• “Zero new infections”… By 2015
  - 50% reduction in HIV incidence through sexual transmission
  - Elimination of vertical transmission
HIV Prevention: Opportunities and Challenges

• New technological approaches
  - “Treatment for prevention”
  - Circumcision

• Increasing focus on prevention, globally and at the country level
  - What drives the epidemics in different countries, and at the local level?
  - What is the right mix of interventions?

• Declining financial resources:
  - Resource allocation must be strategic to achieve impact efficiently
“...the systematic application of theoretical and empirical scientific knowledge to improve the design, implementation and evaluation of public health programmes.”
HIV Prevention – “What’s Science got to do with it?”

- Discover new technologies and biomedical interventions
- Assessing the efficacy and effectiveness of interventions, and combinations of interventions
- Building knowledge about what creates and sustains epidemics, and where to focus prevention efforts
- Optimizing the implementation and efficiency of programs through operations research
- Evaluating the impact and cost-effectiveness of interventions and programs
What is a public health “Program”?

• A set of interrelated activities and services addressing a defined public health issue
• Defined leadership, budget, authority and responsibilities
• Defined goals, objectives and strategies
Science

Goal Setting

Monitoring & Evaluation

Implementation

Planning & Design

Strategic Priorities
Programme Science Components – Key Issues

Strategic Planning
- HIV transmission dynamics
- Local epidemic appraisal

Programme Implementation
- Selection of intervention mix
- Tailoring interventions to local settings

Programme Management
- System models for scaling up
- Monitoring and impact evaluation methods
Strategic Planning – the first Program Science challenge

• Getting the right “footprint” – matching resources to where the epidemic is most severe

• Matching prevention objectives and strategies to HIV transmission dynamics

• Covering the key populations
Global Fund Financing for HIV prevention by Types of Epidemics, 2010

Source: Global Fund data
<table>
<thead>
<tr>
<th>Mode of Transmission</th>
<th>Total number with risk behaviour</th>
<th>Percentage with risk behaviour</th>
<th>Incidence</th>
<th>% of incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injecting Drug Use (IDU)</td>
<td>994</td>
<td>0.0%</td>
<td>258</td>
<td>0.28</td>
</tr>
<tr>
<td>Partners IDU</td>
<td>252</td>
<td>0.0%</td>
<td>10</td>
<td>0.01</td>
</tr>
<tr>
<td>Sex workers</td>
<td>32,652</td>
<td>0.3%</td>
<td>833</td>
<td>0.91</td>
</tr>
<tr>
<td>Clients</td>
<td>189,381</td>
<td>1.5%</td>
<td>7,172</td>
<td>7.83</td>
</tr>
<tr>
<td>Partners of Clients</td>
<td>108,676</td>
<td>0.8%</td>
<td>1,660</td>
<td>1.81</td>
</tr>
<tr>
<td>MSM</td>
<td>3,976</td>
<td>0.0%</td>
<td>559</td>
<td>0.61</td>
</tr>
<tr>
<td>Female partners of MSM</td>
<td>1,569</td>
<td>0.0%</td>
<td>92</td>
<td>0.10</td>
</tr>
<tr>
<td>Multiple partnership</td>
<td>1,808,919</td>
<td>13.9%</td>
<td>21,722</td>
<td>23.73</td>
</tr>
<tr>
<td>Partners MP</td>
<td>1,417,881</td>
<td>10.9%</td>
<td>19,925</td>
<td>21.76</td>
</tr>
<tr>
<td>Mutual monogamous heterosexual sex</td>
<td>6,022,317</td>
<td>46.1%</td>
<td>39,261</td>
<td>42.89</td>
</tr>
<tr>
<td>No recent risk</td>
<td>3,474,169</td>
<td>26.6%</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Medical injections</td>
<td>13,060,787</td>
<td>100.0%</td>
<td>54</td>
<td>0.06</td>
</tr>
<tr>
<td>Blood transfusions</td>
<td>134,053</td>
<td>1.0%</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Uganda “Know Your Epidemic, Know Your Response” Analysis

ii) Policies and guidelines for HIV counselling and testing, IEC/mass media, and behaviour change interventions should be reviewed and strengthened with a view to targeting the following population sub-groups:

a. Persons in long-term marital or co-habiting partnerships
b. Discordant couples
c. Persons living with HIV and AIDS
d. Most-at-risk populations (MARPs) including commercial sex workers, uniformed services, fishing communities, truck drivers, MSMs and IDUs
Discordant Couples in Uganda - Analysis from Rakai*

<table>
<thead>
<tr>
<th>Status</th>
<th>% of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not married / not in consensual relationship</td>
<td>39%</td>
</tr>
<tr>
<td>Currently married / in consensual relationship</td>
<td>61%</td>
</tr>
<tr>
<td>Concordant HIV negative couples</td>
<td>39%</td>
</tr>
<tr>
<td>Discordant couples</td>
<td>2%</td>
</tr>
<tr>
<td>Unknown partner status</td>
<td>20%</td>
</tr>
</tbody>
</table>

Development of a Program Science Consortium

• 3 global meetings in 2010-11, funded by the NIH (OAR) and CIHR

• Participants:
  - **Science:** London School of HTM, University College (London), Imperial College, Johns Hopkins, U of Washington, Family Health International, U of Manitoba
  - **Program/policy leaders:** World Bank, Global Fund, UNAIDS, USAID/PEPFAR, Gates Foundation
  - **Country Program leaders:** India, Kenya, Nigeria, USA, Canada
“Global HIV Prevention Program Science Technical Support and Knowledge Management”*

- Countries of focus:
  - India, Kenya, Nigeria, Pakistan, +2 (TBD)

- Epidemic appraisal
  - Understanding epidemic typologies and drivers

- Strategic planning
  - Tailoring prevention objectives and resource allocation to maximize population-level impact

- Implementation planning and support
  - Improving effectiveness and efficiency

* Supported by the Global HIV/AIDS Program of the World Bank
Global Program Science Initiative – A Knowledge Translation Network

Global Program Science Group

India

Pakistan

Other Country

Nigeria

Kenya

Other Country

Global bodies

Other countries
Key Methods for Knowledge Development and Translation

• “Program Science” platforms:
  - Working with HIV programs at the national and state levels
  - Focusing on iterative evidence-planning-implementation approaches

• “Learning Sites”:
  - Learning about what works
  - Building capacity for others

• Knowledge synthesis and dissemination
  - Country to country
  - Packaging lessons for global dissemination
Nigeria – HIV Prevention Context

• Contributes second highest number of new HIV infections globally
• Very large investments for HIV (US Govt, GFATM, World Bank, DfID)
• Most investments have been for:
  – HIV counseling and testing
  – Treatment, care and support
  – PMTCT
• Concerted national effort for HIV prevention underway
Nigeria HIV Prevention Policy

- Minimum Prevention Package Interventions (MPPI) Approach
  - “Combination Prevention”
  - Differentiated by population group

- Challenges:
  - Epidemic heterogeneity
  - Diversity in socio-cultural characteristics and sexual structure

- Program Science questions
  - How best to allocate resources within a state?
  - Optimizing coverage levels to the right populations
  - Selecting the right intervention-population mix
HIV Prevalence in Nigeria - by State

<table>
<thead>
<tr>
<th>Epidemic Type</th>
<th>Concentrated</th>
<th>Generalized</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Saturation coverage of most at risk key populations with high quality targeted interventions</td>
<td>Programming and policies to change behavioural norms at the population level Reduce multiple partnerships and concurrency High coverage of PMTCT programs</td>
<td>High coverage targeted interventions for MARPs, focusing on populations and locations where there is substantial overlapping with general population networks Programming and policies to change key behavioural norms in focused areas with specific populations</td>
</tr>
</tbody>
</table>
Nigeria – Program Science Initiative

State Level Epidemiological Syntheses

Local Epidemic Appraisal

Implementation Support

HIV Prevention Planning & Implementation
<table>
<thead>
<tr>
<th></th>
<th>Nasarawa</th>
<th>Kaduna</th>
<th>Ondo</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV prevalence - general</td>
<td>6.8%</td>
<td>6.3%</td>
<td>0.9%</td>
</tr>
<tr>
<td>HIV prevalence - ANC - most recent</td>
<td>10.0%</td>
<td>7.0%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Highest most recent local prevalence if avail</td>
<td>19.5%</td>
<td>17.7%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Multiple partners - men</td>
<td>11.4%</td>
<td>19.1%</td>
<td>18.8%</td>
</tr>
<tr>
<td>Multiple partners - women</td>
<td>1.4%</td>
<td>4.9%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Non-marital partner - men</td>
<td>44.3%</td>
<td>9.2%</td>
<td>47.7%</td>
</tr>
<tr>
<td>Non-marital partner - women</td>
<td>12.2%</td>
<td>0.9%</td>
<td>20.8%</td>
</tr>
<tr>
<td>Know where HIV test - men</td>
<td>55.3%</td>
<td>54.4%</td>
<td>61.0%</td>
</tr>
<tr>
<td>Know where HIV test - women</td>
<td>22.3%</td>
<td>70.9%</td>
<td>62.0%</td>
</tr>
<tr>
<td>HIV test ever - men</td>
<td>19.9%</td>
<td>9.0%</td>
<td>7.0%</td>
</tr>
<tr>
<td>HIV test ever - women</td>
<td>7.8%</td>
<td>15.4%</td>
<td>17.0%</td>
</tr>
<tr>
<td>Paid for sex - men</td>
<td>3.4%</td>
<td>0.6%</td>
<td>0.3%</td>
</tr>
<tr>
<td># lifetime partners - men</td>
<td>4.6</td>
<td>4.1</td>
<td>5.3</td>
</tr>
<tr>
<td># lifetime partners - women</td>
<td>1.3</td>
<td>1.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Condom use - non-marital - men</td>
<td>40.4%</td>
<td>15.7%</td>
<td>62.0%</td>
</tr>
<tr>
<td>Condom use - non-marital - women</td>
<td>10.5%</td>
<td>24.3%</td>
<td>38.0%</td>
</tr>
</tbody>
</table>
Components and Purposes of Epidemic Appraisals

Epidemiological Assessments
- Status of the epidemic
- Population distribution
- Basic epidemic typology
- High level HIV prevention priorities

Modeling Transmission Dynamics
- Assessing the relative importance of sub-populations
- Projecting the impact of interventions
- Prioritizing sub-populations
- Prioritizing intervention mixes

Local Epidemic Appraisals
- Determining the distribution and characteristics of key populations
- Planning local implementation
Developing State Level HIV Prevention Prioritization and Implementation Plans

Assess Epidemic Typology

Set High Level Prevention Objectives

Local Epidemic Appraisal

Developing HIV Prevention Plan

Develop Operational Plan

Implement and Monitor Progress

Evaluation Plan
Three Approaches to Epidemic Rapid Appraisals – 9 States

- Mapping MARPs
- Assess other high risk networks:
  - Identify locations where people meet new sexual partners:
  - Identify other methods that people meet new sexual partners
  - Assess what high risk behaviours are prevalent and what groups are involved
  - Gain understanding of the social dynamics in different groups who have higher levels of risk behaviours
- Assess key behavioural patterns in the “general” population
Some key research questions for epidemic appraisals

• What is the size and contribution of defined key populations to the overall epidemic?
  - Female sex workers
  - MSM, IDU

• What are the operational typologies for sex work and transactional sex, and how does this translate to intervention strategies?

• What is the extent, nature and context for intersections between MARPs and other high risk sexual networks?

• What are the key aspects of the sexual structure in the general population driving HIV transmission, particularly in rural areas?
Implementation Process and Progress

Science team work intensively with NACA and SACAs from 9 states

- Review existing epidemiological data
- Develop initial HIV prevention prioritization and implementation policy briefs
- Design protocols for state-level epidemiological appraisals, based on initial assessment of epidemic typology
- Train NACA, SACAs and national technical working groups in epidemic appraisals
- Train and support state teams for implementing epidemic appraisals
Next Steps

• Summarize results of epidemic appraisals and translate them into detailed implementation plans:
  - Geographic and sub-population focus
  - Intervention mix and implementation modalities

• Implementation support:
  - Capacity building for implementers
  - Intervention standards, guides and tools
  - “Learning Sites” – learn by doing (operations research), training others
Pakistan – HIV Prevention Context

• National HIV prevention planning focused on targeted interventions for most at risk populations (MARPs).
  - Heavy emphasis on IDU
  - Highly decentralized response
• Declining resources for HIV prevention
• Uneven capacity for implementation
Pakistan – A highly concentrated epidemic
Pakistan Epidemic Typology

• A mix of three sub-epidemics
  - IDU - oldest and most severe
  - MSW / HSW - expanding in many cities
  - FSW - emerging in cities with older and more advanced epidemics

• Heterogeneous
  - Severity and distribution of sub-epidemics differs by city
Graphs showing trends in different cities:

- **Karachi**
- **Larkana**
- **Lahore**
- **Faisalabad**

The graphs depict the number of individuals (IDU, Male / Hijra SW, FSW) over time (years 1990 to 2025). The x-axis represents years from 1990 to 2025, and the y-axis represents the number of individuals.
Relative Size of IDU Populations in Cities of Pakistan

69% of IDUs
Relative Size of FSW Populations in Cities of Pakistan

72% of FSWs
Relative Size of Hijra (transgender) SW Populations in Cities of Pakistan

- Multan
- Lahore
- Karachi

64% of HSW
Implications for HIV prevention priorities

• Focus on scaling up HIV prevention programs for key populations at higher risk:
  – IDUs, HSW, MSW and FSW

• Allocate resources according to the size of key populations in different cities, and prioritize cities with more advanced IDU and MSW / HSW epidemics
Program Science issues

- Getting the right footprint for allocating prevention resources
- “Micro-planning” interventions within cities
- Implementation support
Implementation Process and Progress

• Establish “Program Science” working groups at state and provincial levels
• Analyze and review HIV second generation surveillance data → develop high level plans to guide resource allocation
• Develop implementation standards and tools
• Establish implementation “Learning Sites”
  - Develop effective intervention models
  - “Getting research out of practice” to better understand implementation context and refine models
  - Monitor and evaluate
Reflections on Program Science initiatives, so far

- Substantial interest in this approach from national and state programs
  - Improvement on extant technical support models
  - Opportunity for sustained engagement between programs and science
- Importance of coherence and collaboration between key funders and actors within a country
- Substantial capacity building needs and opportunities:
  - For public health trainees
  - For public health leaders
Implications for Canada and USA?
Initial thoughts

• Find ways to bring STD / HIV prevention programs and public health science closer

• Define “program science” platforms to more systematically learn scientific approaches to program development and implementation

• Build leadership and expand training opportunities
Thank You
India’s HIV Epidemic – Does it matter which intervention we use?

To control the epidemic

Effective prevention for female sex workers vs. “treatment for prevention”
HIV elimination without antiretroviral therapy (ART) in Southern India: Modelling and projected costs

Mike Pickles
Peter Vickerman
Marie-Claude Boily
Anna Vassall

Imperial College & London School of Hygiene and Tropical Medicine

On behalf of the CHARME-India team
HIV prevalence in sex workers and clients (Mysore) – predicted program impact and measured prevalence

From left to right: Model projections of HIV prevalence in FSWs, clients and MSM, fitted to prevalence data. Grey shaded area show 95% CrI of model projections.
Elimination in the general population

In the 3 districts modelled so far >90% of runs reach the elimination criteria in the total male and female population by 2015.

HIV prevalence in low-risk women. Red and blue lines show simulated control groups of epidemic in absence of Avahan. Also shown: results from general population survey in urban Mysore (model runs not fitted to data)
Predicted impact of a targeted intervention on PMTCT in a concentrated epidemic: (80% condom use in FSW in Karnataka)*

Cost comparisons

<table>
<thead>
<tr>
<th></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>
</table>

Using cost estimates from Dodd et al (US$10 per test; US$800 cost of ART per year) and assuming a strategy of testing every 5 years