

#### Imperial College London



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Women at risk, young people, and HIV interventions in Côte d'Ivoire: what is their impact on the HIV epidemic?

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# Young People and HIV

Young women are especially vulnerable to HIV acquisition in sub-Saharan Africa. Incidence is high because:

- Increased biological susceptibility of young women to HIV.
- Sexual mixing (older male partners), multiple partnerships, and early sexual debut.
- Gender inequality (education, reproductive health, etc.).

The UN Political Declaration on Ending AIDS calls for reducing new HIV infections <100,000 year<sup>-1</sup> (~80% reduction) by 2020 among 15-24 women.

Need to better understand importance of different risk groups and behaviours to transmission. Goal is to inform priorities globally and HPTN research in terms of expected impact of potential interventions.

## Côte d'Ivoire

(UNAIDS estimates for 2014)



#### Most recent estimates:

- Prevalence in women 15-24 (DHS 2011-12): 2.2%
- Prevalence in men 15-24 (DHS 2011-12): 0.3%
- •FSW (Abidjan RDS): 11%
- MSM (Multiple cities RDS): 14%
- •Overall (DHS 2011-12): 3.7%

### **Research Questions**

 $\rightarrow$ To better inform the national response.

**A)** What was **the past contribution** of the following populations to HIV acquisition and transmission in Côte d'Ivoire (1976-2015, by 10-year periods)?

- Who acquired new HIV infections? (by age, gender, KP)
- Who transmitted HIV infections? (by age, gender, KP)

**B)** What would be the maximum **impact of age-targeted interventions** in Côte d'Ivoire over 2015-2030?

- Hypothetical interventions that would completely block HIV acquisition and transmission.
- Using high coverage of existing tools (condoms and TasP).

## Methods - Model Description

Represents an open population of sexually active individuals, the disease natural progression, the continuum of care, the effect of past and existing interventions, and key characteristics of the epidemic.

Deterministic model of HIV transmission8 risk groups

4 age groups

### Age/Risk Groups



References: Maheu-Giroux (2017) JAIDS; Maheu-Giroux (2017) PLOS Medicine; Maheu-Giroux (2017) AJE.

### **HIV Progression and Care Continuum**



# Data for Model Parameterization

- Demography: WPP 2015.
- Sexual behaviors (condom, nb partners, mixing) and HIV testing:
  - General Population: WFS 1988-81, EDS 1994, 1998, 2005 et 2011-12.FSW, CFSW, and MSM: RDS surveys, literature, government reports.
- Intervention efficacy and cascade of care (meta-analyses).
- Programmatic data (DIPE).





#### Côte d'Ivoire



Enquête Démographique et de Santé et à Indicateurs 2 Multiples

# **Main Parameters**

- 15-24 are ~40% of the modeled population

- Age groups (as a % of 15-59 years old):
  - 15-19 years old: 21%.
  - 20-24 years old: 18%.
  - 25-49 years old: 51%.
  - 50-59 years old: 10%.
- Population size estimate (prior distributions)
  - FSW: 0.8-2.7% of female population.
  - MSM: 0.8-1.6% of male population.
- Relative HIV susceptibility for 15-24 women: 1.2-2.5.
- Condom effectiveness: 75-94%.
- ART efficacy to reduce transmission: 96% (63-99%).

# Model Calibration

### Data for model calibration:

### • HIV prevalence and programmatic data (ART).

- WHO/UN 1989, AIS 2005, and DHS 2011-12 (by age/ sex).
- RDS surveys, government reports, literature for FSW, CFSW and MSM.
- ART Coverage (DIPE).

### Bayesian melding approach

- 1<sup>st</sup> stage: 5 million LHS samples.
- 2<sup>nd</sup> stage: Incremental Mixture Importance Sampling.

### Outcomes

Who acquires HIV? measured using fraction of new infections acquired by a specific group (1976-2015, by 10-year periods).

 $Fraction \downarrow t - t0 = \int t0 \uparrow t \text{ I} \downarrow Group / \\ \int t0 \uparrow t \text{ I} \downarrow Total$ 

What are the epidemiologic drivers? assessed using the Population Attributable Fraction (PAF) (1976-2015, by 10-year periods).

 $PAF\downarrow t - t0 = \int t0 \uparrow t \equiv I \downarrow Risk - \int t0 \uparrow t \equiv I \downarrow No Risk / \int t0 \uparrow t \equiv I \downarrow Risk$ 

What is the potential impact of future age-targeted interventions? calculated using prevented fractions (PF) over 2015-2030.

### **Results** – Calibration



## Past Contribution Acquisition

#### Who Acquired New HIV Infections?



Women 15-24 acquire  $\geq$  infections than women 25-49 years old, but this group is 20% smaller than the 25-49 years old. CFSW acquire high % of men's infections.

### Past Contribution Transmission

#### **Who Transmitted Infections?**



Age and Gender by Time Periods

After excluding young FSW, young women never transmitted more infections than they acquired. Men 25-49 transmitted most infections.

### Potential Max Impact of Age-Targeted Interventions (2015-2030)

What would be the impact of a targeted intervention that is 100% effective at preventing HIV acquisition and transmission?



Higher impact of targeting women 25-49 (65%) as opposed to 15-24 (53%). Highest impact we if target men 25-49 (PF=80%). (Young women do not transmit much.)

### Potential Impact of Age-Targeted Interventions (2015-2030)

What would be the impact of condoms (all acts protected) and TasP (90-90-90)?



Blocking all youth HIV acquisition/transmission could prevent 55% infections. Achieving 90-90-90 among youth averts 14% of infection, up to 40% with condoms. Reaching 90-90-90 among 25-49 (PF=41%) is lower than if targeted to all ages (PF=50%).

# Recap

- Young women (15-24) continue to disproportionately acquire HIV infections (more than they transmit).
- Men 25-49 years vulnerable to HIV infection (especially, CFSW) & are the group that transmit the more.
- Importance of sex work declined with time (high condom use).
- MSM do not contribute much to overall transmission (small size and limited mixing). But prevalence is highest of all groups – separated dynamics.
- Infections prevented (2015-2030) likely maximized if sources of transmission are targeted: men 25-49.

# Interpretation

- Sustainably reducing HIV transmission in Côte d'Ivoire require considering epidemiological dynamics.
- Core-group interventions need to be sustained (FSW, CFSW, MSM).
- Impact of focusing on young people will depend on interventions. Higher impact if acquisition is prevented (condoms; possibly PrEP).
- Scaling-up ART (90-90-90) could reduce transmission, especially if older men are reached.



### Collaborators





### **Questions?**