SIMULATION OVERVIEW

The AIDS Epidemic: Integration of System Dynamics and Gaming for Strategic Simulation

July 2005

This document has been prepared for the Annual Meeting of the System Dynamics Society

Agenda

- Background
- Integrated Simulation Overview
- Introduction to the HOPE Model
- Impact and Implications

Globalization Has Increasingly Transformed Local and National Public Health Issues to International Challenges

- **Public Health Challenges: A Complex, Interdependent System**

Natural Epidemics

Can move more quickly due to enhanced international mobility and can have an impact on the global economy

HIV
Tuberculosis
SARS

Chronic Disease

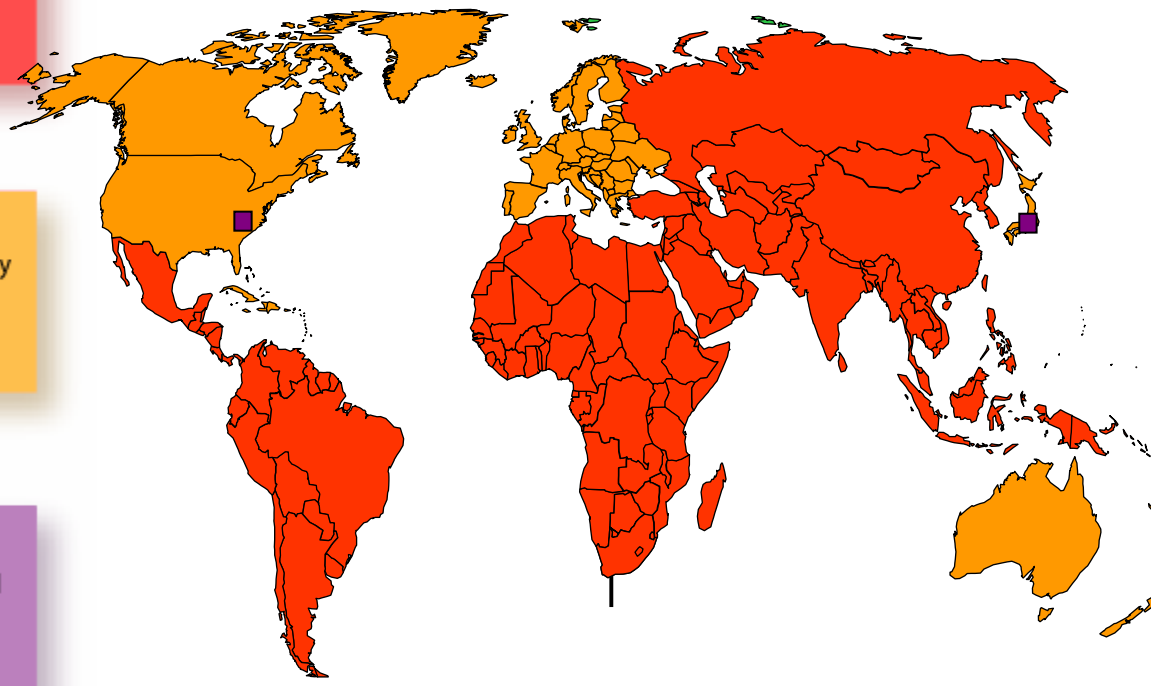
Industrialization, modernization, affluence, and increased longevity have brought these diseases to the "third world"

Heart Disease
Stroke
Obesity and Diabetes

Bio-terrorism

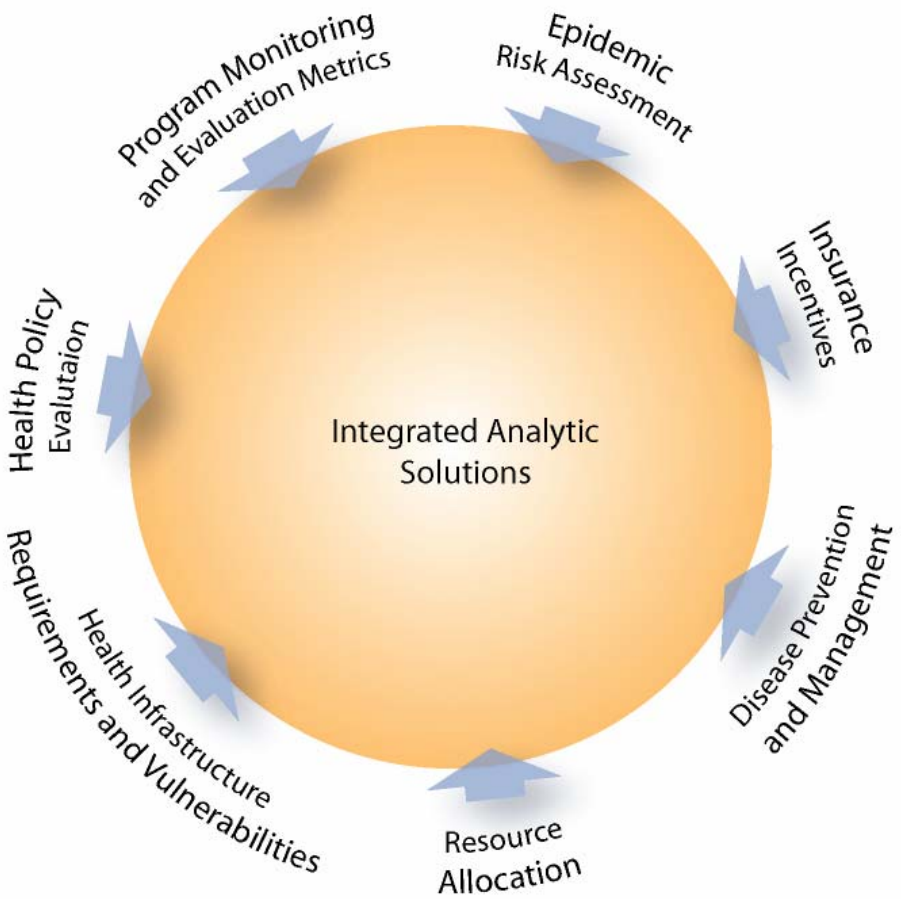
Emanate from an international network; contagious agents could have an international impact

Smallpox
Pneumonic Plague



Public and Private Sectors Face Complex Issues Around Quantifiable Risk Assessment, Response, and Resource Alignment

- **The Hybrid Analytic Framework Provides an Integrated and Interdisciplinary Approach to Tackle Global Public Health Issues Like HIV/AIDS**
  - Framework Leveraged World Class Epidemiological and Economic Modeling
  - Framework Can Be Applied Across a Range of Chronic Diseases and Epidemics
  - Provides a Quantification of Global Health Risks and the Impact of Responses for Both Public and Private Sector Stakeholders



Application of the Framework in India Revealed How National Level Collaboration Can Provide a More Comprehensive Response to AIDS

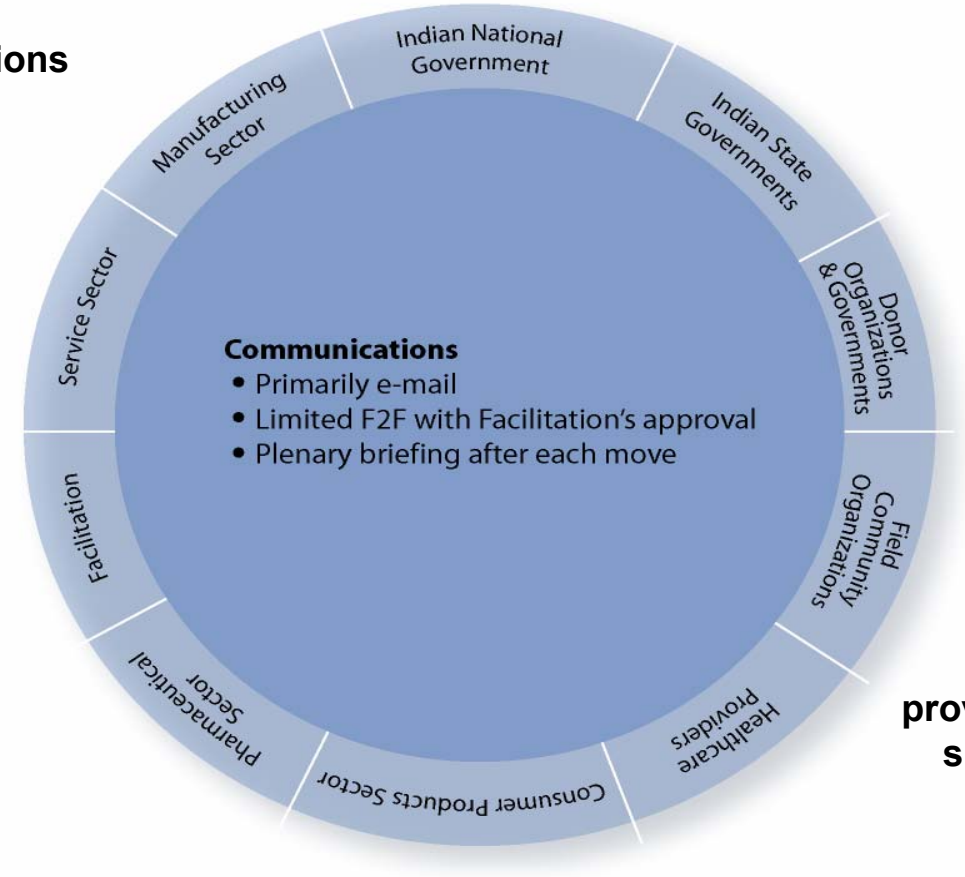
- **The firm, in concert with the Global Business Coalition to Fight HIV/AIDS and the Confederation of Indian Industry, hosted a strategic simulation around HIV/AIDS in India**
  - Focus of the Simulation Was to Work With Existing Leadership in India and Increase Action by the Business Sector to Develop Effective Strategies for Public Private Collaboration
  - Simulation Provided an Opportunity for Multi-Sectoral Stakeholders to Explore and Understand the Continuum of Responses to HIV/AIDS
- **Provided insights into ways that public-private partnerships can enhance success in the fight against HIV/AIDS**
- **This simulation provided an opportunity to:**
  - Identify opportunities for collaboration among business, government and civil society
  - Educate all stakeholders about how best to mobilize the unique skills and resources of all sectors in response to AIDS
  - Stress-test alternative strategies, identifying potential risks
  - Explore the potential impacts of innovative partnerships, strategies and interventions
  - Reshape perspectives on the dynamics and drivers for future success
  - Build consensus for next steps to improve and enhance the response to AIDS

Participants Were Grouped Into Nine Teams Representing the Major Stakeholders in the Fight Against HIV/AIDS

Stakeholder Teams:

- Agree on objectives
- Take actions
- Make recommendations
- Identify potential solutions
- Create partnerships

Simulation Structure



Facilitation Team:

- Structure game
- Introduce external shocks
- Monitor and arbitrate
- Assess the impact
- Play other parties/stakeholders (e.g., press)

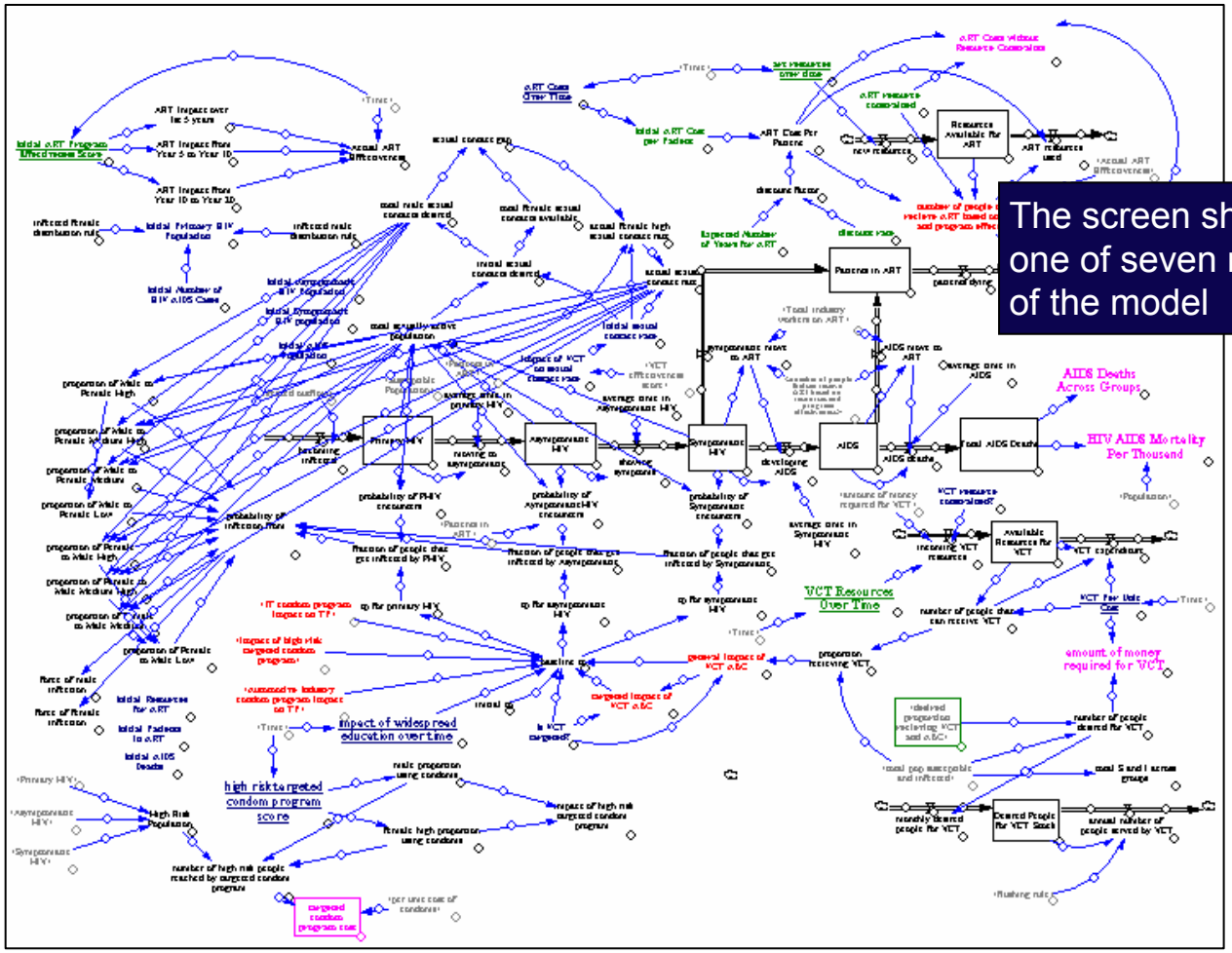
The SD model, HOPE, provided the analytic rigor to support decisions in the larger simulation.

Stakeholder Teams Interacted to Play Out Actions and Reactions to Address AIDS in India

- **A mix of over 200 participants were assigned to the nine teams representing private and public stakeholders**
  - Each team consisted of a core of representatives of the stakeholder(s) the team is playing, along with mix of representatives from other stakeholders
  - This provided a variety of perspectives on each team, and allowed people to "walk in each other's shoes"
- **Teams were presented with the current HIV/AIDS situation in India, and then asked to work together to respond to and mitigate its impact**
- **Teams interacted with each other – simulating actions and collaboration – to identify and implement responses**
  - There were 3 moves, each of which intended to simulate a step forward in time (5 years)
  - Each team identified its objectives and strategies, and interacted with others to develop partnerships and gather information
  - At the end of each move, teams briefed their decisions and rationale
- **At the end of each move, teams actions were evaluated by the HIV Operational Planning Environment (HOPE) Model: An integrated epidemiological and economic model**

H.O.P.E. Opening Screen

H.O.P.E. Captured the Complex Interdependencies That Drive the HIV/AIDS Epidemic and the Economic Consequences

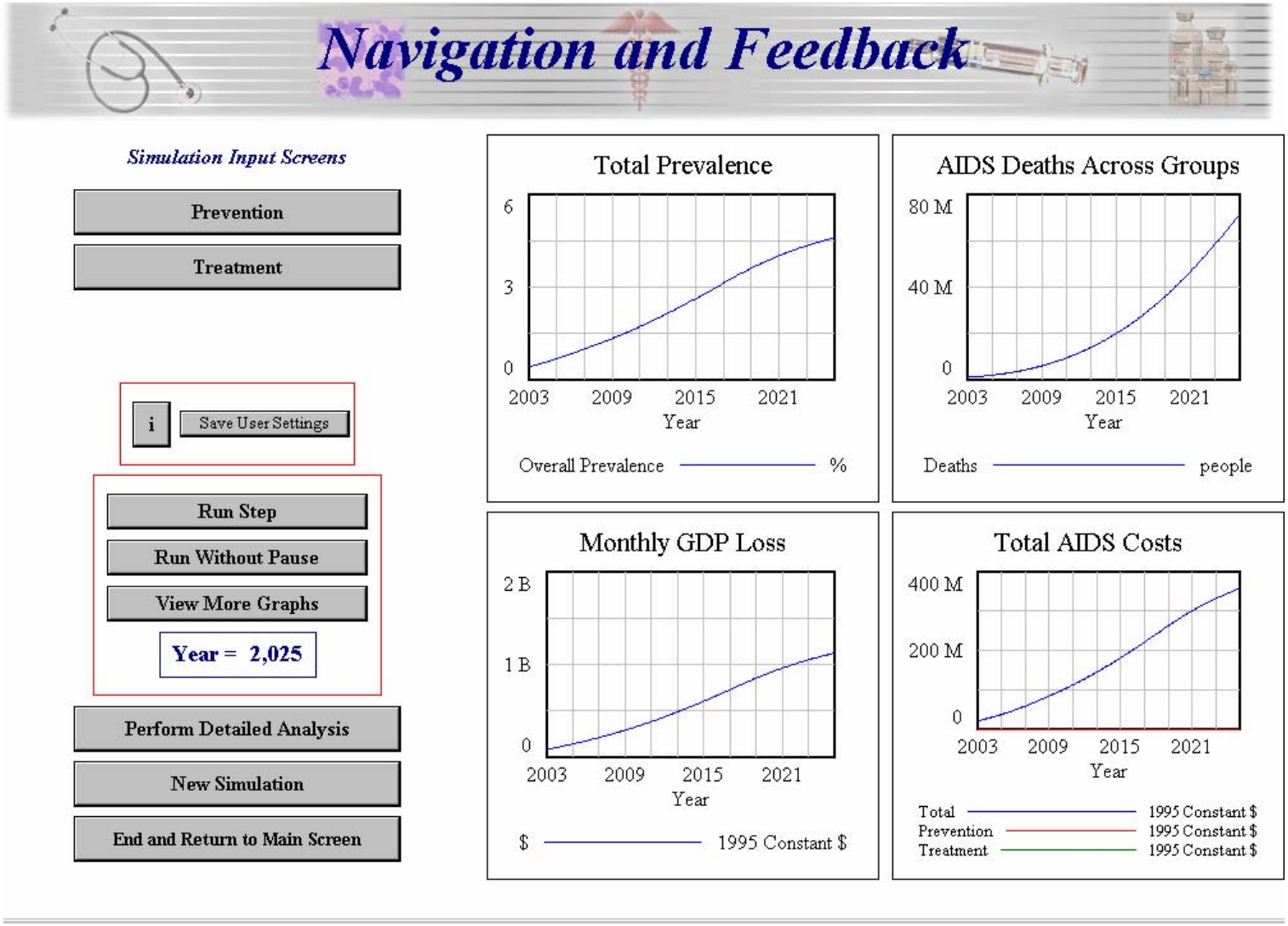


The screen shot shown is one of seven major sections of the model

H.O.P.E. Projected HIV Progression and Estimated Its Economic and Social Impact in India

- **HOPE has two major integrated components**
  - Disease progression module
    - Disease epidemiology model is based on peer-reviewed scientific publications
    - Based on Intellectual Capital From Leading Experts on HIV Modeling; Disease Modeling Approach Validated in Kenya, Thailand, Brazil
      - Partnered with Brown, Emory, and Wayne State Universities to develop and validate HOPE
  - Economic impact module
    - Impact of HIV/AIDS at micro and macro levels
- **Data Sources Included National Aids Control Organization (NACO), UNAIDS, WHO, and the World Bank**
- **Model was set with real parameters that existed in 1987 (i.e. how many HIV/AIDS infections and deaths, initial population, birth rate)**
- **Accurately predicted the course of the epidemic from 1987 to 2003 as evidenced by UNAIDS**
- **Perhaps the Most Robust Model Ever Used to Project and Quantify the Impact of HIV in a Simulation Exercise**

Typical Output Display



H.O.P.E. Enables Analysis of Program Options Across the Entire Prevention and Treatment Continuum

- **Inputs into the model included a choice of prevention and treatment programs**
- **Prevention Actions at the National and Industry Levels**
  - General Education and Wellness
  - Voluntary Counseling & Testing
  - Condom Distribution and Education
  - Mother to Child Transmission Prevention
- **Treatment Actions at the National and Industry Levels**
  - Anti-Retroviral Treatment
  - Non-ARV Care
- **Programs were limited by available resources and weighted effectiveness scores**
  - Programs had effectiveness scores that were developed in consultation with HIV/AIDS clinicians, researchers, and providers from Brown University Medical Center, Apollo Hospitals in New Delhi, and Emory University
  - Each program was given a weighted average score ranging from 1-4
  - Funding for programs was time phased, and the costs for programs were discounted appropriately

H.O.P.E. Enabled Teams to Work Together to Innovate and Evaluate a Range of Partnerships and Initiatives to Fight the Epidemic

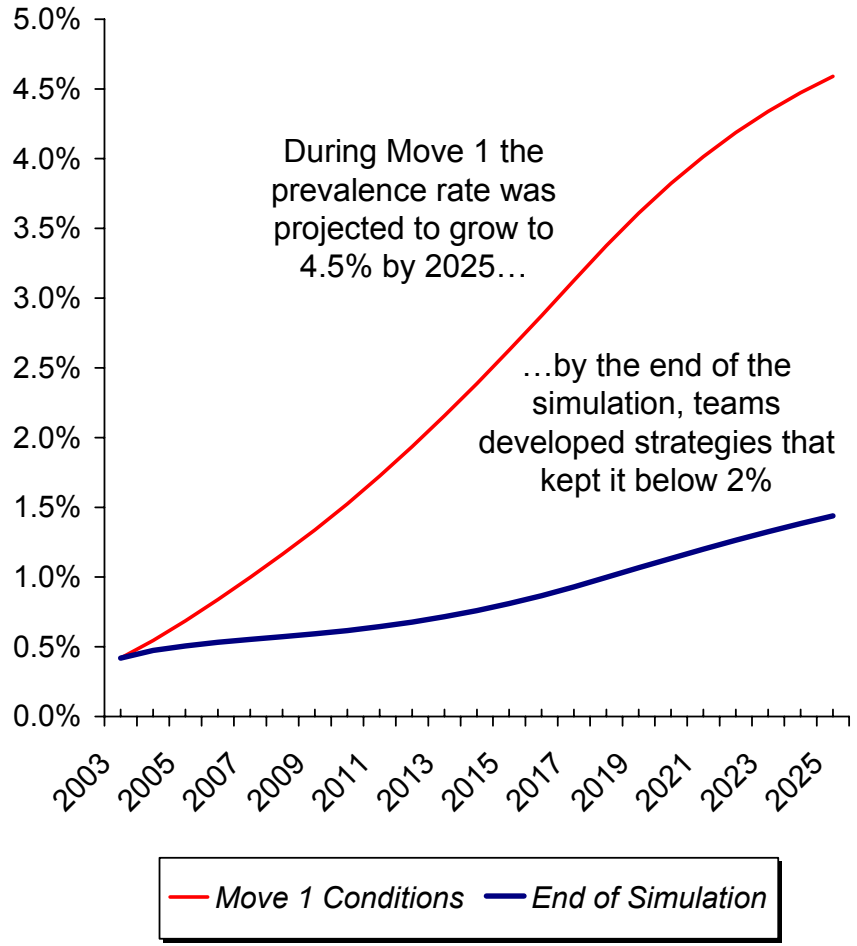
- **Teams initiated and explored 53 partnerships and over 100 new initiatives**
  - Telecom companies provided a toll-free help line, managed by NGOs, with IT industry providing technical support
  - The pharmaceutical and donor teams worked together to reduce drug costs
  - The donor and national teams collaborated to channel funding—80 percent of funding was directed to the state level
  - Industry teams offered to open their healthcare facilities, in collaboration with the government, to provide VCT, treatment, and care to the broader community
  - Services industry led other industries and donors in creating and managing the “India Fund for HIV/AIDS”
  - The donor team organized other NGOs to set funding strategies and identify criteria for program selection
  - The donor team also proposed a basket-funding approach, whereby donors would collaborate their funding decisions to ensure programs supported the national strategy
  - Prime Minister developed an HIV/AIDS task force and made cabinet-level assignments
  - Healthcare providers led an effort that forged partnerships among the pharmaceutical industry, state governments, and NGOs, to serve patients in high-risk areas
  - National government team strongly and publicly stated that HIV/AIDS was not a moral issue
  - Legislation was introduced to reduce stigma and protect privacy

HOPE Demonstration

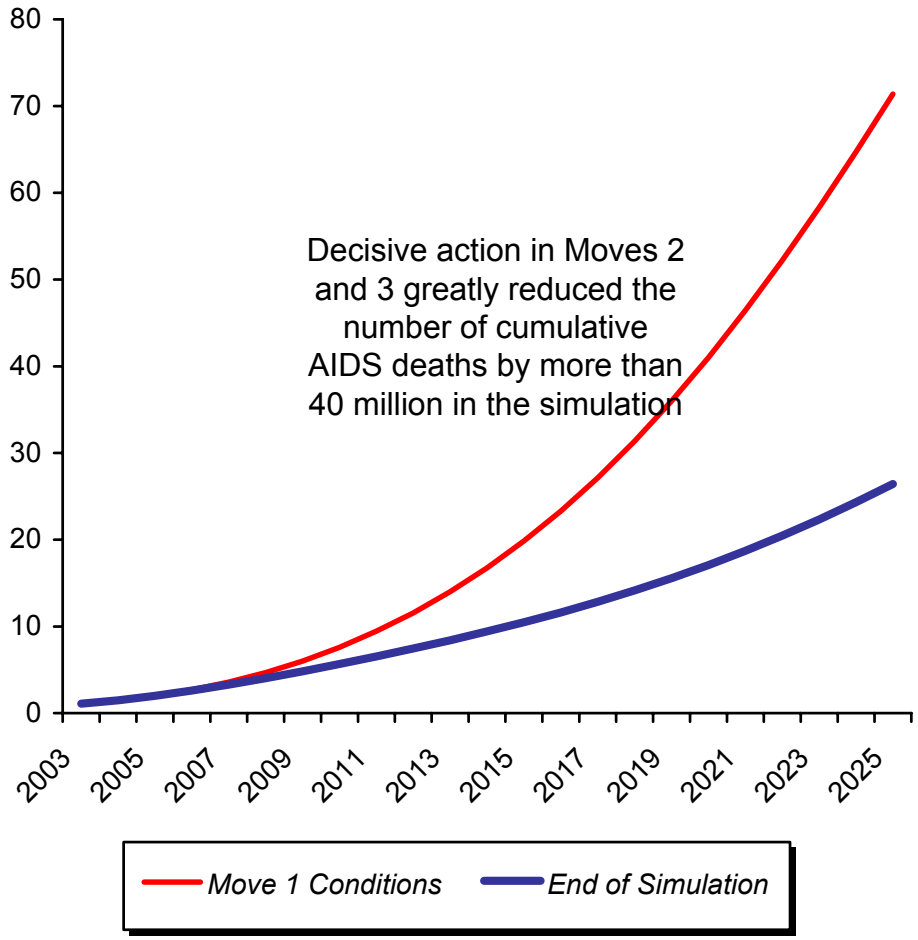
- **Please Ask Questions At Any Time**

Integrated Framework Results: Team Actions Reduced Potential AIDS Prevalence and Mortality by Over 50% in the Simulation

Reduction in AIDS Prevalence Rates

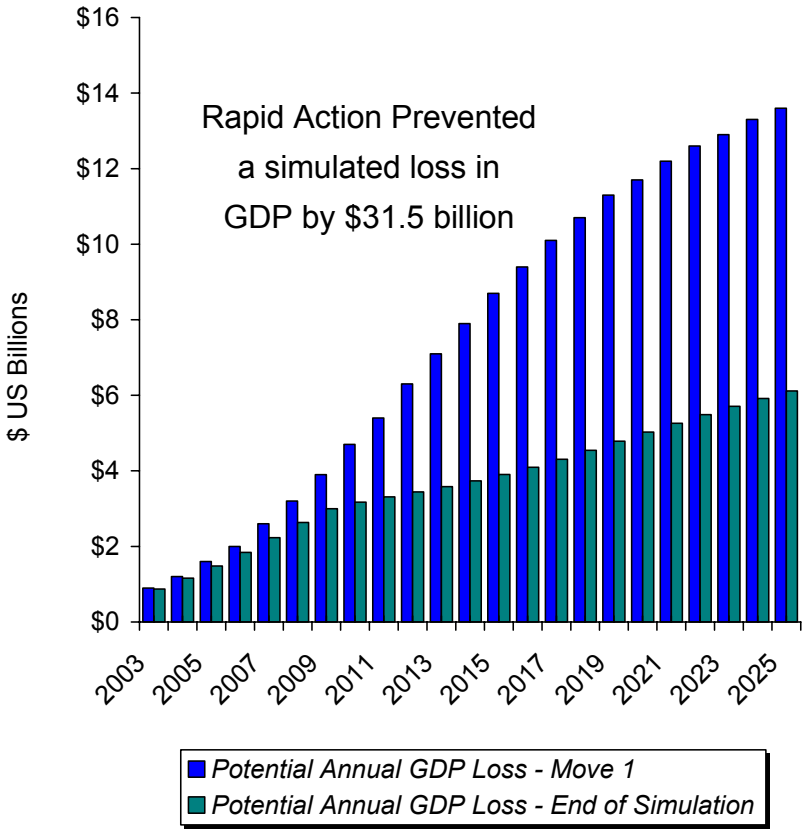


Reduction in Cumulative AIDS Deaths (Millions)

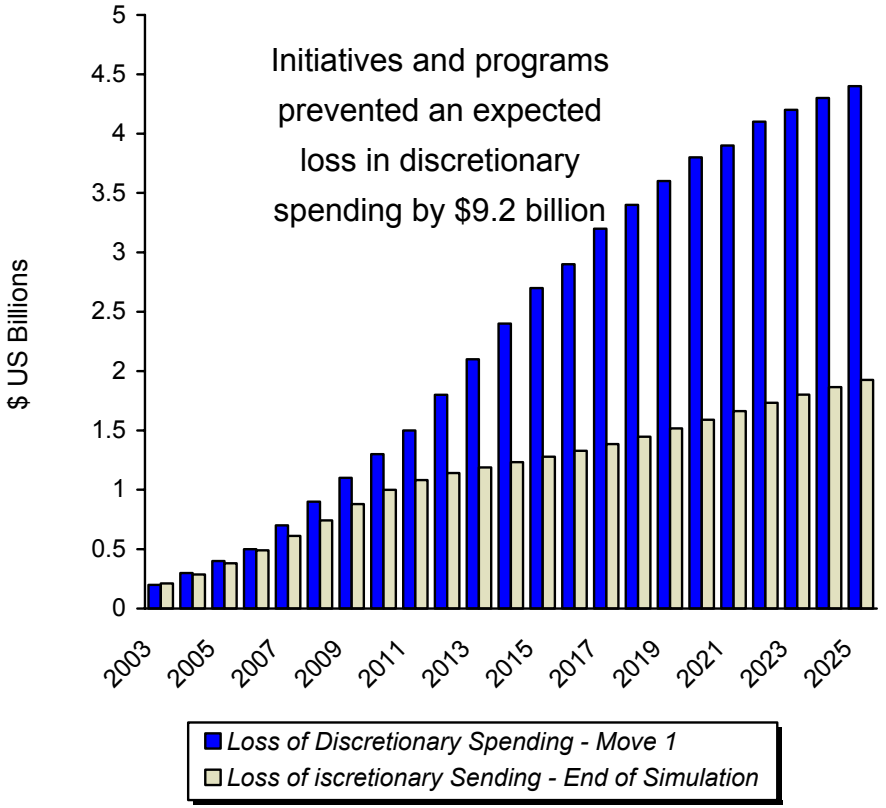


Integrated Framework Results: Team Actions Also Halved Potential Losses in GDP and Discretionary Spending

Annual Loss of GDP ($US Billions)



Annual Loss of Discretionary Spending ($US Billions)



Integrated Analytic Solutions Enable Decisions Makers to Rapidly and Robustly Make Trade Off Decisions

- **Analytic Models such as H.O.P.E. Can be Used to**
  - Quantify Public Health Risks for both Public and Private Sector Stakeholders
  - Develop and Assess the Impact of Different Interventions and Assumptions
  - Identify leading monitoring and evaluation metrics
  - Assess Health Infrastructure requirements and vulnerabilities
  - Conduct strategic planning
  - Evaluate resource allocation options
- **H.O.P.E. Could Be Adapted for**
  - Use in Other Countries Attempting to Quantify the Long Term Impact of HIV and Specific Interventions
  - Model Impact of Other Infectious Diseases Such As TB, SARS, or Bio-terrorist Pathogens, or Chronic Conditions/Diseases Such As Obesity/Diabetes