

Reflections on the use of future HIV vaccines as part of an integrated package of preventive measures

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2016 Global Vaccine & Immunization Research Forum
(GVIRF)

15 – 17 March 2016 Johannesburg, South Africa

INTRODUCTION

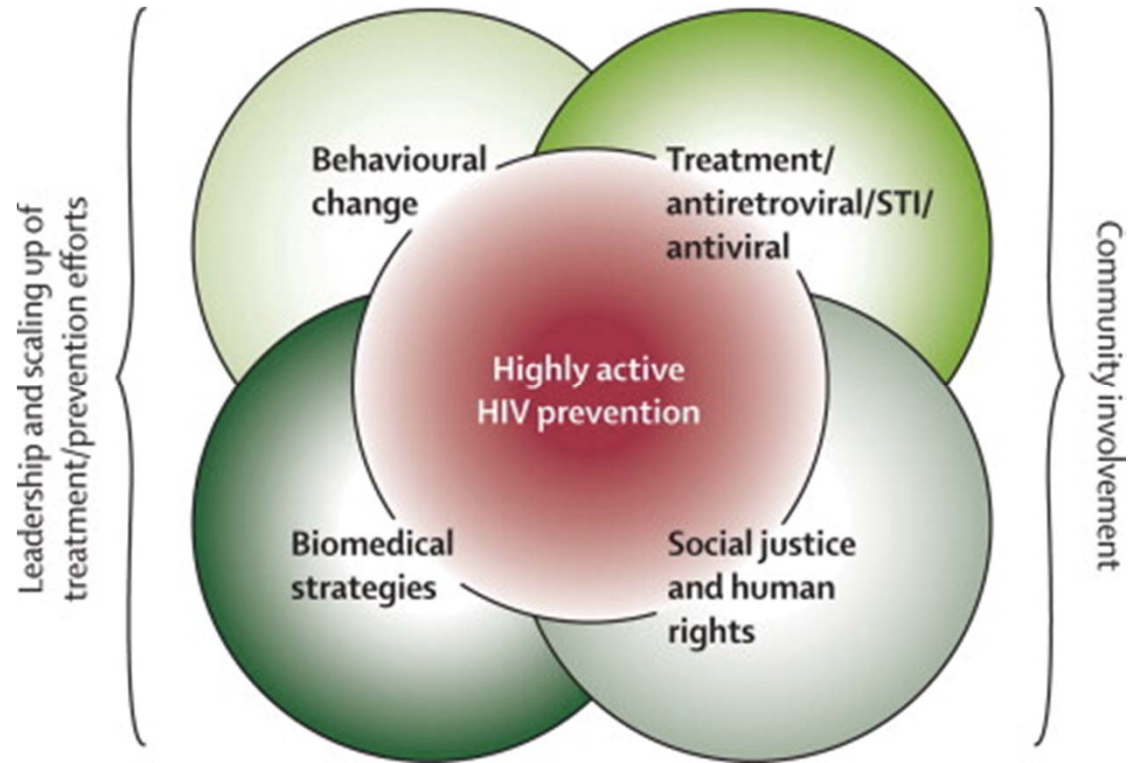
- Investment Framework for HIV/AIDS urges rational use of resources to confront the epidemic
- Countries should focus on programs of proven effectiveness
 - ✓ PMTCT
 - ✓ Condom promotion & distribution
 - ✓ Programs for key populations (SWs & their clients, MSM, IDU)
 - ✓ Treatment, care & support for those living with HIV
 - ✓ VMMC
 - ✓ Targeted behaviour change programs
- Its full implementation expected to avert at least 12.2M new HIV infections & 7.4M AIDS deaths by 2020

INTRODUCTION

- A lot of gains in development of new tools for HIV prevention
 - ✓ Adult Male Medical Circumcision
 - ✓ Treatment as Prevention
 - ✓ Pre-exposure Prophylaxis
- Promising results in research on other prevention methods
 - ✓ Microbicides
 - ✓ Vaccines

Both with efficacy of >30%

INTRODUCTION



Success in HIV prevention will require combination approach and therefore a preventive HIV vaccine is an additional tool not a stand alone prevention tool

INTRODUCTION

- But what contribution would a preventive HIV vaccine make in the battle against HIV?
- Reflection using an e.g. of Kenya, a low income country
- Thoughts drawn from work conducted at KAVI-ICR, UoN

What impact would an HIV/AIDS vaccine have on the HIV/AIDS epidemic in Kenya?

Anzala *et al.* Open Journal of Immunology

INTRODUCTION

- HIV prevalence in Kenya in 2007 was 7.8%
- Prevention - BCC, PICT, PMTCT, condoms, abstinence, VMMC etc have contributed to lowering no. of new infections
- Reducing trend in new infections in urban areas but not in rural populations & among most-at-risk populations
- About 120,000 (71,000 - 155,000) new infections/year
- Critical need for other prevention technologies to combat & ultimately end the epidemic in Kenya
- Preventive vaccine considered best hope of ending epidemic

INTRODUCTION

- Mathematical modelling & computer simulation
- Aim = studying potential impacts of a HIV vaccine on the HIV pandemic in Kenya
- KAVI – ICR, IAVI, Futures Institute & KARSCOM
- Used available data; population 15-49; compartments based on their behaviour, HIV & immunization status; 5 risk groups (Low-risk heterosexual, Medium-risk heterosexual, High-risk heterosexual, High-risk MSM, High-risk IDUs)
- One enters model as not sexually active, remain in category until median age at 1st sex, is moved into one of risk groups
- Medium & high risk remain in group or move to a lower-risk

Vaccine scenarios

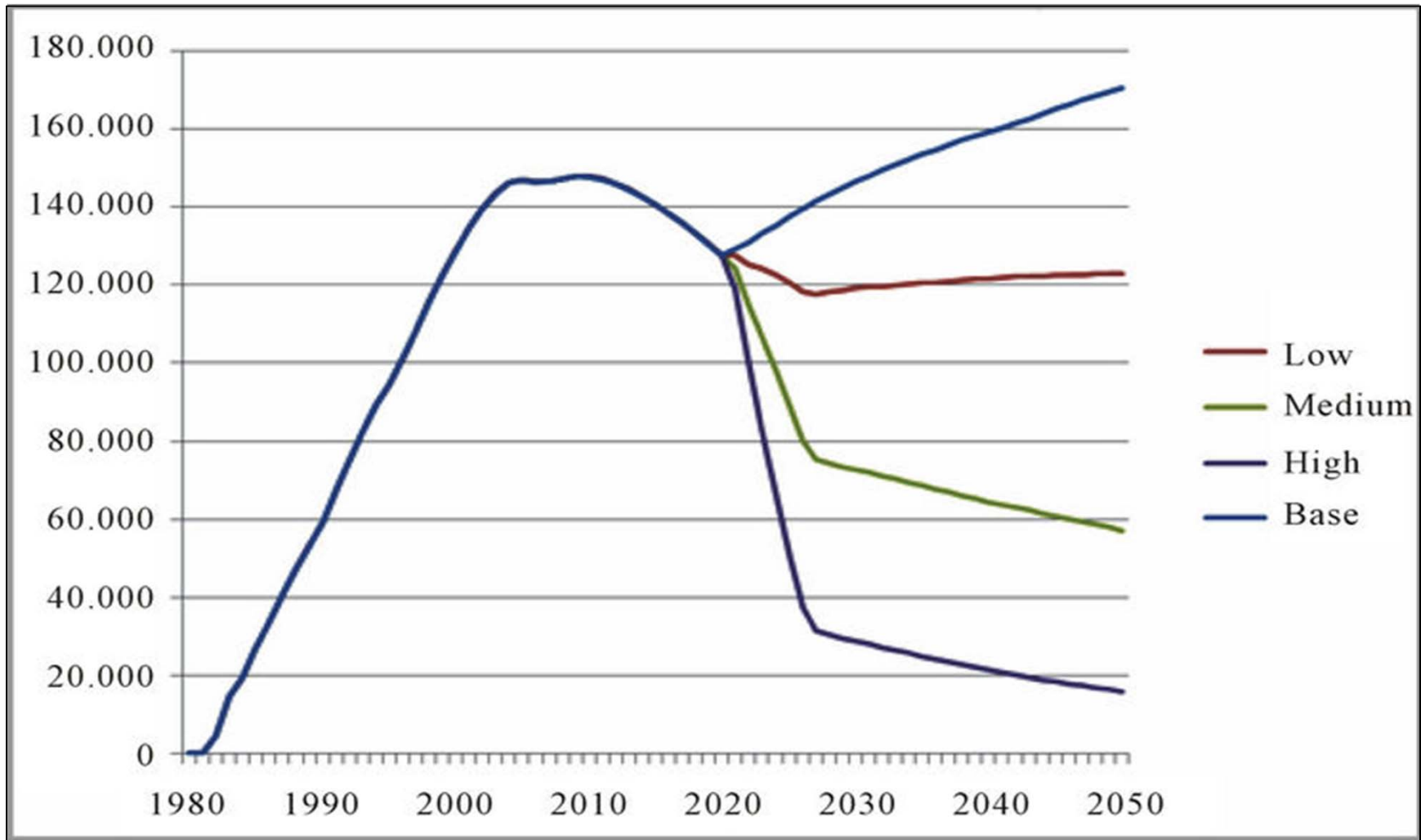
- 3 plausible scenarios constructed to reflect current vaccine science & Kenyan response to the epidemic
- Looked at impact of a vaccine with varying effectiveness (30%, 50% & 70%) & coverage (30%, 50% & 70%) of 15 - 49 yrs old
- Vaccine is assumed to be introduced in year 2020 & coverage scaled up to the maximum by 2025
- Coverage then remains constant until 2050
- Assume vaccine will protect individuals for duration of 20 yrs
- Model assumed vaccination administered without HIV testing

RESULTS

Year	New infections	Incidence	Prevalence	Number of adults
1990	59,339	0.62	2.67	9,873,624
2000	128,590	0.92	5.76	14,827,138
2010	147,560	0.79	7.10	20,126,852
2020	127,419	0.52	6.69	26,439,312
2030	146,324	0.46	5.73	34,231,152
2040	159,181	0.41	5.16	41,300,200
2050	170,406	0.37	4.74	48,068,916

HIV incidence base projection

RESULTS



HIV infection in Kenya by year & vaccine scenario (2020-2050)

RESULTS

Vaccine scenarios	Efficacy	Percentage of population given vaccine	New infections averted, 2020-2050	Deaths averted, 2020-2050	Percentage reduction in new infections
LOW	30%	30%	1.4 million	409.000	25%
MEDIUM	50%	50%	2.3 million	850.000	65%
HIGH	70%	70%	3.5 million	1.233.000	90%

Effect with different vaccine efficacy

RESULTS

Vaccine Strategy	Percentage Reduction in New Infections, 2020-2050	New Infections Averted, 2020-2050	Vaccinations Required, 2020-2050	Vaccinations Per Infections Averted
HIGHER COVERAGE 80% 80% coverage of medium-and high-risk and 50% of low risk groups	72%	2.67 million	69.4 million	26
MEDIUM-AND HIGH-RISK ONLY 50% coverage of medium-and high-risk groups	26%	950,000	8.6 million	9
HIGH-RISK ONLY 50% coverage of high-risk groups	3%	120,000	1.4 million	12
MEDIUM 50% coverage of adult population	65%	2.4 million	62.4 million	26

Potential impact of different vaccine strategy in Kenya

RESULTS

- Vaccines has significant savings compared to present value of future treatment costs
- Infection averted means person wont need ART in the future
- In Kenya, lifetime costs of care & treatment app **US\$7000**
- Prevention intervention costing <USD\$ 7000 cost-effective
- To break even for medium efficacy vaccine scenario cost per vaccination would be $(\text{US\$}7000/26) = \text{\$}269$

Cost-effectiveness of HIV vaccine

CONCLUSION

- Scaling-up all currently available treatment & prevention options will make an impact on the epidemic in Kenya, but we will still experience $> 170,000$ new infections/year by 2050, **THUS THERE IS AN URGENT NEED FOR A VACCINE**
- Even a vaccine with efficacy of 50% & with 50% population coverage would have a significant impact in reducing number of new infections & deaths by the year 2050
- **Targeting high risk group only provides less overall impact than targeting general population**

Other factors to consider

- Infrastructure required to achieve expected results predicted
- Costs involved in manufacture of the vaccine
- Cost for vaccination coverage & the logistics involved
- If target is HIV -ve individuals additional costs for testing large numbers of people will have to be taken into consideration
- Introduction of a partially effective AIDS vaccine may result in some degree of behavioural disinhibition hence education & awareness campaigns needed prior to introduction of vaccine

Interactive impact modelling tool

- IAVI/Futures Institute have developed a tool that allows users to explore the interaction of future potential AIDS vaccines with existing HIV-prevention tools within an HIV epidemic in southern Africa, eastern Africa, Asia, Latin America & Eastern Europe

<http://www.iavi.org/what-we-do/advocacy/policy/impact-modeling>

ACKNOWLEDGMENT

- KAVI-ICR TEAM, UNIVERSITY OF NAIROBI, KENYA
 - ✓ Omu Anzala
 - ✓ Gaudensia Nzembi Mutua
 - ✓ Fredrick Jack Odia Oyugi
 - ✓ Bashir Farah Mohamed
- SCHOOL OF MATHEMATICS, UNIVERSITY OF NAIROBI, KENYA
 - ✓ Thomas Achia
- FUTURES INSTITUTE, NEW LONDON, GLASTONBURY, USA
 - ✓ John Stover



International AIDS Vaccine Initiative

IAVI gratefully acknowledges the generous support provided by the following major donors.*



Canadian International Development Agency

Agence canadienne de développement international



Buitenlandse Zaken

Alfred P. Sloan Foundation
 Basque Autonomous Government
 Becton, Dickinson and Company (BD)
 Bill & Melinda Gates Foundation
 Broadway Cares/Equity Fights AIDS
 Canadian International Development Agency
 Continental Airlines
 Crusaïd
 Deutsche AIDS-Stiftung
 European Union
 Google Inc.
 The Haas Trusts
 Irish Aid
 The John D. Evans Foundation
 Kathy Bole & Paul Klingenstein
 Merck & Co., Inc.

The Netherlands Ministry of Foreign Affairs
 The New York Community Trust
 Norwegian Royal Ministry of Foreign Affairs
 Pfizer Inc
 The Rockefeller Foundation
 Royal Danish Ministry of Foreign Affairs
 The Starr Foundation
 Swedish International Development Agency
 Swedish Ministry of Foreign Affairs
 U.K. Department for International Development
 Until There's a Cure Foundation
 The U.S. President's Emergency Plan for AIDS Relief through the U.S. Agency for International Development
 The World Bank/Global Forum for Health Research



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 * As of 11/06

