

Relationship-level Estimates of Risk

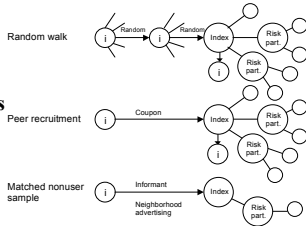
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BACKGROUND

The critical importance in the transmission of HIV are “gatekeepers,” the HIV-negative partners of persons who are HIV-infected. These are the persons at risk and they are the persons who can eventually spread the disease further. And since the highest infectivity comes in the first months after infection, usually before knowledge of infection, the behavior of these “gatekeepers” while they are HIV- is critical.

RESEARCH METHODS

We collected a **representative sample of 267 persons** consisting of 169 quasi-randomly recruited index persons and 98 of their sex and drug injection partners from high drug use neighborhoods. They described **3254 relationships** involving **1538 persons**.



HIV Risk Index:

Estimating Potential Transmission

$$\text{risk index}_{ik} = 1 - \left\{ \prod_j (1 - f_j) c_{ijk} \right\}^{120}$$

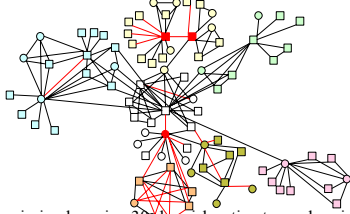
where
i is respondent
k is partner
j is risk behavior
f_j is per-act risk
c_{ijk} is number of 30-day risk behaviors

Imputed per-act transmission probabilities:

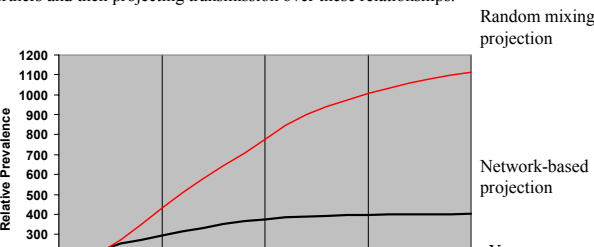
Vaginal sex from male to female without condom	0.001
Vaginal sex from female to male without condom	0.0005
Vaginal sex from male to female with condom	0.000025
Vaginal sex from female to male with condom	0.0000125
Receptive anal sex without a condom	0.02
Insertive anal sex without a condom	0.0087
Receptive anal sex with a condom	0.0008
Insertive anal sex with a condom	0.00035
Shared injection equipment (infected)	0.0067
Shared cooker, cotton, or water	0.000067

NETWORKS AND RANDOM MIXING

Networks organize the possibility of disease transmission. In this set of seven interlocking networks, there are three HIV+ persons (in red). They are linked to eight other persons by risk behaviors (also in red). None of the other persons in the networks is at direct risk.

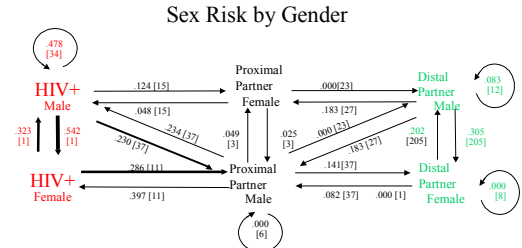


We projected HIV transmission by using 30-day risk estimates and projecting them over the next 20 years. Next we examined the effect of network organization by modifying our data. We took all links from a given person and randomly selected a different partner from the list of partners and then projecting transmission over these relationships.

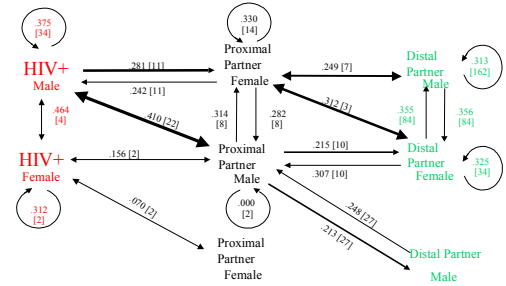


RESULTS

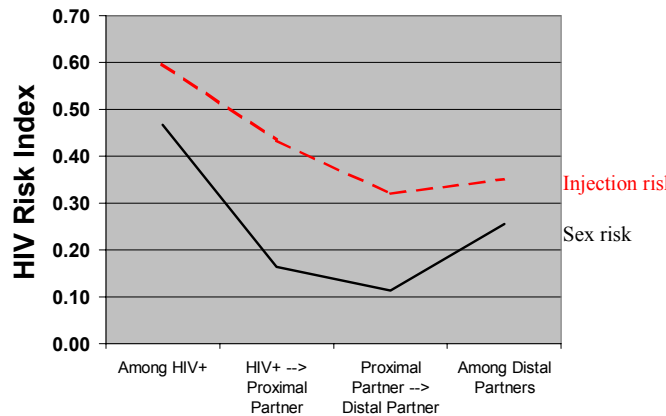
There is a gradient of infection potential by which HIV can diffuse from the HIV+ population through “gatekeepers” to the rest of the population.



Injection Risk by Gender



The HIV Transmission Gradient



CONCLUSIONS

- The network organization of sex and injection behaviors reduces transmission by almost 70% over random mixing.
- In general, the highest levels of risk we observe are among HIV+ individuals.
- There is an HIV transmission gradient that operates to limit the spread of HIV.
- In the general population, people are acting approximately as if their sex partners were HIV+.
- Among drug injectors (at least cocaine injectors), we find much higher levels of risk.