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Estimating HIV incidence among PWID: Population-and Facility-Based Approaches

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BACKGROUND

- Monitoring HIV incidence is vital for characterizing the epidemiology and trajectory of HIV epidemics as well as evaluating prevention efforts
- Gold standard of cohort studies to measure incidence requires significant time, resources, and is not feasible in many settings
- Often rely on new HIV *diagnoses*, an inherently biased incidence measurement
- **Aim: To compare HIV incidence estimates among people who inject drugs (PWID) in India using three different methods/data sources which might leverage available program data in a variety of settings**

METHODS

Data for analysis are derived from the PWID stratum of the NCA Study, a cluster-randomized trial,[1] in 22 Indian cities (12 PWID cities depicted in **Figure 1**)

METHOD 1: CROSS-SECTIONAL MAA

- Cross-sectional sample of ~1000 PWID accrued using respondent-driven sampling (RDS) (Aug 2016 – Apr 2017) in each of 12 cities
- All study participants received onsite rapid HIV testing
- Validated multi-assay algorithm (MAA)[2] used to define recent HIV infection among HIV+ participants: LAg-Avidity < 2.9, BioRad Avidity < 85%, viral load > 400 copies/mL, and CD4 count > 50 cells/μL
- Recently infected HIV+ and HIV negative participants included in analysis
- Annual HIV incidence (%) estimated for each city using 191-day window period (0.52 year): *[# of recent infections / (# of HIV negatives * 0.52)] * 100*

METHOD 2: SERIAL CROSS-SECTIONAL

- 2 cross-sectional samples of ~1000 PWID accrued using RDS in each of 12 cities
- 1st sample accrued Jan – Dec 2013 and 2nd sample accrued Aug 2016 – Apr 2017 with identical study procedures
- Study participants negative in 1st sample and participated in 2nd sample (verified using biometric) included in analysis
- Person-time accrued from date of 1st study visit to:
  1) date of 2nd visit for HIV negatives *or*
  2) date of self-reported positive test at 2nd visit for previously diagnosed positives *or*
  3) mid-point of time between 1st and 2nd visit for unaware positives at 2nd visit
- HIV incidence (per 100 person-years [PY]) estimated for each city: *# of seroconversions / total person-years*

METHOD 3: ICC

- Integrated care centers (ICCs) – the intervention of interest for the trial – provided core and PWID-focused HIV prevention and treatment services, including HIV counseling and testing, in a single venue
- ICCs established after 1st RDS sample in 6 of 12 cities as part of trial, other 6 cities were control sites
- Clients with negative HIV test tracked within 6 months for repeat testing
- Utilized client HIV testing data from date ICC was established until start of 2nd RDS recruitment in each city
- Clients with ≥ 2 HIV tests in time period and negative on first test included in the analysis
- Person-time accrued from first negative test to:
  1) last negative test *or*
  2) mid-point of time between last negative test and first positive test for seroconverters
- HIV incidence (per 100 PY) estimated for each city: *# of seroconversions / total person-years*

RESULTS

Table 1 Baseline sample characteristics by data source

Characteristic(s) n (%) / median (IQR)	Cross-sectional MAA (N=9440)	Serial cross-sectional (N=1222)	ICC (N=3665)
Site			
Aizawl	760 (8.1)	54 (4.4)	212 (5.8)
Amritsar	800 (8.5)	85 (7.0)	--
Bilaspur	820 (8.7)	110 (9.0)	341 (9.3)
Chandigarh	926 (9.8)	145 (11.9)	676 (18.4)
Churchandpur	771 (8.2)	124 (10.2)	--
Delhi	659 (7.0)	84 (6.9)	--
Dimapur	860 (9.1)	85 (7.0)	727 (19.8)
Imphal	696 (7.4)	115 (9.4)	713 (19.5)
Kanpur	781 (8.3)	43 (3.5)	--
Ludhiana	821 (8.7)	33 (2.7)	996 (27.2)
Lunglei	898 (9.5)	190 (15.6)	--
Mumbai	648 (6.9)	154 (12.6)	--
Age	29 (24 – 36)	29 (24 – 34)	28 (24 – 33)
Male	9158 (97.0)	1189 (97.3)	3509 (95.7)
Injection drug use in prior 6 mo.	7597 (80.5)	1145 (93.7)	2809 (76.6)
Shared needle/syringe in prior 6 mo.	3072 (32.5)	469 (38.4)	953 (26.0)
Individual follow-up time (years)	n/a	3.3 (3.1-3.4)	1.2 (0.8 – 1.6)
Seroconversions (n)	248	124	57
Pooled HIV incidence (95% confidence interval)	**5.16 (4.33 – 5.98)**	**3.25 (2.73– 3.88)**	**1.24 (0.94 – 1.61)**

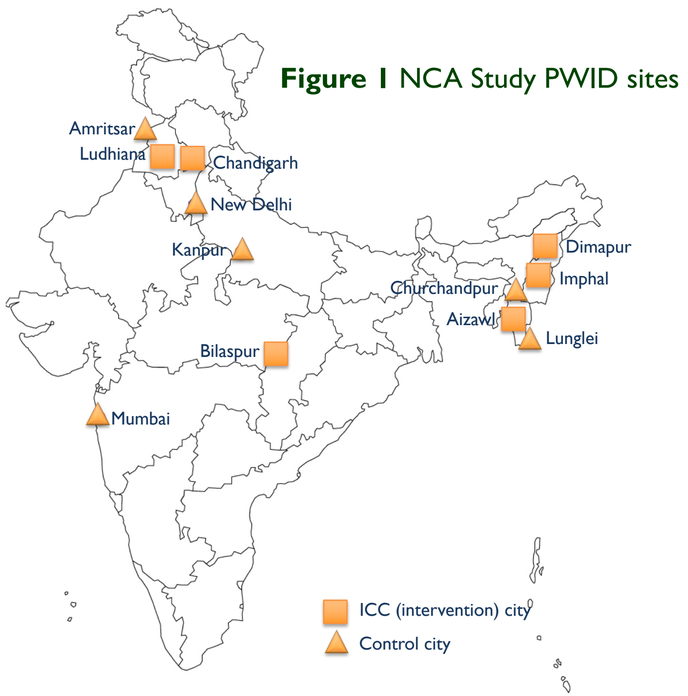
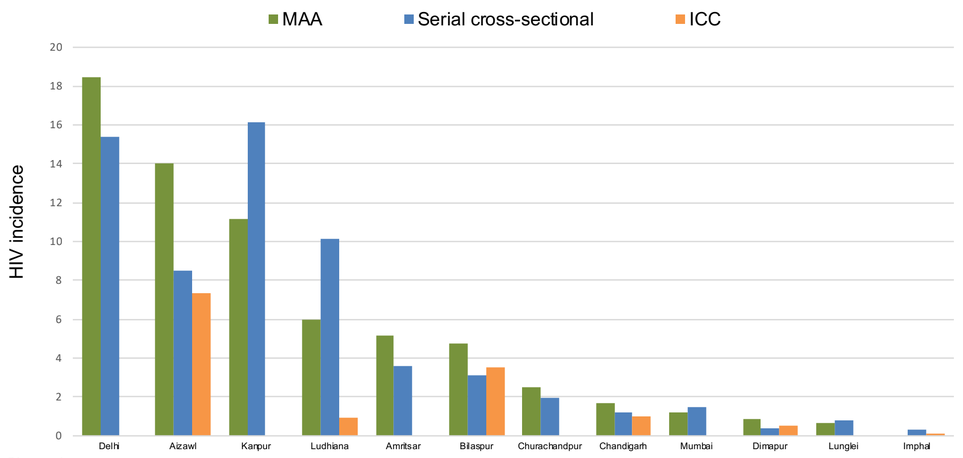


Figure 1 NCA Study PWID sites

Figure 2 HIV incidence estimate and rank by method



City rank												
MAA	1	2	3	4	5	6	7	8	9	10	11	12
Serial CS	2	4	1	3	5	6	7	9	8	11	10	12
ICC	-	1	-	4	-	2	-	3	-	5	-	6

Table 2 Spearman rank correlation (ρ) and relative difference of incidence estimates

ρ (median difference, range)	Cross-sectional MAA	Serial cross-sectional	ICC
Cross-sectional MAA			
Serial cross-sectional	0.94 (-19%, -60% to +190%)		
ICC	0.83 (-40%, -84% to + 20%)	0.66 (-14%, -90% to +47%)	

CONCLUSIONS

- HIV incidence estimates within a given city were variable by method
- However, rank order by incidence was largely consistent
- Facility-based and serial cross-sectional data will likely underestimate population incidence (i.e., selection and survival bias)
- Triangulation of incidence estimates utilizing different methods or data sources could be useful
- Using cross-sectional population-based data to estimate HIV incidence can prioritize where resources may be optimally be directed

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