long will people with HIV live for? And what are they dying of now?

Life expectancy at birth (years)

Developments in this decade

• New drugs and drug classes
  • Fewer side effects
  • Improved options for MDR HIV
Haitian Patient, before and after Receiving Free Treatment for HIV Infection and Tuberculosis.

The photograph on the left was taken in March 2003, and that on the right in September 2003. Many impoverished patients in rural Haiti and Rwanda now receive comprehensive medical care through public–private partnerships.
Results: Assuming a high rate of HIV diagnosis (median CD4 cell count at diagnosis, 432 cells/μl), projected median age at death (life expectancy) was 75.0 years. This implies 7.0 years of life were lost on average due to HIV. Cumulative risks of death by 5 and 10 years after infection were 2.3 and 5.2%, respectively. The 95% uncertainty bound for life expectancy was (68.0, 77.3) years. When a low diagnosis rate was assumed (diagnosis only when symptomatic, median CD4 cell count 140 cells/μl), life expectancy was 71.5 years, implying an average 10.5 years of life lost due to HIV.

Conclusion: If low rates of virologic failure observed in treated patients continue, predicted life expectancy is relatively high in people with HIV who can access a wide range of antiretrovirals. The greatest risk of excess mortality is due to delays in HIV diagnosis.
• Uganda: almost NORMAL life expectancy
• SA – increased life expectancy
“Between 2000 and 2003, the life expectancy of this population fell from 59 years to 52 years due to high rates of HIV infection and lack of access to ARV treatment. However, since 2003 – when ARVs became available through the public health system – there has been a gain of 8.2 years in life expectancy from 52.4 years in 2003 to 60.6 years in 2011. The adult life-expectancy years gained were found to be 9.5 years for women, compared to 6.6 years for men. Regardless of exposure to HIV, there has been a 13.9 year increase in median life expectancy of a typical person.”
The greying of HIV...
Trends in death

- Non-AIDS deaths have dropped dramatically – Eurosida unpublished
- Death rate <1%; still higher than general population

(Lewden et al, CROI 2007 mortality 2005 study, BHIVA – deaths in Britain; Johnson)
• Lodwick – Death rate higher in HIV patients in UK if CD4>350 – but same in MSM (?other factors confounding);

• Context of these patients is important (as with any disease) – contrast outcomes rural vs urban
What happens to people with HIV on ART?

- Developed world cohorts: 8% die of AIDS
- Developing world?
Survival of Patients with CD4 Counts $\geq 500$ for $>5$ Years is Similar to the General Population

<table>
<thead>
<tr>
<th>Duration of Follow-up with CD4 $\geq 500$ cells/mm$^3$ (Yrs)</th>
<th>N</th>
<th>Deaths</th>
<th>Standardized Mortality Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1208</td>
<td>37</td>
<td>2.5 (1.8-3.5)</td>
</tr>
<tr>
<td>1</td>
<td>1156</td>
<td>29</td>
<td>2.1 (1.4-3.1)</td>
</tr>
<tr>
<td>2</td>
<td>1083</td>
<td>26</td>
<td>2.2 (1.4-3.2)</td>
</tr>
<tr>
<td>3</td>
<td>1031</td>
<td>22</td>
<td>2.1 (1.3-3.2)</td>
</tr>
<tr>
<td>4</td>
<td>967</td>
<td>18</td>
<td>2.1 (1.3-3.4)</td>
</tr>
<tr>
<td>5</td>
<td>864</td>
<td>12</td>
<td>1.9 (1.0-3.2)</td>
</tr>
<tr>
<td>6</td>
<td>763</td>
<td>2</td>
<td>0.5 (0.1-1.6)</td>
</tr>
<tr>
<td>7</td>
<td>610</td>
<td>1</td>
<td>0.5 (0.0-2.6)</td>
</tr>
</tbody>
</table>

Standardized Mortality Ratio = Mortality in HIV-infected patients / Mortality in General Population

• Conventional thinking: ART side effects will drive mortality
• Probably not true....
MACS: Increase in Waist Size in HIV+ Men May Be “Return to Normal”

- Longitudinal measurements of BMI, circumference of waist, hip, thigh, and midarm in 661 HIV-infected and 392 HIV-uninfected men enrolled in Multicenter AIDS Cohort Study
- NRTIs associated with BMI decrease; NNRTIs and PIs not associated
- Significant increases in BMI, waist, and hip circumference observed for each year of follow-up, regardless of HIV status
  - Waist circumference lower at baseline in HIV-positive men and increased more rapidly than in HIV-negative controls
- Suggests increased waist may reflect return to “normal”

D:A:D Study: Recent Use of ABC, ddI Associated With Increased Risk of MI

- TAs not associated with ↑ risk of MI
- Current or recent (within 6 months) use of ABC or ddI associated with ↑ relative risk of MI
  - 90% ↑ risk of MI with recent ABC
  - 49% ↑ risk of MI with recent ddI
  - Overall predicted rate of MI
    - Recent ddI: ~ 5/1000 PY
    - Recent ABC: ~ 6/1000 PY
  - Risk most prominent in individuals with underlying CVD risk factors
- ↑ risk no longer observed in patients who had discontinued ABC or ddI for > 6 months

Part 4: Is ageing different for HIV-infected people?

• Yes!
• But…
• Non-HIV malignancies
• Chronic illnesses – kidney and liver disease
• Cardiovascular mortality
Pathophysiology HIV/ageing?

- Microbial translocation – generalised immune activation
- Fibrosis of lymphatic tissue
- Less control of oncogenic pathogens
- Chronic inflammation – increased cancer
- Kidneys and HIV
• Lung cancer even when smoking corrected for – Kirk, CID 2007, Chaturvedi AIDS 2007
Cancer in People With HIV-1: A Changed Picture

- Non-AIDS-defining cancer types now make up majority of cancers
- Slight reduction in overall cancer incidence, driven by fall in AIDS-defining cancers
- Rise in several non-AIDS-defining cancers (anus, liver, pancreas, Hodgkin lymphoma)
- Overall risk of cancer remains higher nearly twice as high as general population (SIR, 1.9)
  - Increased risk of individual non-AIDS-defining cancers as well as AIDS-defining malignancies

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<tr>
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<tbody>
<tr>
<td>All</td>
<td>↓</td>
<td>3.0 (2.6–3.4)</td>
<td>1.9 (1.8–2.1)</td>
<td>0.9 (0.7–1.0)</td>
</tr>
<tr>
<td>Kaposi sarcoma</td>
<td>↓</td>
<td>2.800 (2,300–3,500)</td>
<td>790 (640–980)</td>
<td>0.4 (0.3–0.6)</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>↓</td>
<td>9.8 (7.7–12)</td>
<td>6.5 (5.4–7.7)</td>
<td>0.7 (0.5–1.0)</td>
</tr>
<tr>
<td>Cervix</td>
<td>↓</td>
<td>3.1 (1.1–6.7)</td>
<td>2.9 (1.8–4.4)</td>
<td>0.8 (0.3–2.0)</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>↓</td>
<td>2.5 (1.1–4.8)</td>
<td>1.5 (0.9–2.4)</td>
<td>0.6 (0.3–1.4)</td>
</tr>
<tr>
<td>Anus</td>
<td>↑</td>
<td>10 (2.1–29)</td>
<td>9.1 (5.1–15)</td>
<td>1.7 (1.7–6.0)</td>
</tr>
<tr>
<td>Liver</td>
<td>↑</td>
<td>0 (0.0–5.9)</td>
<td>3.1 (1.7–5.2)</td>
<td>∞</td>
</tr>
<tr>
<td>Pancreas</td>
<td>↑</td>
<td>0.8 (0.0–4.6)</td>
<td>2.5 (1.3–4.2)</td>
<td>4.5 (0.6–34.3)</td>
</tr>
<tr>
<td>Larynx</td>
<td>↑</td>
<td>1.8 (0.2–6.7)</td>
<td>2.7 (1.5–4.7)</td>
<td>2.2 (0.5–9.9)</td>
</tr>
<tr>
<td>Lung</td>
<td>—</td>
<td>2.6 (1.6–4.1)</td>
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CI = confidence interval; RR = relative risk; SIR = standardized incidence ratio.
↓ = decline in incidence as indicated by RR; ↑ = increase in incidence as indicated by RR.
SIR is incidence in HIV-1–infected population/expected rate based on general population rate.
*Incidence of liver cancer per 100,000 patient-years in studied population was 0 in 1991–1995 and 10 in 1996–2002, *p*≤0.03.
SMART changed our world!
### Serious Non-AIDS Outcomes in SMART

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>No. of Patients with Events</th>
<th>Rate DC</th>
<th>Rate VS</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major CVD, hepatic or renal disease</td>
<td>104</td>
<td>1.8</td>
<td>1.1</td>
<td>1.7</td>
</tr>
<tr>
<td>CVD+</td>
<td>79</td>
<td>1.3</td>
<td>0.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Hepatic (ESRD)</td>
<td>17</td>
<td>0.3</td>
<td>0.2</td>
<td>1.4</td>
</tr>
<tr>
<td>Renal (Cirrhosis)</td>
<td>11</td>
<td>0.2</td>
<td>0.1</td>
<td>4.5</td>
</tr>
<tr>
<td>NADM++</td>
<td>47</td>
<td>0.8</td>
<td>0.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Other non-OD death</td>
<td>51</td>
<td>0.9</td>
<td>0.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Any of the above</td>
<td>184</td>
<td>3.2</td>
<td>1.9</td>
<td>1.7</td>
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- MI (clinical or silent), stroke, surgery for CAD
- Except non-melanoma skin
Framingham Underpredicts MI Risk in HIV-Infected Patients

Observed and Predicted MI Rates According to ART Exposure (D:A:D Study)

- D:A:D investigators developing HIV-specific cardiovascular risk equation

Framingham Underpredicts MI Risk in HIV-Infected Patients

Observed and Predicted MI Rates According to ART Exposure (D:A:D Study)

- HIV is an independent risk factor for CVS and other disease
- D:A:D investigators developing HIV-specific cardiovascular risk equation

CASCADE: Nadir CD4+ Cell Count Predicts AIDS and Non-AIDS Events

- CASCADE collaboration cohort: N = 9858
- Several clinical markers of HIV progression correlated with death due to AIDS-related causes, non-AIDS–related severe infection, liver diseases, and non-AIDS–related malignancies including
  - Latest and nadir CD4+ cell counts
  - Time spent with CD4+ cell count < 350 cells/mm³

Section 3: ARE there old people with HIV?
Challenges in Diagnosing HIV-1 in Older Patients

• Health care providers may attribute symptoms of HIV-1 to “normal aging”

• HIV-1–associated neurocognitive impairment and other clinical manifestations misidentified as aging-associated conditions, such as:
  - Stroke
  - Alzheimer’s disease
  - Viral pneumonia
  - Malnutrition
  - Occult malignancies

Granny and Grandpa get around...

- “A cross sectional study showed that more than 80 percent of 50 to 90 year olds are sexually active with cases of many common sexually transmitted infections more than doubling in this age group in the past 10 years”

*Student BMJ* 2012;20:e688.
• Conventional thinking – ageing related to ART
Age at diagnosis is a problem...

- Is it simply that people are living longer?
- London study (6 clinics): 40% 40-50 years; 11% over 50; 25% of them >60! 75% diagnosed in last 10 years...
- CD4 much lower at diagnosis
- ? prevention and risk awareness/VCT programmes do not talk to older people...

Italian study

- 11.4% > 50 years (over 1000 Italians studied)
- Fewer HIV tests, more high risk behaviour, and diagnosed with lower CD4
- Poorer, lower education status, lower use of recreational drugs
- Same condom use (poor!)

Orchi N et al, Ageing with HIV, AIDS Care, April 2008
Increasing Proportion of HIV-1 Population Is Older

Percentage of Persons in the United States With Diagnosed HIV-1 Infection Age 50 Years or Older, by Year (Estimated)

- By 2015, an estimated 50% of people in US with HIV-1 will be 50 years or older

Johannesburg Hospital ART clinic

- <50 years – 91%
- 50-60 years – 7%
- 60-79 years – 1 %
- >70 years – 18 patients (0.6%)

Age at initiation of ART; thanks to Justin Yarrow, RHRU
Assuming this 10% holds

- Minimum of ½ million South Africans > 50 years at the moment with HIV!
Elderly do as well....

- Similar virological and immune responses on ART
What can we do?

• Live life well!
Future

• Is this the new diabetes? Will we manage it in a similar way?
• The ultimate ‘lifestyle disease’
A new paradigm of ageing

- Human life span is 85 years
- Vitality pretty guaranteed till 40!
- Sloth, gluttony after that accelerate slope
- Lifestyle determines vitality and infirmity
- Manage chronic underlying conditions AND lifestyle
The 10 Keys to Healthy Aging

1. Control blood pressure
2. Regulate blood glucose
3. Lipids
4. Stop smoking
5. Be active
6. Participate in cancer screenings
7. Get regular immunizations
8. Prevent bone loss and muscle weakness
9. Combat depression
10. Maintain social contact
HIV and Aging — Preparing for the Challenges Ahead

Edward J. Mills, Ph.D., Till Bärnighausen, M.D., Sc.D., and Joel Negin, M.I.A.

By 2015, half the U.S. population living with human immunodeficiency virus (HIV) infection with HIV. We are still learning about what determines the success of ART in older age groups, and for the treatment of noncommunicable diseases. The failure of both meetings to consider the is-
Causes of death in South Africa

1) Pneumonia
2) TB
3) Diarrhea
4) Hypertension…
6) Diabetes
Causes of death in SA

1) Pneumonia
2) TB
3) Diarrhea
4) Hypertension...
5) Diabetes
BMJ 1990

- “Type 2 DM will be the commonest cause of death in South Africa”
- Lancet 2013: same?
2 Overlapping Epidemics

HIV infection

Obesity

Sugar is as toxic as tobacco and alcohol, scientists say. Photo: Rob Hornner

Public health: The toxic truth about sugar

Robert H. Lustig, Laura A. Schmidt & Claire D. Brindis

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Nature International weekly journal of science
...Over the past decade, it has become widely accepted that inflammation is a driving force behind chronic diseases that will kill nearly all of us (Cancer. Diabetes and obesity. Alzheimer’s disease. Atherosclerosis.)...

...Mediating inflammation in chronic diseases is a new frontier, its success still uncertain...
Traditional risk factors (age, gender, DM, HTN) are major predictors for MI (D:A:D)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Adjusted Model 1</th>
<th></th>
<th></th>
<th>Adjusted Model 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relative Rate</td>
<td>P Value</td>
<td>Relative Rate</td>
<td>P Value</td>
<td></td>
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<tr>
<td></td>
<td>(95% CI)</td>
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<td>(95% CI)</td>
<td></td>
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<tr>
<td>Exposure to PIs (per year)</td>
<td>1.16 (1.10-1.23)</td>
<td>&lt;0.001</td>
<td>1.10 (1.04-1.18)</td>
<td>0.002</td>
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<tr>
<td>Age (per 5 yr)</td>
<td>1.39 (1.31-1.46)</td>
<td>&lt;0.001</td>
<td>1.32 (1.23-1.41)</td>
<td>&lt;0.001</td>
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<tr>
<td>Male sex</td>
<td>1.91 (1.28-2.86)</td>
<td>0.002</td>
<td>2.13 (1.29-3.52)</td>
<td>0.003</td>
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<tr>
<td>BMI &gt;30 kg/m²</td>
<td>1.70 (1.08-2.69)</td>
<td>0.02</td>
<td>1.34 (0.77-2.34)</td>
<td>0.31</td>
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<tr>
<td>Family history of CHD</td>
<td>1.56 (1.10-2.23)</td>
<td>0.01</td>
<td>1.40 (0.96-2.05)</td>
<td>0.08</td>
<td></td>
<td></td>
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<tr>
<td>Smoking status</td>
<td></td>
<td></td>
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<tr>
<td>Current</td>
<td>2.83 (2.04-3.93)</td>
<td>&lt;0.001</td>
<td>2.92 (2.04-4.18)</td>
<td>&lt;0.001</td>
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</tr>
<tr>
<td>Former</td>
<td>1.65 (1.12-2.42)</td>
<td>0.01</td>
<td>1.63 (1.07-2.48)</td>
<td>0.02</td>
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</tr>
<tr>
<td>Previous cardiovascular event</td>
<td>4.30 (3.06-6.03)</td>
<td>&lt;0.001</td>
<td>4.64 (3.22-6.69)</td>
<td>&lt;0.001</td>
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<tr>
<td>Diabetes mellitus</td>
<td>-</td>
<td>-</td>
<td>1.86 (1.31-2.65)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
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<tr>
<td>Hypertension</td>
<td>-</td>
<td>-</td>
<td>1.30 (0.99-1.72)</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol (per mmol/liter increase)</td>
<td>-</td>
<td>-</td>
<td>1.26 (1.19-1.35)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL cholesterol (per mmol/liter increase)</td>
<td>-</td>
<td>-</td>
<td>0.72 (0.52-0.99)</td>
<td>0.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MUST pause: we DON’T know…

- “Although undoubtedly there are higher rates of comorbidities in the HIV-infected population, there are a number of possible explanations for this as well as the possibility that HIV or HAART causes premature ageing.”
- NOT CLEAR that HIV be people are demented, aggressively ageing, getting more CVS disease/cancer
- We need more data
Fatter may be better...

Clinical Infectious Diseases Advance Access published September 26, 2011

MAJOR ARTICLE HIV/AIDS

An Optimal Body Mass Index Range Associated With Improved Immune Reconstitution Among HIV-Infected Adults Initiating Antiretroviral Therapy

John R. Kothe,1 Cathy A. Jenkins,2 Bryan E. Shepherd,2 Samuel E. Stinnette,1 and Timothy R. Sterling1,3

1Department of Medicine, Division of Infectious Diseases and Departments of 2Biostatistics and 3Medicine, Center for Health Services Research,

Conclusions. 12-month immune reconstitution on ART was highest among patients commonly classified as overweight, suggesting there may be an optimal BMI range for immune recovery on ART.
The 11 Keys to Healthy Aging in HIV

1. Viral suppression after early diagnosis
2. Control blood pressure
3. Regulate blood glucose
4. Lipids
5. Stop smoking
6. Be active
7. Participate in cancer screenings
8. Get regular immunizations
9. Prevent bone loss and muscle weakness
10. Combat depression
11. Maintain social contact
What can we do?

- **Start ART earlier** – need earlier testing – clear that the lower the CD4, the higher the risk of diseases of ageing; but optimal time 350, or above

- **Context of care** – other things are very important – poverty, depression

- **Aggressive risk factor management** – think diabetes, not the general population

- **TB prevention** – INH probably a good idea

- **Focus on quality of live of the four-score and five** – disease prevention!
REMEMBER THE TWENTY EXTRA YEARS YOU ADDED TO YOUR LIFE THROUGH CLEAN, HEALTHY LIVING? - WELL, THESE ARE THEM.
The end...