The economics of TasP

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Global HIV/AIDS Program
The World Bank

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The economics of TasP

- Public goods
- Burden of AIDS
- Population level effectiveness and implementability of TasP
- Cost-effectiveness of TasP
- Current AIDS financing
- Required AIDS financing
- Smarter implementation
- Conclusion
Public goods

• Public goods non-excludable and non-rivalrous:
  – individuals can’t be excluded from use
  – use by any individual doesn’t reduce availability to others
  – Eg. clean air and street lighting
Public goods – TasP and HIV?

• TasP not a public good but ART has major positive externalities

• Elimination of HIV a public good – non-excludable and non-rivalrous

• Economic analysis of TasP must focus on feasibility, affordability, probability and cost-effectiveness of eliminating HIV
From the positive externalities of TasP to the public good of AIDS elimination

- ART
  - Benefits to non-users, including reduced HIV transmission, health and social expenses, increased productivity, household income, and parental participation

- AIDS elimination
  - Benefits everyone, without excluding anyone

Feasibility, affordability, probability, and cost-effectiveness of eliminating HIV
The economics of TasP

- Public goods

- **Burden of AIDS**

- Population level effectiveness and implementability of TasP

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AIDS fastest growing cause of disease burden globally in last 20 years
AIDS and malaria greatest causes of disease burden in Sub-Saharan Africa

IHME/World Bank, 2013
AIDS by far the largest cause of disease burden in Uganda
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Population level effectiveness of TasP

• **TasP clinical trial efficacy** 96%+

• **TasP real world effectiveness** lower?
  
  – Infection **34% lower** in area with 30%-40% ART coverage (the effect saturation point) than area with <10% coverage in KZN (Tanser et al, 2013)
  
  – Infection **26% lower** in discordant couples in China - for transfusion or sexually infected but not IDU infected indexes (Jia, 2012)
  
  – **No difference** in discordant couples in Uganda (Birungi et al. 2013)
  
  – HIV infections **rising** in highly treated MSM communities in developed countries (Wilson et al, 2012)
  
  – Less effective in MSM epidemics? (Cohen 2013)
  
  – With ~85% on ART at CD4<350, Swaziland has measured HIV incidence of 2.4% on top of 26% adult prevalence (SHIMS, 2013)
## Population level effectiveness of TasP

<table>
<thead>
<tr>
<th></th>
<th>HPTN 071 (PopART)</th>
<th>TasP</th>
<th>Botswana/ HSPH</th>
<th>SEARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sites</strong></td>
<td>Lusaka, Cape Town</td>
<td>South Africa</td>
<td>Mochudi, Botsana</td>
<td>Kenya, Uganda</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>Cluster RCT 24 @ 55,000 3 arm</td>
<td>Cluster RCT 34 @ 1,250 2 arm</td>
<td>Paired cluster RCT, 30 @ 5,000, 2 arm</td>
<td>Paired cluster RCT, 32 cl @ 10,000, 2 arm</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td><strong>Immediate ART if HIV+</strong> HCT, VMMC, condom, risk reduction counselling</td>
<td><strong>Immediate ART if HIV+</strong> HCT home-based</td>
<td><strong>ART for CD4&lt;350, WHO I/II or VL&gt;10,000</strong> HCT, VMMC, PMTCT-B</td>
<td><strong>Immediate ART if HIV+</strong> Combination HIV prevention package</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>2 year HIV incidence in cohort</td>
<td>2 year HIV incidence in cohort</td>
<td>Cumulative 2 year HIV incidence in cohort</td>
<td>Cumulative HIV incidence 3 + 5 years, cross-sectional</td>
</tr>
</tbody>
</table>
Implementability of TasP: Numbers

- 9.7 million on ART - 26 million eligible at CD4<500 and 32 million eligible for “test and treat”

1. **11 million**
   - CD4 ≤ 200
   - Recommended until 2010

2. **17 million**
   - CD4 ≤ 350
   - + TB/HIV
   - HBV/HIV
   - Recommended since 2010

3. **21 million**
   - CD4 ≤ 350
   - + TB/HIV
   - HBV/HIV

4. **26 million**
   - CD4 ≤ 500
   - + TB/HIV
   - HBV/HIV
   - SD couples
   - Pregnant
   - Children < 5

5. **32 million**
   - “Test and treat”
   - All HIV+

- ART regardless of CD4 count for:
  - HIV-SD couples
  - Pregnant women

Apollo et al, 2013

- Recommended since 2010
- Recommended until 2010

- 9.7 million on ART
- 26 million eligible at CD4<500
- 32 million eligible for “test and treat”
Implementability of TasP: Access and implicit rationing

KAMPALA, 12 June 2013 - Uganda has run out of most ARVs, HIV testing kits, drugs to treat OIs, according to a recent Ministry of Health stock status report (1).

Malawi: Insufficient resources prevent switch to tenofovir – HIV+ pregnant women, patients co-infected with HIV and TB, and those with severe reactions to stavudine are being prioritized (2).

Zambia, 21 Aug 2013 - The Zambian government has introduced a rationing system for antiretroviral drugs causing concern among people living with HIV (3).

3. http://www.trust.org/item/20130821105629-qn26o
Implementability of TasP: Cascades

US treatment cascade - 28% virally suppressed

West Africa treatment cascade - 10% virally suppressed

U Montpellier, 2013
Implementability of TasP:
Retention

WHO/UNAIDS 2012

<60%
<50%

percentage

12 months
24 months
60 months

Malaysia
Bolivarian Republic of Venezuela
Mexico
Burundi
Botswana
Cambodia
Guatemala
Ecuador
Namibia
Togo
Niger
Swaziland
China
Brazil
Kenya
Ethiopia

<60% Malawi
<50% Indonesia
Implementability of TasP:
Viral load

Kranzer et al, 2013
Implementability of TasP: Resistance

Acquired HIV drug resistance in low resource settings

- 6-11 months
- 12-23 months
- 24-35 months
- >36 months

Stadeli et al, 2013
Implementability of TasP: Unknowns

• Feasibility and cost of identification, enrolment, retention and adherence of:
  • Last 20-30%
  • Most marginalized
  • The healthy
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• After treatment:
  • All adult mortality declined by 20% in Africa (Herbst et al, 2009)
  • Population level life expectancy increased by 11 years in South Africa (Bor et al, 2013)
  • Adult working hours increased, child labor declined and children’s nutrition and school attendance increased in Kenya (Goldstein et al, 2010)
  • Absenteeism declined to pre-infection levels in Botswana Habyarimana J et al, 2007)
Cost-effectiveness of TasP: South Africa

- Barninghausen et al examined cost-effectiveness of ART, MC and TasP in South Africa from 2009-2020
- All cost-effective at WHO rule of 3x/per capita GDP
- Significant cost savings through optimal intervention mix without compromising prevention or mortality
- High ART+MC coverage similar HIV incidence reduction as TasP
- High ART+MC coverage $5 billion less expensive than TasP
- Increased MC ($1,100 per infection averted) outperforms ART ($6,800) and TasP ($8,400)
- Most cost-effective prevention and mortality scenario is MC first then ART - 50% ART and 60% MC coverage optimal
- MC more cost-effective than TasP because cost is one-ninth, accrued once versus lifetime
- As only half needing ART at CD4<350 receive it, increasing treatment in this group should precede treatment expansion to earlier disease stages
<table>
<thead>
<tr>
<th>Item</th>
<th>Mysore</th>
<th>Belgaum</th>
<th>Bellary</th>
<th>Guntur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of general population</td>
<td>480,000</td>
<td>460,000</td>
<td>490,000</td>
<td>620,000</td>
</tr>
<tr>
<td>Size of FSW population</td>
<td>2300</td>
<td>2000</td>
<td>4300</td>
<td>6400</td>
</tr>
<tr>
<td>% gen pop HIV positive</td>
<td>0.94%</td>
<td>0.63%</td>
<td>1.36%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Cost of testing general population every 5 years (US$)</td>
<td>960,000</td>
<td>920,000</td>
<td>980,000</td>
<td>1,240,000</td>
</tr>
<tr>
<td>Estimate of annual test-and-treat costs</td>
<td>4,600,000</td>
<td>3,200,000</td>
<td>6,300,000</td>
<td>10,600,000</td>
</tr>
<tr>
<td>Annual cost of core group intervention</td>
<td>470,000</td>
<td>400,000</td>
<td>570,000</td>
<td>1,200,000</td>
</tr>
</tbody>
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$16.8 billion AIDS financing in 2011

- **USA**: 25%
- **Global Fund**: 6%
- **Bilateral**: 9%
- **Philantropic**: 1%
- **Development banks/funds**: 1%
- **Domestic public**: 1%
- **Domestic private**: 9%

UNAIDS, 2012
Trajectory and sources of AIDS financing

UNAIDS, 2012
Allocation of AIDS financing, 2009-2011

- Antiretroviral drugs
- Psychological care
- Laboratory monitoring
- PICT
- Nutritional support
- HBC
- OIs & palliative care
- OVCs
- HR incentives
- Social protection
- Research
- Management

53% for care and treatment

UNAIDS, 2012
Treatment dominates HIV budgets in concentrated epidemics
Treatment increasingly dominates budgets in generalised epidemics
Treatment still reliant on international financing

- 43 LMIC finance over 75% of treatment costs from international sources
- Another 59 LMIC finance over half of treatment costs from international sources
- In Malawi, treatment costs externally financed and almost equal to total health budget
LMIC domestic AIDS spending has grown, especially in UMC

UNAIDS, 2012
The BRICS have stepped up

- Brazil and Russia now fund almost all their AIDS programs.
- China will fund its entire AIDS program after GF resources end.
- India funds 93% of its AIDS program.
- South Africa’s AIDS budget grew 500% in a decade to $1.9 billion, the second largest globally.
Declining overall development assistance

2% decline in 2011
4% decline in 2012
Many competing priorities:

Post-2015 MDG High Level Panel Report Word Cloud
Africa’s rapid economic growth since 2000

Africa’s annual real GDP, 2010

$ billion

Compound annual growth rate, %

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

589 563 570 683 837 981 1125 1310 1533 1445 1684

4.3 1.9 3.3 5.2 6.0 6.1 6.3 6.5 5.5 3.0 4.8

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
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Treatment expansion scenarios

By 2010: 5.1 million people
By 2011: 6.2 million people
By 2012: 9.7 million people

Practice
- <200 CD4: 11 million people
- <350 CD4: 17 million people
- <350 + selected pop's: 21 million people
- <500 + selected pop's: 26 million people
- All HIV+: 32 million people
Required global financing

• In 2011, global AIDS care and treatment spending was $5 billion

• Treating all 26 million PLHIV at CD4<500 could cost $16 billion annually

• Treating all PLHIV could cost $20 billion annually

• Economies of maturity and scale offset by greater cost to reach and retain hard to reach and healthy
Treatment at CD4<500 could equal South Africa’s entire health budget

South Africa GARPR 2012, MoF 2013, Meyer-Rath PloS 2012 (average unit cost $800)
TasP could equal 10% of Nigeria’s health budget

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Treatment expansion outpaced resource growth as efficiency increased

UNAIDS / WHO, 2012
Major declines in drug costs, 2008-2011

UNAIDS/WHO 2012 Global price reporting mechanism
Task shifting to reduce personnel costs in Kampala, Uganda

Reduce management costs to increase efficiency
Site maturity and client volume major determinants of cost per patient.

Menzies et al, 2012

-50%
Blue dots show higher cost (less efficient) facilities

Drive costs from inefficient blue to efficient red spectrum

Red dots represent lowest cost (most efficient) facilities
Scientific innovation may further reduce costs

- Cheaper, better diagnostics?

- Longer acting ART?

- Lower dose ART?

- Treatment interruption with early initiation or new drugs?
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**Conclusion**
Conclusion

• TasP feasible in high income countries with limited epidemics and early treatment initiation

• In lower income countries with large epidemics, approach TasP with progressively earlier initiation of those with more advanced infection

\[ \text{CD4} < 200 \quad \rightarrow \quad \text{CD4} < 350 \quad \rightarrow \quad \text{CD} \text{\$} < 500 \]

• Redouble focus on male circumcision

• In high burden counties, TasP progress painstaking, incremental, patient-by-patient, building demand, sustaining quality – no short cuts