Abstract #: 849

Network Viral Load: A Critical Metric for HIV Elimination

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Introduction

More than 1.2 million people in the United States are living with HIV infection.[1]

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  - (12.8%) are unaware of their infection[1]

There is evidence that viral load is positively associated with transmissibility of HIV.[2]
Individuals with VL of ≥ 50,000 copies/mL are considered highly infectious.[2]

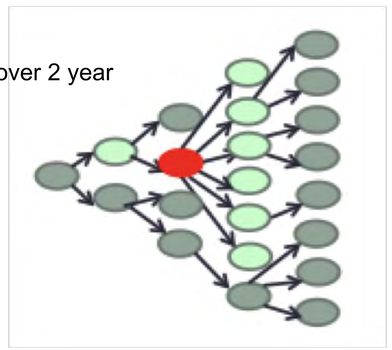
Current research suggests that an aggregate viral load measure, the community viral load (CVL) is associated with increases in new HIV infections.
However , CVL aggregates viral loads within chosen, defined geographic areas; therefore inferences about HIV acquisition risk for HIV-negative persons are restricted to HIV-positive source patients within these geographic areas.

Methods: uConnect Study

Population:
Black men (born male), age 16-29
Live on South Side of Chicago, IL, USA
Had sex with another man in past 2 years

Measurements at each time point:
HIV antibody status
Viral Load
Behavioral Questionnaire

Study Design:
Respondent Driven Sampling
Longitudinal: 3 measurements over 2 year follow-up period



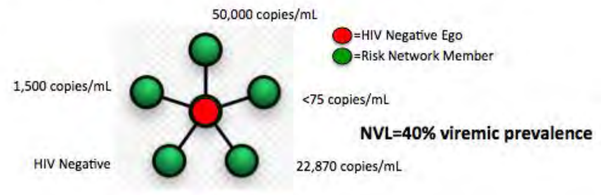
Network Construction: Risk Network[4,5]
RDS recruitment chain-referral structure to generate personal "risk" networks
6 potential recruits (coupons distributed)
1 recruiter (non-seeds)

65 seeds generated a sample of 618 respondents
Longest chain: 13 waves
Mean chain length: 3.3 waves

Justification

- Non-random, close social YBMSM ties
- Network sample
- Risk networks influence transmission patterns of HIV[6]
- Significant overlap between sexual and social networks of BMSM[7]
- HIV prevalence is high in this group
- HIV risk behaviors high; shared norms in networks[8]
- Exclusively defined sex network tracing challenging

Figure 1. Example sociogram depicting Network Viral Load calculation



Analytic Plan

Primary Outcome: Lab confirmed HIV serostatus (at baseline)
-n= 457 (91% of total n)

Primary Exposure Variable: Network Viral Load
-Prevalence of viremic (those with >20,000 copies/mL) individuals in network
0=Entire network HIV-
1= ≥ One HIV+ member, but <10% of network above 20k copies/mL
2=10%-100% of network 20k copies/mL

Covariates:
Ego level attributes & behaviors
Demographics

Analysis:
Multivariate logistic regression (cross-sectional at baseline)

Results

- HIV prevalence: 39%
- Proportion with ≥1 HIV+ network member: 58%

Network Size:
Mean: 1.9, Range: 1-7

Mean NVL: 20% of network with >20k copies/mL
Range 0 – 100% of network with >20k copies/mL

Results

Recruiter Relationship, (n=502)	n	%
Stranger	13	3
Someone you know, but not closely	95	20
Close friend	274	59
Sex Partner	40	9
Family Member	43	9
Seed	37	7

Demographics, Ego Characteristics, and bivariate associations with HIV status, uConnect (n=502)

	n (%)	OR	C.I.
Age (median, IQR)	23 (20-25)	1.13	(1.06-1.21)
Education < High school Degree	34 (7)	1.16	(0.56-2.40)
Unemployed (previous Year)	163 (33)	1.55	(1.04-2.30)
Has Health Care Coverage	258 (51)	1.15	(0.78-1.67)
Have Used PrEP	20 (4)	0.40	(0.14-1.13)
Unstably Housed (previous year)	129 (26)	0.98	(0.64-1.51)
Ever been Detained or Arrested	233 (46)	1.49	(1.02-2.17)
Sex Drug Use (previous 6 months)	118 (24)	1.66	(1.08-2.55)
Sexual Orientation			
Gay	331 (66)	1.00	-
Straight	20 (4)	0.61	(0.20-1.83)
Bisexual	138 (27)	0.46	(0.29-0.72)
Other	12 (2)	1.46	(0.44-4.90)
# Male Sex Partners previous 6 months (median, IQR)	2 (1,3)	1.20	(1.05-1.37)
# Male condomless sex partners	1 (0,1)	1.17	(0.98-1.39)

Multiple Logistic Regression: Factors Associated with HIV serostatus: uConnect Study (n=425)

		OR	95% CI	p-value
Age		**1.10**	**1.03-1.18**	**0.006**
Syphilis Dx (previous year)	No	1.00	-	-
	Yes	**4.26**	**2.38-7.61**	**<0.001**
Frequency of anal sex (previous 6 months)		1.02	0.99-1.05	0.08
Number of social & sexual connections (Degree)		0.98	0.95-1.02	0.37
Sex Drug Use (previous 6 months)	No			
	Yes	1.48	0.91-2.41	0.11
Network Viral Load			-	-
		1.00		
> One HIV+ member, but <10% of network above 20k copies/mL		**1.85**	**1.18-2.92**	**0.008**
10%-100% of network 20k copies/m		**2.73**	**1.54-4.85**	**0.001**

OR=Odds Ratio, CI=Confidence Interval

Conclusions

The current analysis establishes the relationship of Network Viral Load and HIV seropositivity. We found an increase in the strength of the association between NVL and HIV infection with increasing levels of NVL (prevalence of viremia). It addresses the limitations of the CVL by refining the the risk population to a network and not placing restrictions on geographic areas.

Our study is limited in its ability to infer causality between NVL and HIV acquisition due to the cross-sectional nature of the study design. However, when examining the longitudinal results, we found that 38 of the 261 respondents (15%) who were HIV negative at baseline seroconverted to HIV+ over the 18 months of follow-up. While this rate is high, it is not substantial enough to be adequately powered for analysis. Nevertheless, descriptive results using lower NVL thresholds show signs of association between NVL and HIV seroconversion. A lower proportion of those who seroconverted had entirely HIV- networks at baseline (39%) compared to those who remained negative over the course of the study (52%). The study is also limited due to self-report.

NVL could have substantial public health implications as it could be used for targeting HIV prevention interventions, such as PrEP, towards those who would benefit most.

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