THE LANCET
HIV

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Artenie A, Perry R, Mahaso M, et al. HIV incidence and factors associated with HIV risk among people who inject drugs engaged with harm-reduction programmes in four provinces in South Africa: a retrospective cohort study. *Lancet HIV* 2024; **11:** e823–32.

Supplement to: Artenie A, Perry R, Mahaso et al. HIV incidence and factors associated with HIV acquisition risk among people who inject drugs engaged with harm-reduction programs in four provinces in South Africa: A retrospective cohort study.

Table of contents

Table 1: HIV testing kits used by NACOSA-supported programs, by province 2

Table 2: Characteristics of people who inject drugs seen at the NACOSA-supported programs over 01/04/2019-30/03/2022 in four provinces in South Africa by HIV testing status and follow-up 3

Table 3: Baseline characteristics of 2,402 people who inject drugs (PWID) tested for HIV through NACOSA-supported harm-reduction programs in South Africa between 01/04/2019 and 30/03/2022, who were HIV-negative at first test and had ≥2 HIV tests, by race 5

Table 4: HIV incidence overall and by province using different assumptions on the date of HIV seroconversion . 6

Table 5: Sensitivity analysis in which the Cox regression multivariable models include province instead of race and implementing organisation 7

Table 6: Sensitivity analysis in which the Cox regression multivariable models include an alternative categorisation of age 9

STROBE Statement—Checklist of items that should be included in reports of cohort studies 11

Table 1: HIV testing kits used by NACOSA-supported programs, by province

Province	**Screening test**	**Confirmatory test**
Gauteng	Toyo Anti-HIV ½ HIV rapid test (Turklab Tibbi Malzemeler San)	First Response® HIV 1-2-0 Card Test (Premier Medical Corporation Private Limited)
Kwazulu-Natal	ONE STEP Anti-HIV(1&2) Test (InTec PRODUCT, INC)	First Response® HIV 1-2-0 Card Test (Premier Medical Corporation Private Limited)
Western Cape	Toyo Anti-HIV ½ HIV rapid test (Turklab Tibbi Malzemeler San) or ABON™ HIV 1/2/O Tri-Line Human Immunodeficiency Virus Rapid Test Device	First Response® HIV 1-2-0 Card Test (Premier Medical Corporation Private Limited), BioTracer™ HIV 1/2 Rapid Card or Colloidal Gold™ HIV 1/2 rapid test (KHB Shanghai Kehua Bio-engineering Co. Ltd., China)
Eastern Cape	ONE STEP Anti-HIV(1&2) Test (InTec PRODUCT, INC)	First Response® HIV 1-2-0 Card Test (Premier Medical Corporation Private Limited)

Table 2: Characteristics of people who inject drugs seen at the NACOSA-supported programs over 01/04/2019-30/03/2022 in four provinces in South Africa by HIV testing status and follow-up

Variable	Category	Never tested N=20955	Tested HIV+ at 1st test N=2075	Tested HIV- at 1st test & had no follow-up test N=5750*	Tested HIV- at 1st test & had ≥1 follow-up test N=2402
Province					
	Gauteng	16175 (77.2%)	1753 (84.5%)	3773 (65.6%)	1395 (58.1%)
	KwaZulu-Natal	2846 (13.6%)	219 (10.6%)	831 (14.5%)	374 (15.6%)
	Eastern Cape	492 (2.3%)	42 (2.0%)	425 (7.4%)	149 (6.2%)
	Western Cape	1442 (6.9%)	61 (2.9%)	721 (12.5%)	484 (20.1%)
Gender					
	Male	19306 (92.1%)	1894 (91.3%)	5317 (92.5%)	2172 (90.4%)
	Female	1604 (7.7%)	181 (8.7%)	429 (7.5%)	228 (9.5%)
	Transgender	45 (0.2%)	0	4 (0.1%)	2 (0.1%)
Age (years)	≤24	2282 (10.9%)	300 (14.5%)	745 (13.0%)	330 (13.7%)
	≥25 and ≤29	6908 (33.0)	735 (35.4%)	1843 (32.1%)	782 (32.6%)
	≥30 and ≤34	6827 (32.6%)	646 (31.1%)	1685 (29.3%)	687 (28.6%)
	≥35 and ≤39	3167 (15.1%)	269 (13.0%)	853 (14.8%)	368 (15.3%)
	≥40	1550 (7.4%)	125 (6.0%)	624 (10.9%)	235 (9.8%)
	Missing	221 (1.1%)	0	0	0
Race					
	Black	16975 (81.0%)	1713 (82.6%)	3968 (69.0%)	1627 (67.7%)
	Coloured	1428 (6.8%)	77 (3.7%)	759 (13.2%)	448 (18.7%)
	Indian	93 (0.4%)	4 (0.2%)	55 (1.0%)	29 (1.2%)
	White	717 (3.4%)	62 (3.0%)	394 (6.9%)	186 (7.7%)
	Asian	3 (<0.1%)	1 (<0.1%)	3 (0.1%)	0
	Missing	1739 (8.3%)	218 (10.5%)	571 (9.9%)	112 (4.7%)
Current housing					
	House	7199 (34.4%)	623 (30.0%)	1917 (33.3%)	731 (30.4%)
	Homeless	10965 (52.3%)	1125 (54.2%)	2941 (51.1%)	1339 (55.7%)
	Shelter, hostel, or other unstable housing	2322 (11.8%)	152 (7.3%)	360 (6.3%)	202 (8.4%)

	Missing	469 (2.2%)	175 (8.4%)	532 (9.3%)	130 (5.4%)
Nb. of harm-reduction packs received					
	0	4657 (22.2%)	380 (18.3%)	876 (15.2%)	414 (17.2%)
	1-2	11276 (53.8%)	775 (37.3%)	2074 (36.1%)	965 (40.2%)
	3-4	4681 (22.3%)	567 (27.3%)	1458 (25.4%)	522 (21.7%)
	≥5	341 (1.6%)	353 (17.0%)	1342 (23.3%)	501 (20.9%)
OAT in the past year					
	Yes	168 (0.8%)	70 (3.4%)	238 (4.1%)	133 (5.5%)
	No	20787 (99.2%)	2005 (96.6%)	5512 (95.9%)	2269 (94.5%)
Primary drug(s) used†					
	Heroin only	-	1548 (74.6%)	4301 (74.8%)	1773 (73.8%)
	Heroin and stimulants	-	444 (21.4%)	1075 (18.7%)	492 (20.5%)
	Stimulants only or other	-	83 (4.0%)	374 (6.5%)	137 (5.7%)
First engagement ≤1 year before end of study					
	Yes	7884 (37.6%)	829 (40.0%)	2568 (44.7%)	565 (23.5%)
	No	13071 (62.4%)	1246 (60.0%)	3182 (55.3%)	1837 (76.5%)

Abbreviation: OAT= opioid agonist treatment

*Includes a small proportion of PWID (N=264; 4.6%) who had follow-up HIV tests but these were excluded because (i) the time between the first and last HIV test was too short (≤45 days) to detect HIV seroconversion, if it occurred (n=183), (ii) an HIV-negative followed a previous positive test (n=34) and (iii) basic demographic information recorded between follow-up visits was different (i.e., either different date of birth and gender, or date of birth and district; n=47).

†Drug use data were not collected for PWID who were not tested for HIV

Table 3: Baseline characteristics of 2,402 people who inject drugs (PWID) tested for HIV through NACOSA-supported harm-reduction programs in South Africa between 01/04/2019 and 30/03/2022, who were HIV-negative at first test and had ≥2 HIV tests, by race

Variable	**Category**	**Black N=1739**	**Coloured N=448**	**Indian N=29**	**White N=186**
Implementing organisation	ANOVA Health Institute	1159 (66.6%)	18 (4.0%)	5 (17.2%)	9 (4.8%)
	TB HIV Care	406 (23.3%)	419 (92.5%)	22 (75.9%)	160 (86.0%)
	Tintswalo Home Based Care	174 (10.0%)	11 (2.5%)	2 (6.9%)	17 (9.1%)
Age (years)	≤24	285 (16.4%)	31 (6.9%)	2 (6.9%)	12 (6.5%)
	≥25 and ≤29	667 (38.4%)	82 (18.3%)	5 (17.2%)	28 (15.1%)
	≥30 and ≤34	497 (28.6%)	139 (31.0%)	14 (48.3%)	37 (19.9%)
	≥35 and ≤39	207 (11.9%)	115 (25.7%)	5 (17.2%)	41 (22.0%)
	≥40	83 (4.8%)	81 (18.1%)	3 (10.3%)	68 (36.6%)
Gender	Male	1641 (94.4%)	359 (80.1%)	27 (93.1%)	145 (78.0%)
	Female	98 (5.6%)	88 (19.6%)	1 (3.5%)	41 (22.0%)
	Transgender	0	1 (0.2%)	1 (3.5%)	0
Province	Gauteng	1333 (76.7%)	29 (6.5%)	7 (24.1%)	26 (14.0%)
	KwaZulu-Natal	321 (18.5%)	13 (2.9%)	21 (72.4%)	19 (10.2%)
	Eastern Cape	37 (2.1%)	25 (5.6%)	0	87 (46.8%)
	Western Cape	48 (2.8%)	381 (85.0%)	1 (3.5%)	54 (29.0%)
Current housing	House	535 (30.8%)	133 (29.7%)	3 (10.3%)	60 (32.3%)
	Homeless	1025 (58.9%)	302 (68.4%)	26 (89.7%)	116 (62.4%)
	Shelter, hostel or other unstable housing	179 (10.3%)	13 (2.9%)	0	10 (5.4%)
OAT in the previous year	Yes	57 (3.3%)	52 (11.6%)	2 (6.9%)	22 (11.8%)
	No	1682 (96.7%)	396 (93.1%)	27 (93.1%)	164 (88.2%)
Nb. of harm-reduction packs received*	0	225 (12.9%)	129 (28.8%)	11 (37.9%)	49 (26.3%)
	1-2	669 (38.5%)	202 (45.1%)	10 (34.5%)	84 (45.2%)
	3-4	412 (23.7%)	78 (17.4%)	6 (20.7%)	26 (14.0%)
	≥5	433 (24.9%)	39 (8.7%)	2 (6.9%)	27 (6.9%)
Primary drug(s) used	Only heroin	1456 (83.7%)	193 (43.1%)	25 (86.2%)	99 (53.2%)
	Heroin and stimulants	219 (12.6%)	220 (49.1%)	4 (13.8%)	49 (26.3%)
	Only stimulants or other drugs	64 (3.7%)	35 (7.8%)	0	38 (20.4%)

Table 4: HIV incidence overall and by province using different assumptions on the date of HIV seroconversion

Assumption*	Category	No. of person-years of follow-up	No. of incident cases	Rate per 100 person-years (95% CI)
1				
	All 4 provinces combined	2306.1	283	12.3 (10.9 - 13.8)
	Gauteng	1215.1	203	16.7 (14.5 -19.1)
	KwaZulu-Natal	361.7	54	14.9 (11.3 - 19.3)
	Eastern Cape	158.7	8	5.0 (2.3 - 9.6)
	Western Cape	570.5	18	3.2 (1.9 - 4.9)
2				
	All 4 provinces combined	2383.2	283	11.9 (10.6 - 13.3)
	Gauteng	1264.2	203	16.1 (14.0 - 18.4)
	KwaZulu-Natal	381.7	54	14.1 (10.7 - 18.3)
	Eastern Cape	159.1	8	5.0 (2.3 - 9.5)
	Western Cape	578.2	18	3.1 (1.9 - 4.8)
3				
	All 4 provinces combined	2216.7	283	12.8 (11.3 - 14.3)
	Gauteng	1154.7	203	17.6 (15.3 - 20.1)
	KwaZulu-Natal	343.8	54	15.7 (11.9 - 20.3)
	Eastern Cape	155.3	8	5.2 (2.4 - 9.8)
	Western Cape	562.9	18	3.2 (2.4 - 9.8)

*Assumption: (1): HIV seroconversion occurred at the midpoint between the last negative and first positive HIV tests; (2) HIV seroconversion occurred 1 month before the HIV-positive test, and (3) HIV seroconversion occurred 2 weeks after the last negative HIV test.

Table 5: Sensitivity analysis in which the Cox regression multivariable models include province instead of race and implementing organisation

Variable	Category	Model 1* aHR (95% CI)	Model 2** aHR (95% CI)
Overall	—	--	--
Province			
	Gauteng	Ref.	n.s.
	KwaZulu-Natal	0.90 (0.67 - 1.22)	n.s.
	Eastern Cape	0.33 (0.16 - 0.70)	n.s.
	Western Cape	0.22 (0.13 - 0.35)	n.s.
Age (years)			
	≤24	Ref.	n.s.
	≥25 and ≤29	0.98 (0.68 – 1.39)	n.s.
	≥30 and ≤34	1.05 (0.72 – 1.51)	n.s.
	≥35 and ≤39	0.67 (0.41 – 1.09)	n.s.
	≥40	0.90 (0.52 – 1.58)	
Gender			
	Male	Ref.	n.s.
	Female	0.85 (0.52 - 1.40)	n.s.
	Transgender†	NA	n.s.
Current housing status			
	House	n.i.	Ref.
	Homeless	n.i.	0.97 (0.73 - 1.28)
	Shelter, hostel, or other unstable housing	n.i.	0.85 (0.54 - 1.32)
No. of harm-reduction packs received currently			
	0		Ref.
	1-2	n.i.	0.96 (0.62 - 1.50)
	3-4	n.i.	1.16 (0.70 – 1.93)
	≥5	n.i.	1.19 (0.71 - 2.00)
Primary drug(s) used			
	Only Heroin		Ref.
	Heroin and stimulants	n.i.	1.61 (1.17 - 2.20)
	Only stimulants or other	n.i.	1.27 (0.63 - 2.53)

Time between HIV tests (months)			
	≤3		Ref.
	>3 & ≤6	n.i.	0.57 (0.39 - 0.83)
	>6 & ≤12	n.i.	0.44 (0.31 - 0.63)
	>12	n.i.	0.26 (0.17 - 0.39)
OAT in the previous year			
	No	n.i.	Ref.
	Yes	n.i.	0.52 (0.24 - 1.11)

*Model 1 includes province, age and gender. The remaining variables are not included because they are unlikely to act as confounding factors for either province, age or gender.
**Model 2 includes all variables listed in the Table, but the estimates for province, age and gender are not shown.
†HIV incidence could not be estimated given the low number of person-years at risk.
Abbreviations: CI = confidence interval; OAT= opioid agonist treatment; aHR = adjusted hazard ratio; NA = not available; n.i. = not included; n.s. = not shown

Table 6: Sensitivity analysis in which the Cox regression multivariable models include an alternative categorisation of age

Variable	Category	Model 1* aHR (95% CI)	Model 2** aHR (95% CI)
Overall	—	--	--
Implementing organisation			
	ANOVA Health Institute	Ref.	n.s.
	TB HIV Care	0.75 (0.55 - 1.02)	n.s.
	Tintswalo Home Based Care	0.85 (0.57 - 1.25)	n.s.
Age (years)			
	<26	Ref.	n.s.
	≥26 and <30	1.10 (0.82 – 1.48)	n.s.
	≥30 & <34	1.04 (0.75 – 1.46)	n.s.
	≥34	0.75 (0.51 - 1.08)	n.s.
Gender			
	Male	Ref.	n.s.
	Female	0.79 (0.49 - 1.28)	n.s.
	Transgender†	NA	n.s.
Race			
	Black	Ref.	n.s.
	Coloured	0.33 (0.20 - 0.55)	n.s.
	Indian	0.24 (0.03 – 1.73)	n.s.
	White	0.53 (0.28 - 0.99)	n.s.
Current housing status			
	House	n.i.	Ref.
	Homeless	n.i.	1.04 (0.79 - 1.37)
	Shelter, hostel, or other unstable housing	n.i.	0.91 (0.57 - 1.45)
No. of harm-reduction packs received currently			
	0		Ref.
	1-2	n.i.	0.76 (0.50 - 1.16)
	3-4	n.i.	0.83 (0.52 - 1.34)
	≥5	n.i.	0.85 (0.52 - 1.38)
Primary drug(s) used			

	Only Heroin	n.i.	Ref.
	Heroin and stimulants	n.i.	1.37 (1.00 - 1.88)
	Only stimulants or other	n.i.	0.93 (0.48 - 1.80)
Time between HIV tests (months)			
	≤3	n.i.	Ref.
	>3 & ≤6	n.i.	0.57 (0.39 - 0.83)
	>6 & ≤12	n.i.	0.42 (0.29 - 0.60)
	>12	n.i.	0.25 (0.17 - 0.38)
OAT in the previous year			
	No	n.i.	Ref.
	Yes	n.i.	0.49 (0.22 – 1.05)

*Model 1 includes implementing organisation, age, race and gender. The remaining variables are not included because they are unlikely to act as confounding factors for either implementing organisation, age, race or gender.

**Model 2 includes all variables listed in the Table, but the estimates for implementing organisation, age, race and gender are not shown.

†HIV incidence could not be estimated given the low number of person-years at risk.

Abbreviations: CI = confidence interval; OAT= opioid agonist treatment; aHR = adjusted hazard ratio; NA = not available; n.i. = not included; n.s. = not shown

STROBE Statement—Checklist of items that should be included in reports of cohort studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	7-8
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	n/a
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	9-10
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11 and Fig1
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10
		(*b*) Describe any methods used to examine subgroups and interactions	n/a
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, explain how loss to follow-up was addressed	9
		(*e*) Describe any sensitivity analyses	10
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Fig1
		(b) Give reasons for non-participation at each stage	Fig1

		(c) Consider use of a flow diagram	Fig1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11, Table1 and appendix (Tables 2 and 3)
		(b) Indicate number of participants with missing data for each variable of interest	10
		(c) Summarise follow-up time (eg, average and total amount)	12
Outcome data	15*	Report numbers of outcome events or summary measures over time	12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12, Table2
		(*b*) Report category boundaries when continuous variables were categorized	12, Table2
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12, appendix (Tables 4-6)
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1