

# Monitoring Effectiveness of HIV Programs in the Era of Implementation Science utilizing a sample of 27,000 Drug Users and Men who have Sex with Men in India

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# Background

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- Dramatic progress in delivery of HIV services in resource-limited settings
- Monitoring effectiveness of these programs is critical particularly in hard-to-reach populations
- HIV incidence is the optimal measure
  - Longitudinal HIV incidence is cumbersome
  - Novel cross-sectional assays available but require complicated testing protocols

# Study Objective

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- To evaluate biological and self-reported measures that could serve as surrogates for HIV incidence using population-based samples from men who have sex with men (MSM) and people who inject drugs (PWID) across 26 cities in India.

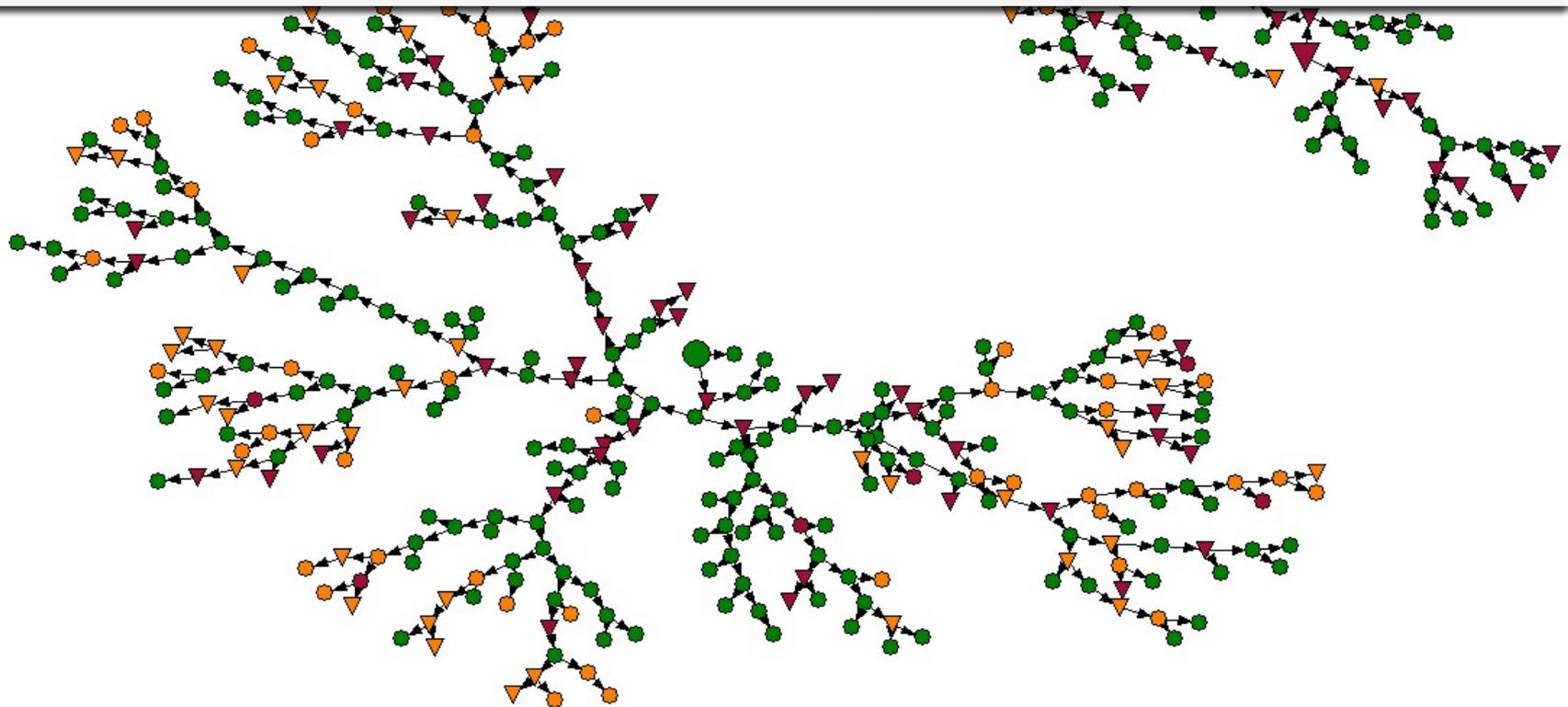
# Surrogates of incidence

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- Biological measures
  - Community viral load (CVL)

# Variations of CVL

**CVL-PV** = Prevalence of HIV RNA > 1000 c/ml in the community



GREEN = HIV negative; ORANGE = HIV+ and aware of status;  
MAROON = HIV+ and unaware of HIV status; ▲ = HIV RNA > 1000 copies/ml

# Surrogates of incidence

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- Biological measures
  - Community viral load (CVL)
  - HIV prevalence
- Self-reported measures
  - **PropART:** Proportion of HIV-infected persons on ART
  - **PropHCT:** Proportion of individuals (excluding known positives) in the community who received HIV counseling and testing in the prior year
  - **CommSERV:**  $(\text{number of HIV-infected currently on ART} + \text{number of HIV-uninfected who received HCT}) \div \text{population size}$

# Methods

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- ~1000 recruited per site across 27 sites (26 cities) in India using RDS (baseline assessment of cluster randomized trial)
  - MSM: 12 cities
  - PWID: 15 cities
- HIV incidence estimated using multi assay algorithm (MAA) that included BED, Avidity Index, CD4 count and HIV RNA
- Correlation between surrogates and incidence assessed using Spearman correlation coefficients
  - Correlation coefficients compared using STATA *cortesti* command
- Association between surrogates and incidence assessed using simple linear regression models (per one SD increase in surrogate)
  - R-squared, AIC/BIC used to compare across models

# Results: Demographics

	MSM (12 sites; n= 12,022)	PWID (15 sites; n=14,481)
	Site median (Range)	Site median (Range)
Median age in years	25 (21 – 30)	29 (24 – 34)
Proportion male (%)	100	96.4 (76.7 – 99.9)
Education (%)		
<i>Primary school or less</i>	17.6 (6.8 – 42.8)	33.7 (4.9 – 69.3)
<i>Secondary school</i>	41.7 (29.8 – 58.8)	46.6 (27.5 – 68.9)
<i>High school and above</i>	31.5 (24.1 – 63.3)	21.3 (3.1 – 44.0)
Marital status (%)		
<i>Currently married/living with partner</i>	35.0 (17.9 - 57.9)	47.5 (18.3 - 62.7)
<i>Never married</i>	62.4 (30.2 - 75.5)	41.9 (21.2 - 59.8)
Median income in Indian Rupees	6000 (4000-8000)	5000 (2000 - 7000)
Ever injected drugs (%)	1.2 (0.1 – 3.4)	100
Injected drugs in past 6 months (%)	0.9 (0.1 - 3.0)	91.1 (68.6 – 99.1)
Ever heterosexual sex, (%)	76.3 (62.6 - 86.2)	87.2 (75.1 - 94.7)
Unprotected heterosexual sex in the past 6 months (%)	45.1 (26.0 - 61.4)	40.5 (24.2 - 63.1)
Ever MSM behavior, n(%)	100	2.8 (0.7 - 12.8)
Unprotected MSM behavior in the past 6 months (%)	48.8 (35.8 - 73.7)	0.8 (0.1 - 3.1)

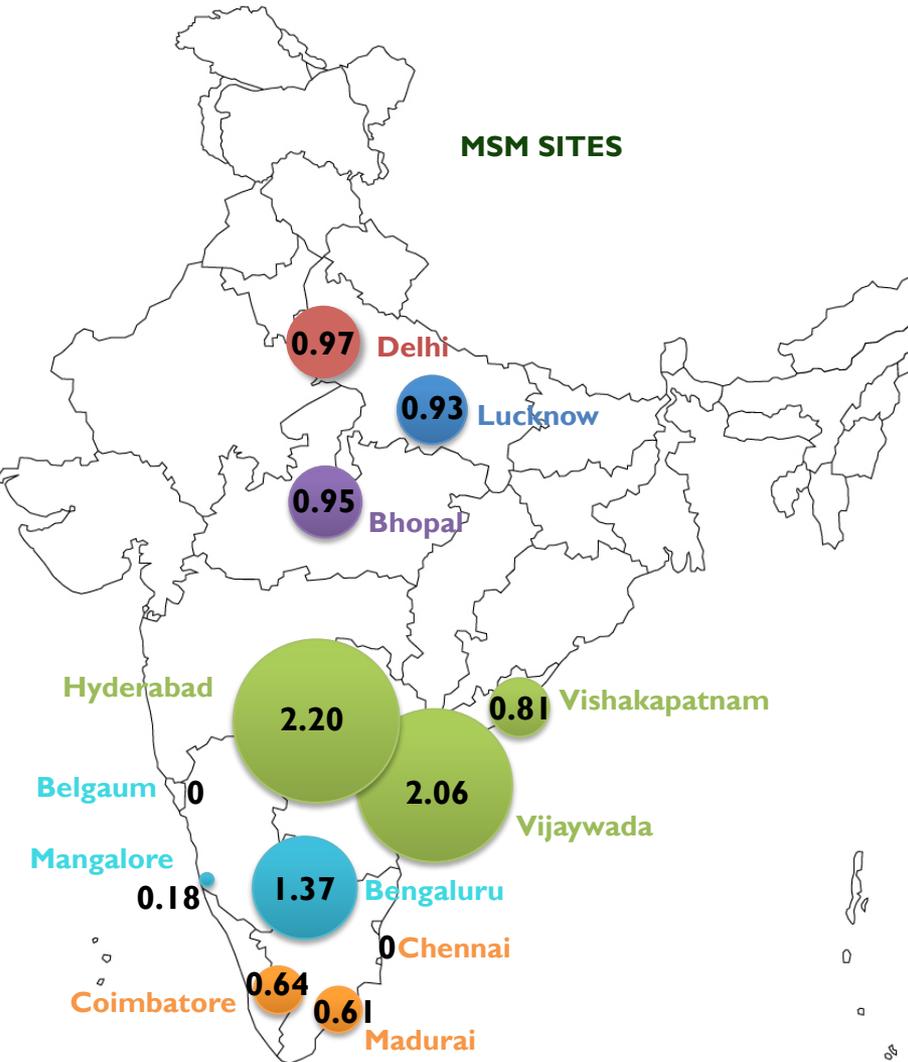
# Surrogates of incidence

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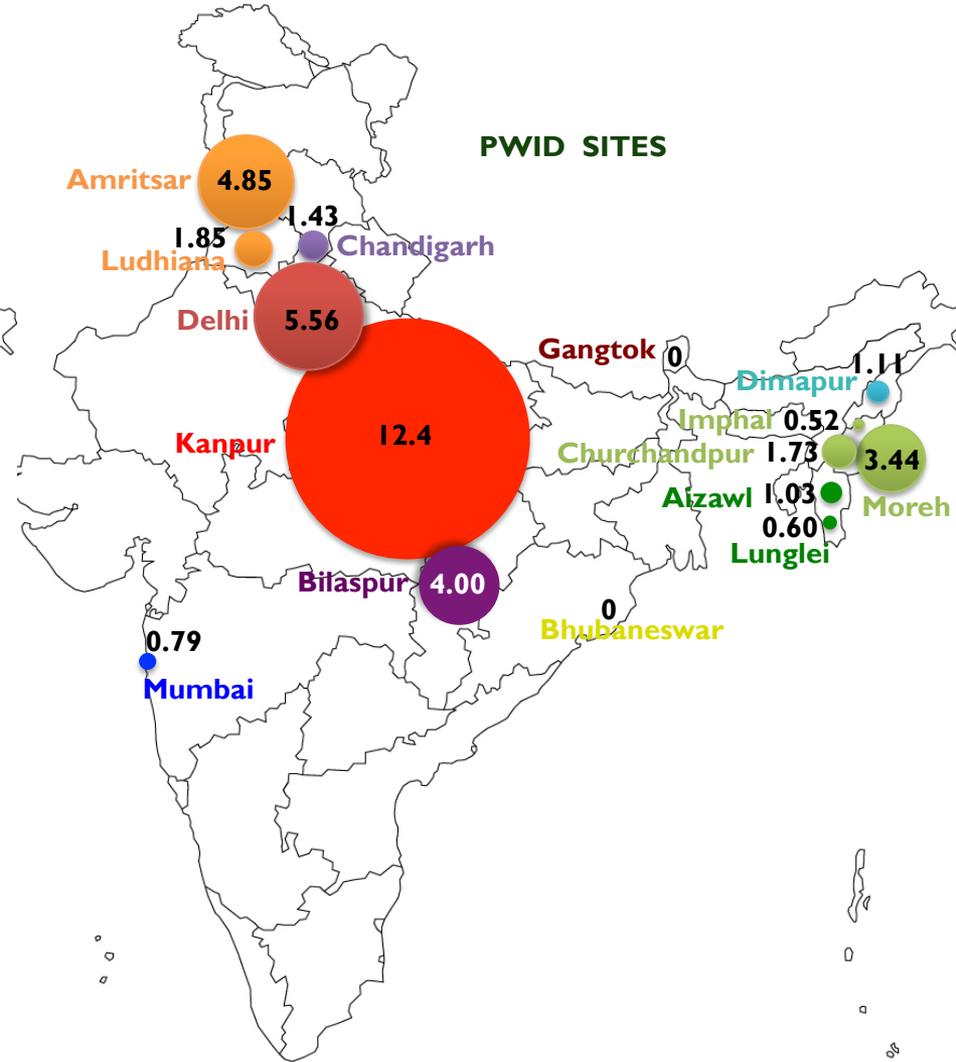
	<b>MSM (n=12 sites)</b>	<b>PWID (n=15 sites)</b>	<b>Overall (n=27 sites)</b>
	<b>Site median (range)</b>	<b>Site median (range)</b>	<b>Site median (range)</b>
CVL-AWARE (log <sub>10</sub> copies/ml)	2.9 (2.5 - 3.8)	3.4 (2.5 - 4.7)	3.1 (2.5 - 4.7)
CVL-POS (log <sub>10</sub> copies/ml)	3.8 (2.7 - 4.4)	4.0 (2.6 - 4.6)	3.9 (2.6 - 4.6)
CVL-PV (%)	4.8 (1.6 - 12.6)	13.7 (2.5 - 33.1)	8.3 (1.6 - 33.1)
HIV prevalence (%)	8.6 (2.0 - 18.8)	19.7 (6.1 - 43.3)	13.1 (2.0 - 43.3)
PropART (%)	39.6 (0 - 84.5)	28.2 (0 - 71.1)	36 (0 - 84.5)
PropHCT (%)	29.9 (8.9 - 36.0)	25.0 (5.3 - 75.7)	27.5 (5.3 - 75.7)
CommSERV (%)	30.6 (9.2 - 38.9)	29.7 (4.5 - 75.5)	29.9 (4.5 - 75.5)

# HIV Incidence

MSM SITES



PWID SITES



# Community viral load (CVL) & Incidence

CVL Measure	$\rho^1$ (P value)	Linear Regression <sup>2</sup>	
		Coefficient (95% CI)	R-squared
CVL – AWARE	0.593 (0.001)	1.33 (0.40, 2.26)	0.266
CVL – POS	0.505 (0.007)	1.19 (0.27, 2.12)	0.220
CVL – PV	0.807 (<0.001)	1.54 (0.74, 2.34)	0.387

**“In New Delhi, reducing the prevalence of viremic individuals in the community from 15% to 11% would result in a corresponding reduction in HIV incidence from 4% to 3%”**

PropNET	-0.255 (0.177)	-0.66 (-1.64, -0.12)	0.116
CommSERV	-0.296 (0.134)	-0.99 (-1.95, -0.03)	0.153

<sup>1</sup> Spearman correlation coefficient

<sup>2</sup> Regression coefficients from unadjusted linear regression models (expressed per standard deviation increase in explanatory variable, standardized within population ([MSM/PWID])

# Statistical comparison of Spearman correlation coefficients for different surrogates and incidence

MEASURE	CVL-AWARE	CVL-POS	CVL-PV	HIV Prevalence	PropART	PropHCT	CommSERV
CVL-AWARE	X	0.901	0.035	0.433	0.308	0.103	0.107
CVL-POS		X	0.021	0.301	0.340	0.178	0.199
CVL-PV			X	0.002	0.029	0.005	0.006
HIV Prevalence				X	0.356	0.057	0.081
PropART					X	0.127	0.130
PropHCT						X	0.256
CommSERV							X

Note: Values reported are the p-values for the comparison

# Conclusions

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- Markers of HIV treatment access better correlated with HIV incidence than markers of HIV prevention access
- Prevalence of viremia in the community (a marker that incorporates HIV prevalence and the entire HIV care continuum) appears to be the ideal marker to evaluate the impact of HIV programs when incidence data is not available
  - Also may be a relevant outcome for implementation trials
- In settings where viral load testing is not feasible, self-reported ART use may be a robust marker of HIV incidence

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**THANK YOU**

