Quantifying sexual mixing by HIV status and pre-exposure prophylaxis use among men who have sex with men

Linwei Wang[1], Nasheed Moqueet[1], Gilles Lambert[2], Daniel Grace[3], Ricky Rodrigues[4], Joseph Cox[5], Nathan J. Lachowsky[6,7], Syed W. Noor[4], Heather L. Armstrong[7,8], Darrell H. S. Tan[1,9,10], Ann N. Burchell[1,3], Huiting Ma[1], Jesse Knight[1], Stefan Baral[11], Trevor A. Hart[3,4], David M. Moore[7,12], Sharmistha Mishra[1,3,9,10,13]

1. Unity Health Toronto, St. Michael's Hospital, Toronto, ON, Canada; 2. Institut national de santé publique du Québec, Montreal, QC, Canada; 3.Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada; 4. Ryerson University, Toronto, ON, Canada; 5. McGill University, Montreal, QC, Canada; 6. University of Victoria, Victoria, BC, Canada; 7. British Columbia Centre for Excellence in HIV/AIDS, Vancouver, BC, Canada; 8. University of Southampton, Southampton, England; 9. Department of Medicine, University of Toronto, Toronto, ON, Canada; 10. Institute of Health Policy, Management, and Evaluation, University of Toronto, Toronto, ON, Canada; 11. Johns Hopkins University, Baltimore, MD, USA; 12. Department of Medicine, Division of AIDS, University of British Columbia, Vancouver, BC, Canada; 13. Institute of Medical Sciences, University of Toronto, Toronto, ON, Canada.

Contact: wanglinw@smh.ca

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INTRODUCTION

- Seroadaptive practices (e.g. serosorting) are adopted by some gay, bisexual, and other men who have sex with men (gbMSM) as a strategy to reduce HIV risk.
- With scale-up of biomedical HIV prevention (e.g. HIV pre-exposure prophylaxis (PrEP)), serosorting and related patterns of 'who has sex with whom' may be changing.
- Preferential partner selection by any attribute at the individual-level can influence the population-level sexual mixing patterns, which in turn can influence HIV transmission.
- To date, there is no empirical estimate that quantifies population-level sexual mixing by HIV status nor its change with PrEP use.
- **Our objectives were to quantify** (by comparing observed partnership distributions vs. what would have been observed by chance if zero individuals selected partners based on the attribute):
  - ➢ population-level serosorting among gbMSM in Canada.
  - ➢ population-level serosorting among HIV-negative gbMSM stratified by PrEP use.
  - ➢ population-level PrEP-matching.

METHODS

Study design and subjects

- Baseline cross-sectional data (Feb 7th 2017 to Aug 31st 2018 (n=1937)) from *Engage*, a prospective cohort of gbMSM in Toronto, Montreal, and Vancouver.
  - ➢ Cisgender and transgender men aged ≥16 years who had sex with another man in the past 6 months (P6M) were recruited using respondent-driven sampling.
- We included respondents (egos) who reported ≥1 anal or oral male sex partner(s) (alters) in the P6M.

Measures: HIV status and PrEP use

- Egos' HIV status: self-report of their most recent HIV test results.
- Alters' HIV status: based on egos' responses to *E.g.,*:
  - ➢ ***'of the men you had oral or anal sex with in the P6M, how many were HIV-positive?'***
- Egos' PrEP use in the P6M: self-report of PrEP use anytime in the P6M.
- Egos' and their recent (up to five most recent in the P6M) alters' PrEP use at last sex: based on egos' responses to the event-level questions: *E.g.*,
  - ➢ ***'The most recent time you had sex with the partner named above, were you using PrEP? Was your partner using PrEP?'***

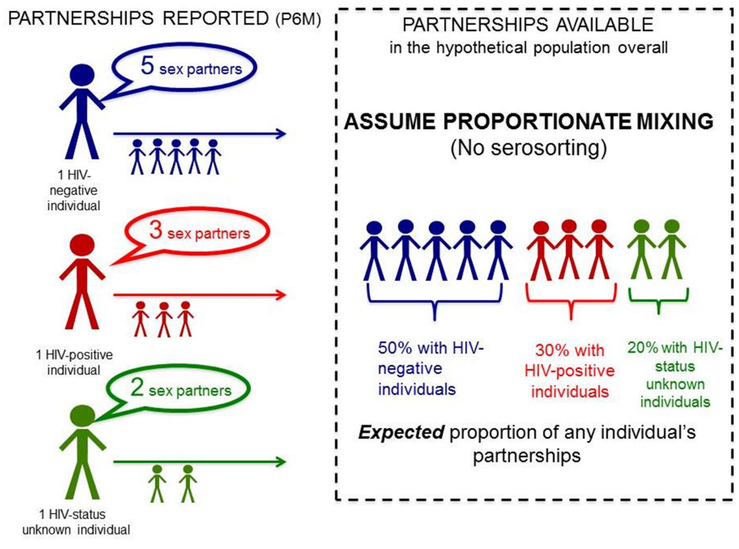
Analysis: Observed partnership distributions

- Of P6M partnerships, we calculated the observed proportions of partnerships by alters' HIV status for:
  - ➢ HIV-positive, HIV-negative (overall, and by P6M-PrEP use), and egos of unknown HIV status, separately.
- Of recent HIV-negative partnerships, we calculated the observed proportions of partnerships by alters' PrEP use at last sex, for :
  - ➢ HIV-negative egos who used PrEP and who did not use PrEP at last sex, separately.

CONCLUSIONS

- Our findings demonstrate population-level serosorting among both HIV-negative and HIV-positive gbMSM.
- Our findings reveal the influence of PrEP on sexual mixing patterns as evidenced by less population-level serosorting among those on PrEP and PrEP-matching.
- These data reinforce the importance of monitoring changes in sexual mixing patterns among gbMSM to inform PrEP implementation and impact evaluation.

Analysis: Counterfactual partnership distributions by chance



- We estimated the partnership distribution by alters' HIV status by chance if zero individuals serosort, under the proportionate mixing assumption (**Figure 1**) using a balancing-partnerships approach*.
- Similarly, we estimated the partnership distribution by alters' PrEP use among all HIV-negative alters by chance, under the proportionate mixing assumption.
- We compared the observed partnership distributions to the counterfactuals using chi-squared tests.

Figure 1. Illustration of the proportionate mixing assumption.

* Given partnership balancing, if an HIV-positive individual has *x* number of sexual partners, he provides *x* number of HIV-positive partnerships to the sexual network (*Garnett GP et al., IMA J Math Appl Med Biol, 1994*).

RESULTS

- 1881 respondents (17.0% self-reported as HIV-positive, 74.5% as HIV-negative, and 8.5% as of unknown HIV status) were included for analyses.
- Respectively, they reported a median of 7 [interquartile range: 3-20], 5 [3-12], and 3.5 [2-7.2] sex partners in the P6M.

Table 1. Evidence of population-level serosorting.

		Alters' HIV status as perceived by egos				
			Conditional on awareness of alters' HIV status			
Egos' characteristics			Unaware/Unsure % (95% CI)	Negative % (95% CI)	Positive % (95% CI)	P-value
HIV status	n					
		Chance	4.9 (4.6-5.2)	75.4 (74.8-75.9)	24.6 (24.1-25.2)	Reference
Negative	1402	Observed	41.6 (40.9-42.4)	87.0 (86.3-87.7)	13.0 (12.3-13.7)	<0.001
Positive	319	Observed	32.2 (30.9-33.5)	35.7 (34.1-37.3)	64.3 (62.7-65.9)	<0.001
Unknown	160	Observed	49.7 (46.7-52.7)	87.5 (84.4-90.2)	12.5 (9.8-15.6)	<0.001

Table 2. Less population-level serosorting among HIV-negative gbMSM who used PrEP vs. HIV-negative gbMSM who did not use.

		Alters' HIV status as perceived by egos				
			Conditional on awareness of alters' HIV status			
Egos' characteristics			Unaware/Unsure % (95% CI)	Negative % (95% CI)	Positive % (95% CI)	P-value
PrEP, P6M	n					
		Chance	4.9 (4.6-5.2)	75.4 (74.8-75.9)	24.6 (24.1-25.2)	Reference
No	1178	Observed	44.7 (43.7-45.6)	91.6 (90.9-92.3)	8.4 (7.7-9.1)	<0.001
Yes	224	Observed	35.9 (34.7-37.2)	79.4 (78.1-80.8)	20.6 (19.2-21.9)	<0.001

Table 3. Population-level PrEP matching: gbMSM on PrEP had a higher proportion of partners on PrEP among their HIV-negative partners vs. by chance.

		Alters' PrEP use at last sex as perceived by egos				
			Conditional on awareness of alters' PrEP use			
Egos' characteristics			Unaware/Unsure % (95% CI)	No % (95% CI)	Yes % (95% CI)	P-value
PrEP, last sex	n					
		Chance	0.0 (0.0-0.0)	65.3 (64.5-66.0)	34.7 (34.0-35.5)	Reference
No	1244	Observed	9.8 (8.5-11.2)	78.6 (76.6-80.5)	21.4 (19.5-23.4)	<0.001
Yes	202	Observed	10.6 (7.8-14.0)	44.2 (39.0-49.5)	55.8 (50.5-61.0)	<0.001

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