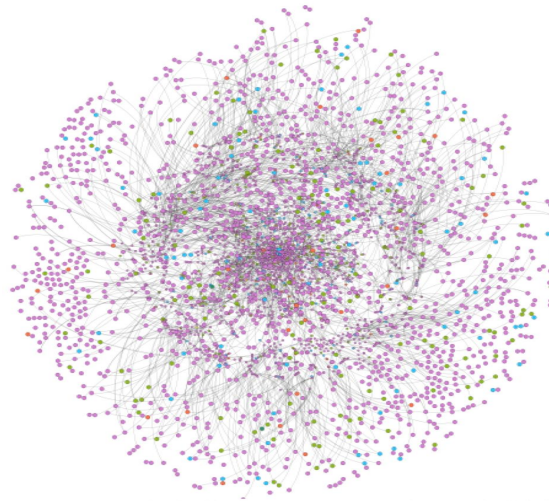# Leveraging Social Networks to Improve Clinical Outcomes Among HIV-infected Youth in East Africa
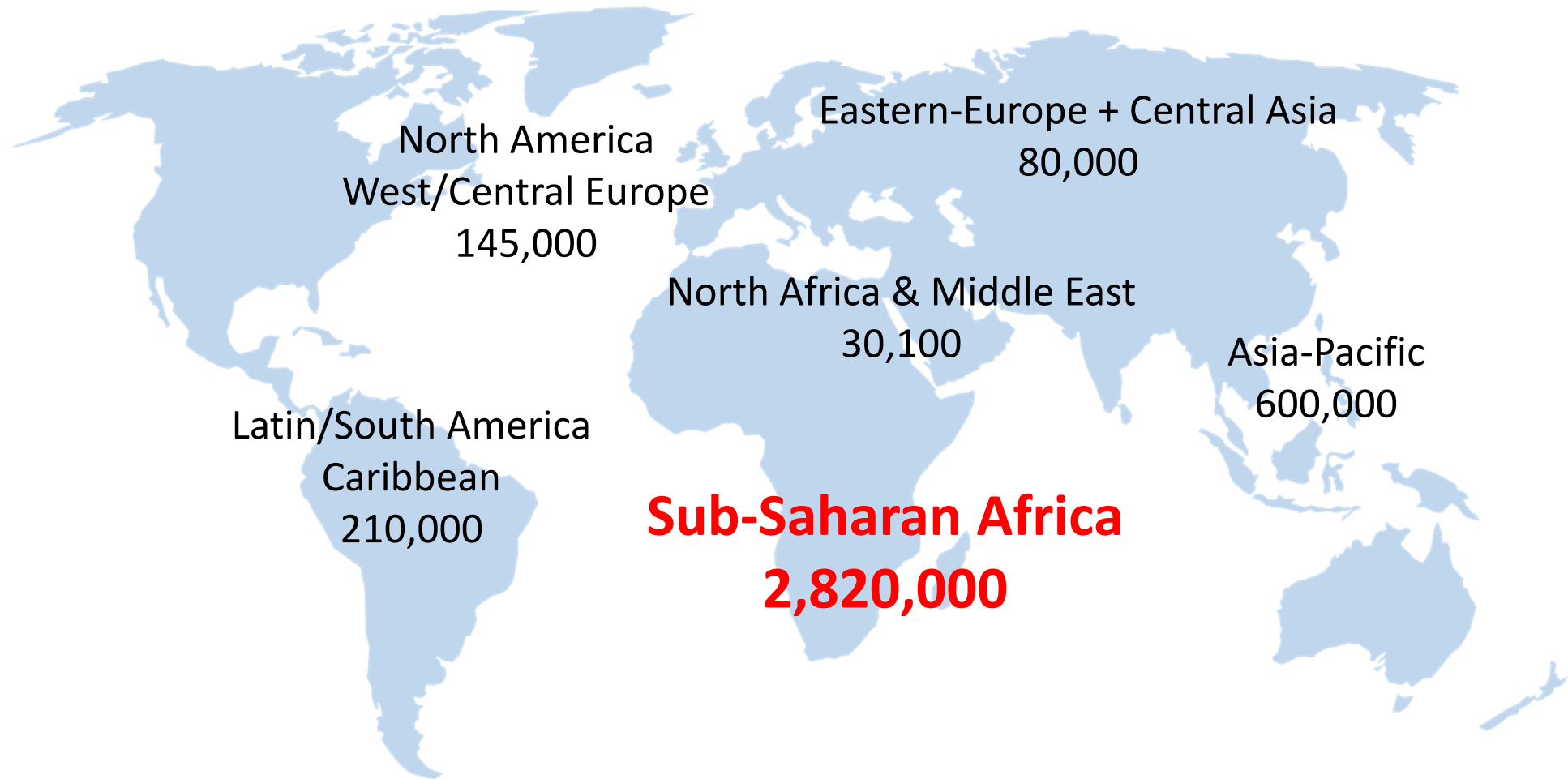
Lillian Brown, MD, PhD

Assistant Professor, Division of HIV, Infectious Diseases, and Global Medicine
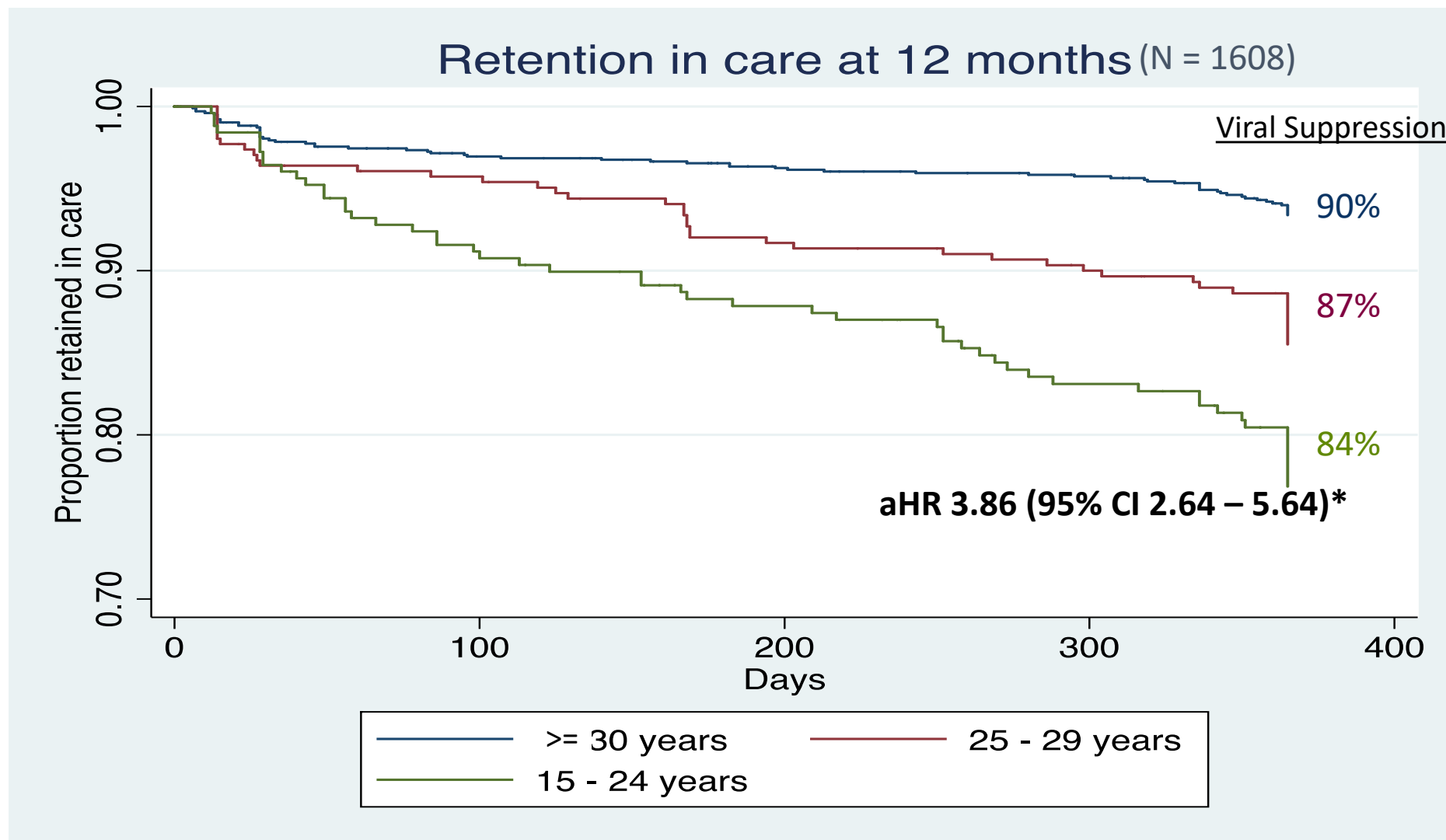
September 28, 2018

SEARCH

SUSTAINABLE EAST AFRICA RESEARCH IN COMMUNITY HEALTH

UCSF

University of California San Francisco

37 million people globally are living with HIV
4 million are **youth age 15 – 24**

North America
West/Central Europe
145,000

Eastern-Europe + Central Asia
80,000

North Africa & Middle East
30,100

Asia-Pacific
600,000

Latin/South America
Caribbean
210,000

**Sub-Saharan Africa
2,820,000**

UNAIDS 2015

Across sub-Saharan Africa youth on ART have poor clinical outcomes

- Compared to older adults, youth age 15 – 24:
  - are **1.5 – 3x *more likely*** to become **lost to follow-up**[1, 2, 3]
  - **50% *less likely*** to report perfect **adherence**[2]
  - are **1.6-3.2x *more likely*** to have **detectable viral loads**[2,3,4,5]

- Implications for their own health, future ART treatment options, and ongoing transmission

[1]Lamb et al, *AIDS* 2014; [2]Nachega et al, *JAIDS* 2009; [3]Evans et al *AIDS* 2013; [4]Jobanputra *Plos One* 2015; [5]Nglazi *BMC Infect Disease* 2012

Youth continue to lag behind older age groups in universal treatment era

Retention in care at 12 months (N = 1608)

aHR 3.86 (95% CI 2.64 – 5.64)*

Viral Suppression: 90% (>= 30 years), 87% (25 - 29 years), 84% (15 - 24 years)

*Adjusted for sex, education, occupation, pre-ART CD4 count, time to link to HIV care, access to mobile phone   Brown et al, AIDS 2016

Youth face unique challenges to success in HIV care

- Time of transition[1]
  - Psychosocial, cognitive, behavioral changes
  - Life events: leaving home, marriage, children
- Stigma[2,3]
- Poor social support[3,4]
- Lack of youth friendly clinics in rural areas[5]

[1]Andiman, *J Pediatr* 2011; [2]Cluver *AIDS* 2014; [3]Wolf *BMC Public Health* 2014; [4]Cluver *AIDS Care* 2016; [5]Geary et al, *BMC Health Services Research* 2014

HIV-infected youth in Kenya who lived with HIV+ household member more likely to be retained in care
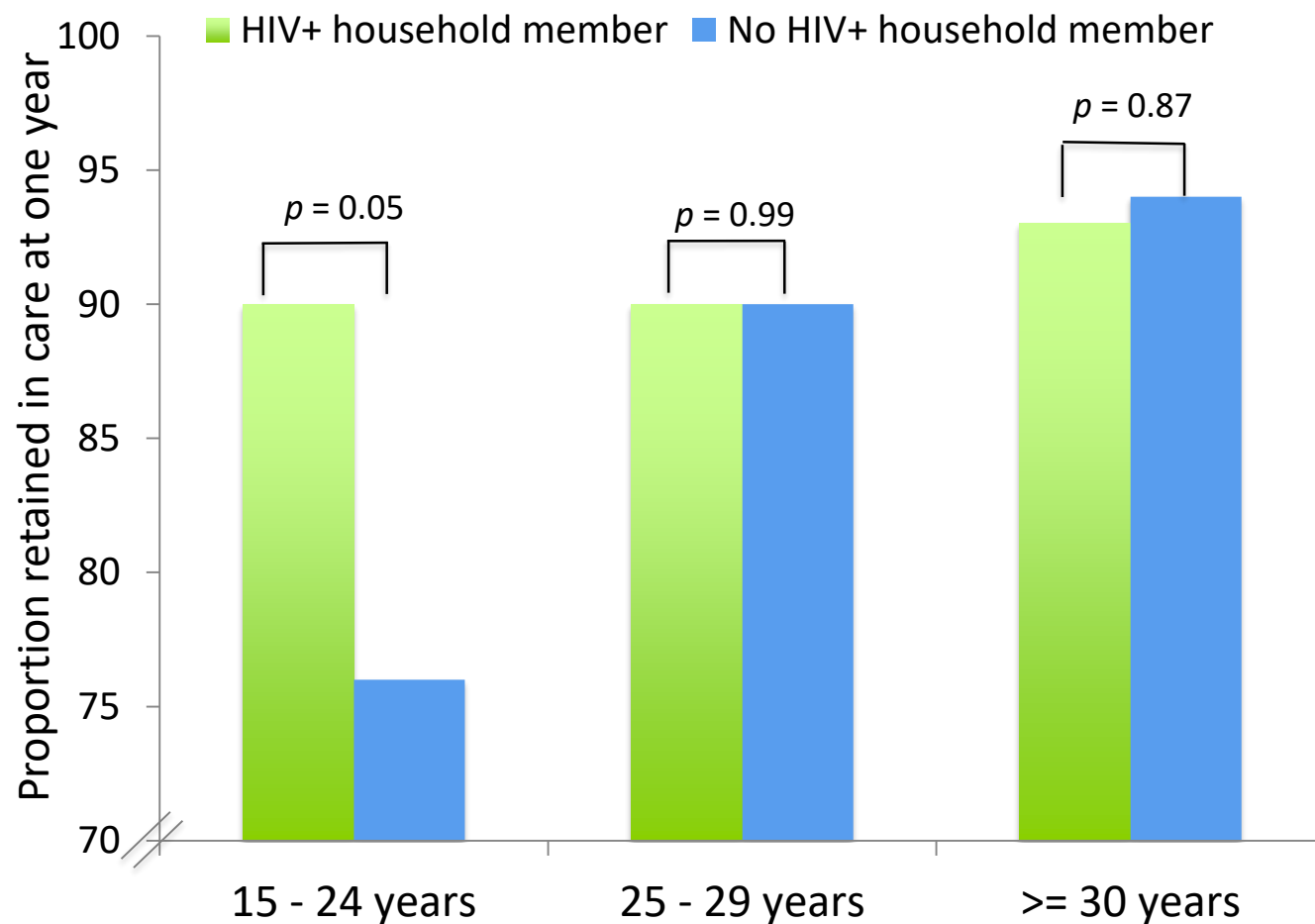
*Having HIV-infected household member associated with increased retention at one year among youth age 15 − 24 **(aHR 2.94; 95% CI 1.35 − 6.25)** -- but not older age groups*

Brown et al, *JAIDS 2017*

How do the social networks of HIV-infected youth influence their clinical outcomes?

*Can the social networks of HIV-infected youth be leveraged to improve their clinical outcomes?*

Social networks of youth may provide insight into engagement in HIV care

- Social networks influence various aspects of disease and behavior[1]
  - Spread of ideas
  - Social support
  - Access to resources

- Example: Social network research and obesity[2]

- Social networks are associated with HIV risk behavior
  - HIV testing[3,4,5]
  - Concurrency[6]
  - Intimate partner violence[7]

[1]Christakis & Fowler, Epidemiol, 2009;[2] Christakis & Fowler *NEJM* 2007; [3]Zheng *CROI* 2016; [4]Zheng *CROI* 2017; [5]Maman *Soc Sci Med* 2016; [6]Yamanis *AIDS Behav* 2016; [7]Yamanis *AIDS Behav* 2015
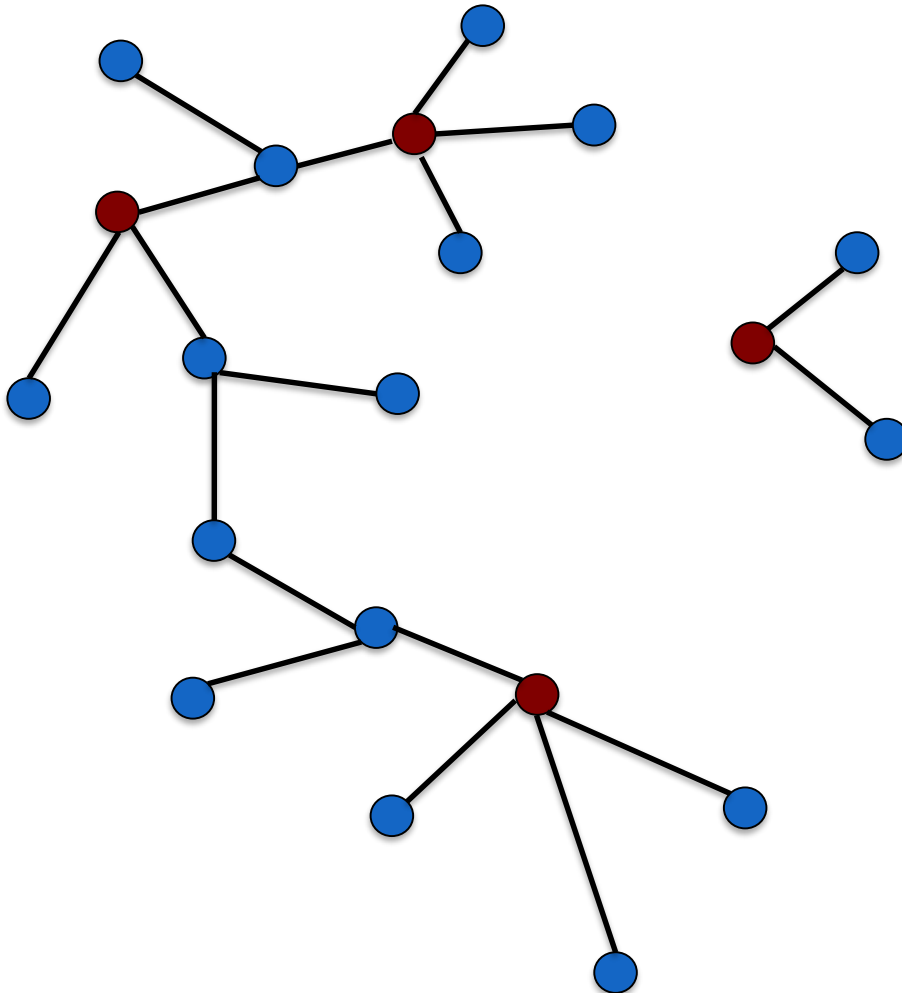
Social Network Analysis
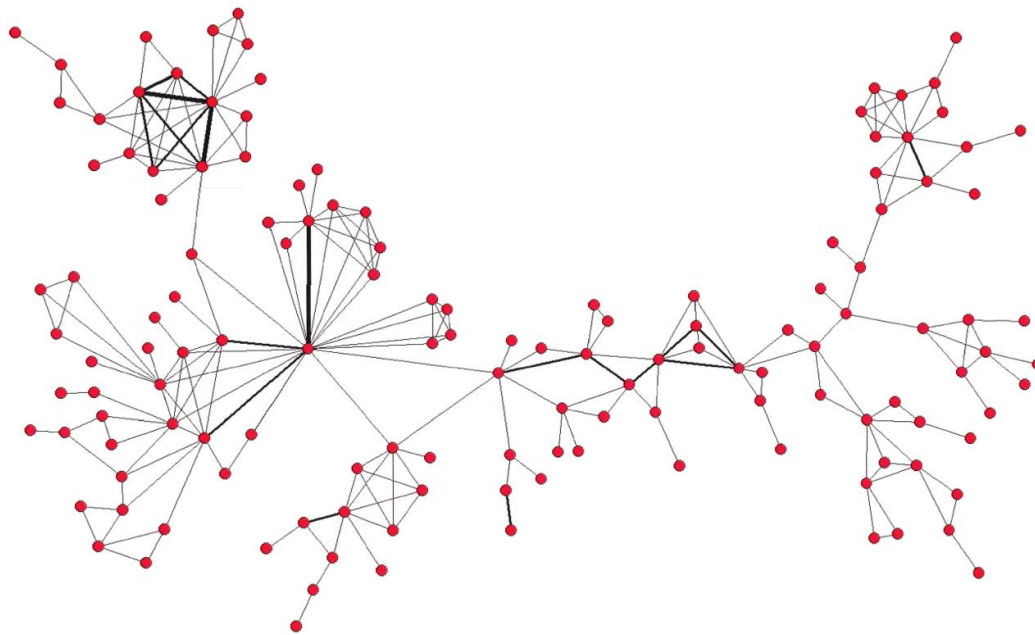
Basic definitions:
- **Node:** each individual (ego) in network
- **Edge:** Direct connection between individuals
- **Local social network:** first degree contacts

Analysis:
- **Network characteristics**
  - **Density:** Proportion of realized edges between nodes to potential edges between all nodes
  - **Clustering:** proportion of trios that are fully connected
- **Ego characteristics**
  - **Centrality:**
    Degree
    Indegree
    Betweeness
    Closeness

Social Network Analysis

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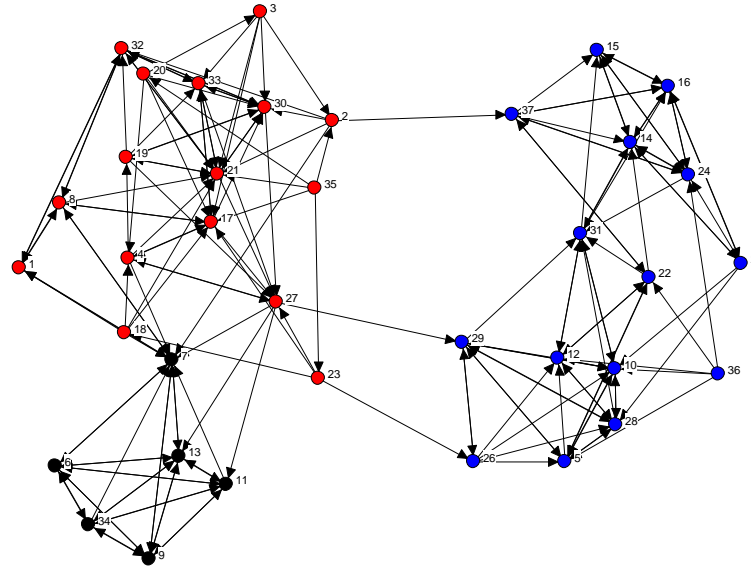
How can social networks be leveraged for interventions?

- Focus on influential individuals

- Target network based groups

- Rewire the network: create new ties

Valente, *Science* 2012; Flodgren et al *Cochrane Reviews* 2011

How can social networks be leveraged for interventions?

- Focus on influential individuals
  - Opinion leaders
    - In-degree for highly cohesive groups
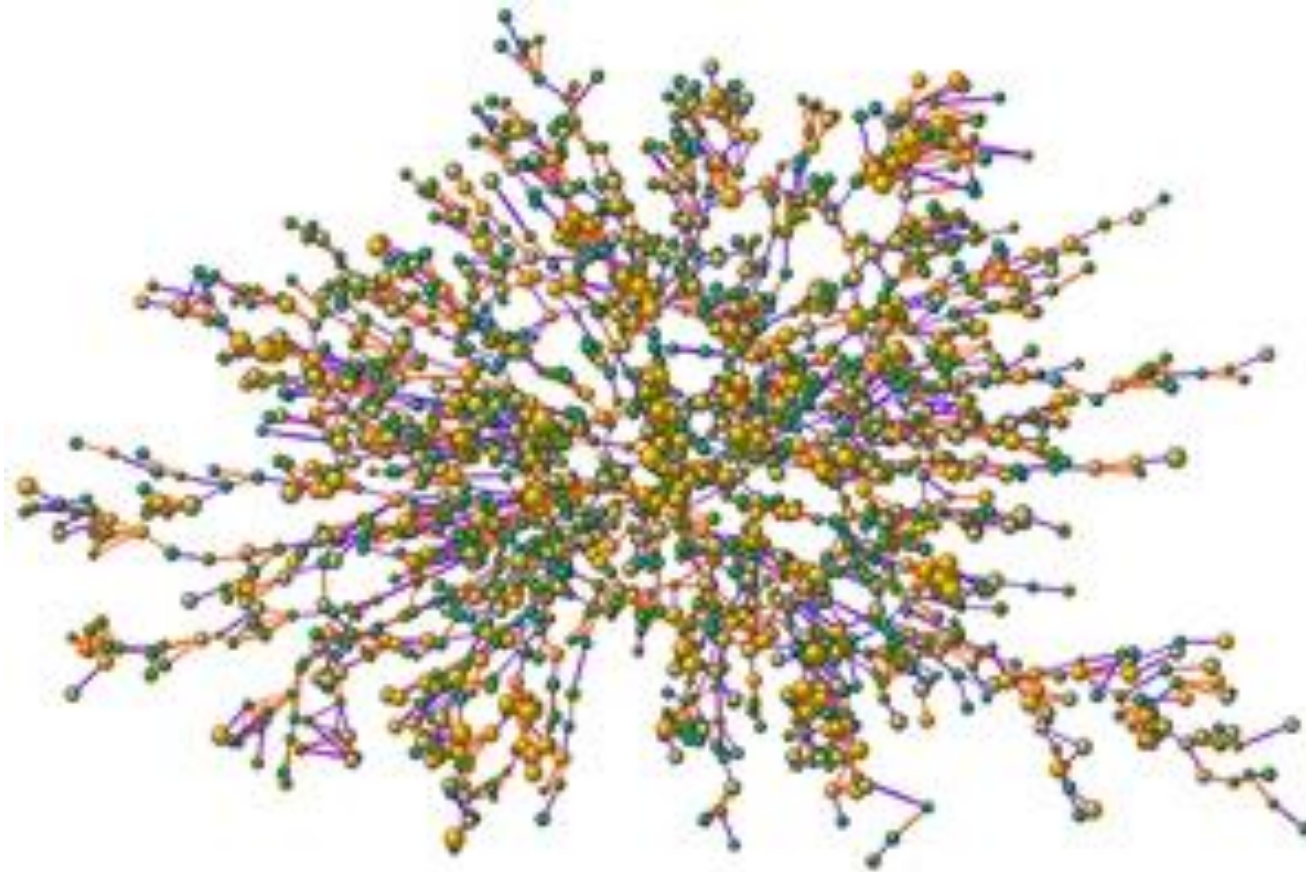   - Betweenness for fractured groups

Valente, *Science* 2012; Kelly JA *AJPH* 1994; Jones KT *AJPH* 2008
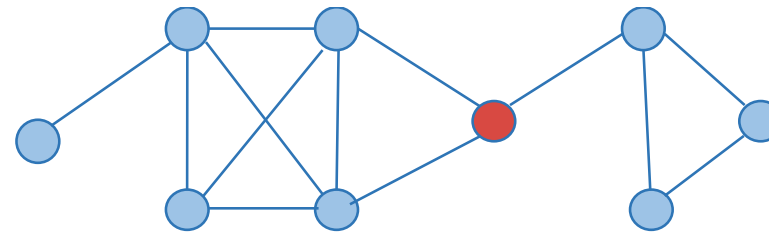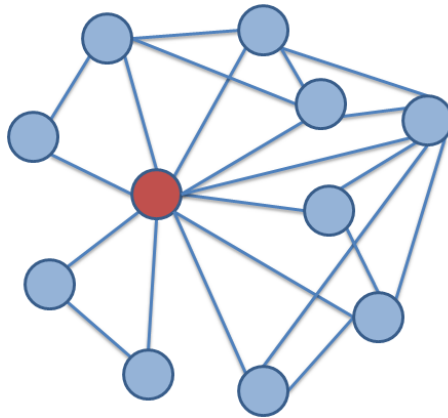
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How can social networks be leveraged for interventions?

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Valente, *Science* 2012; Shakya et al, *BMJ Open* 2017

How do the social networks of HIV-infected youth influence their clinical outcomes?

Can the social networks of HIV-infected youth be leveraged to improve their clinical outcomes?

The SEARCH test-and-treat trial as a platform to address these questions

- Community cluster-randomized trial

- ~320,000 persons across 32 communities

- Complete social networks

UGANDA
Tororo
KENYA
Mbarara
Nyanza

Social Networks

- Social contacts named in 5 domains:
  - **Health:** *"With whom have you discussed any kind of health issue?"*
  - **Emotional support:** *To whom have you gone to receive emotional support?*
  - **Free time:** *With whom have you usually spent time for leisure, enjoyment, relaxation?*
  - **Money:** *With whom have you discussed any kind of money matters?*
  - **Food**: *With whom, outside of your household, have you shared, borrowed, or exchanged any food?*

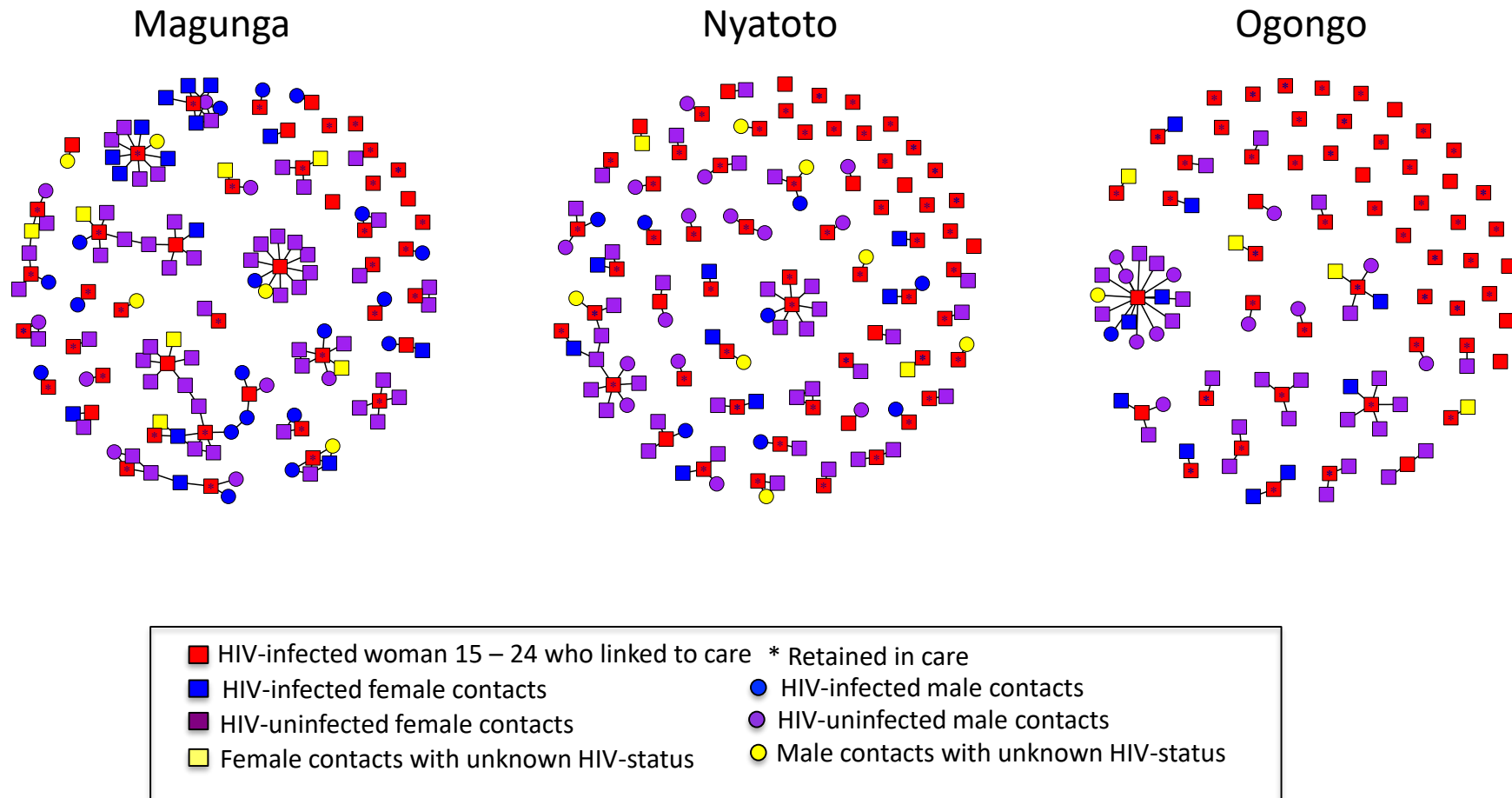- Named contacts matched to residents identified in census
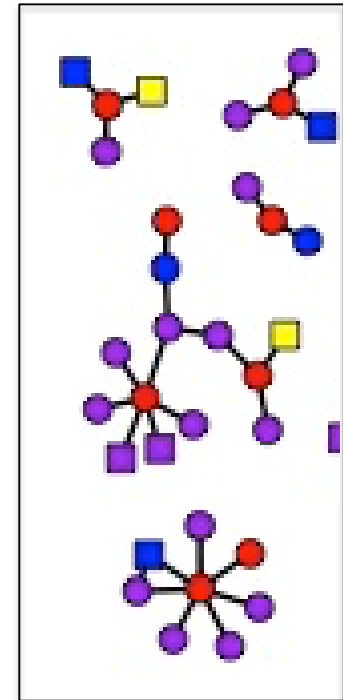
Complete network of all residents ≥ 15 years across 3 communities in Kenya
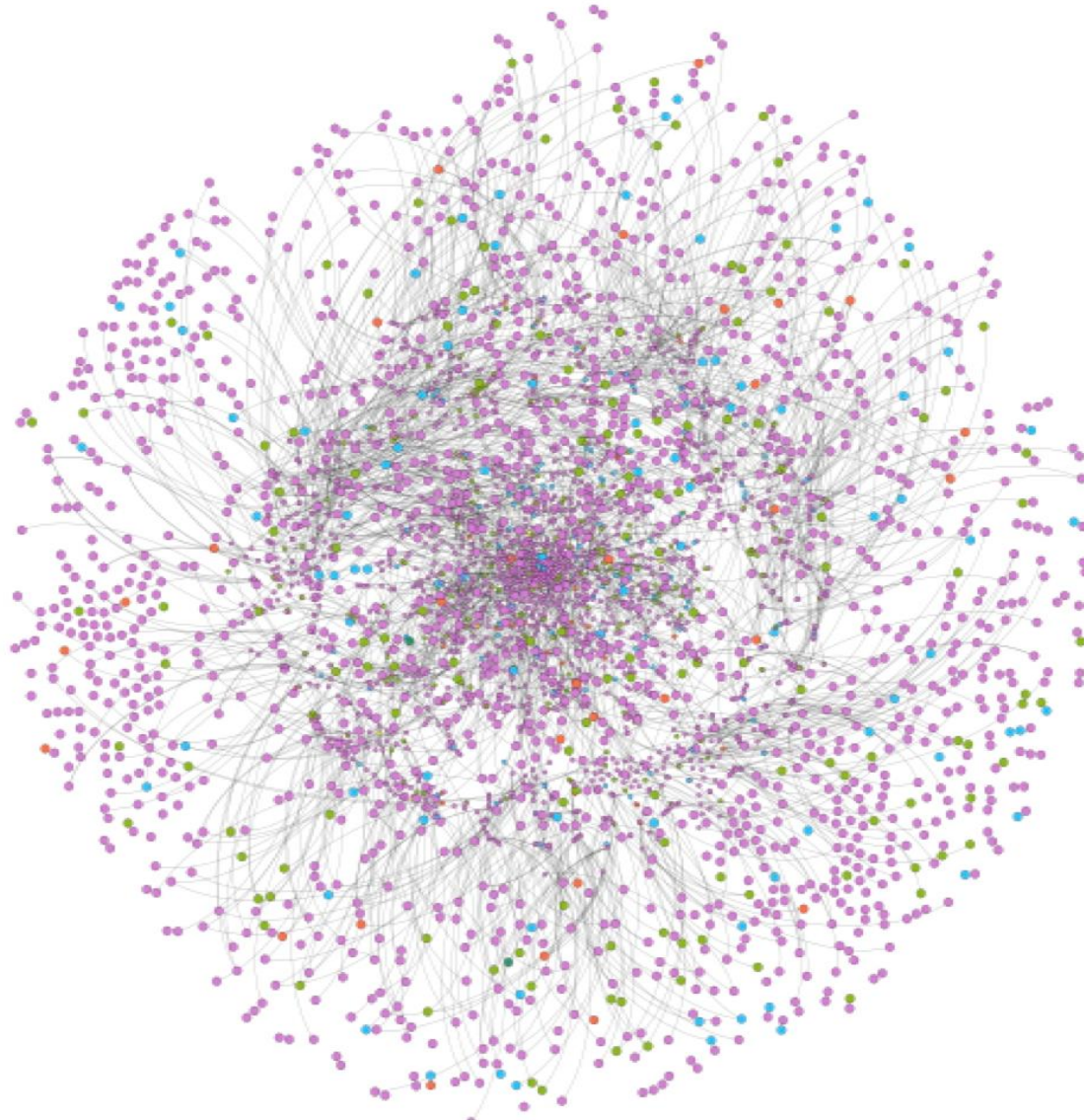
Red = HIV+ young women (15 – 24 years)
Yellow = HIV+ young men (15 – 24 years)
Blue = HIV+ older adult men (≥ 25 years)
Green = HIV+ older adult women (≥ 25 years)
Purple = HIV negative

Local Social Networks of HIV-infected Young Women in 3 communities in Kenya

Magunga   Nyatoto   Ogongo

Legend:
- ■ (red) HIV-infected woman 15 – 24 who linked to care   * Retained in care
- ■ (blue) HIV-infected female contacts   ● (blue) HIV-infected male contacts
- ■ (purple) HIV-uninfected female contacts   ● (purple) HIV-uninfected male contacts
- ■ (yellow) Female contacts with unknown HIV-status   ● (yellow) Male contacts with unknown HIV-status

Young women with HIV+ contacts in local social network more likely to be retained in care & virally suppressed

| Adjusted Hazard Ratio (95% CI) for Retention in Care*,‡			
	Any Gender	Female	Male
Any HIV+ contact	1.45 (0.90 – 4.17)	**2.63 (1.08 – 14.3)**	0.60 (0.24 – 1.49)
Health contact	1.62 (0.63 – 4.17)	1.02 (0.12 – 9.10)	0.44 (0.17 – 1.14)
Emotional support contact	1.49 (0.54 – 4.07)	1.69 (0.20 – 14.3)	0.37 (0.13 – 1.03)
Free time contact	2.00 (0.60 – 6.67)	4.16 (0.62 – 25.0)	1.06 (0.25 – 4.54)
Money contact	0.94 (0.28 – 3.13)	1.04 (0.32 – 3.51)	0.75 (0.23 – 2.44)
Adjusted Odds Ratio (95% CI) for Viral Suppression*,‡			
	Any Gender	Female	Male
Any HIV+ contact	**3.24 (1.08 – 5.45)**	2.81 (0.80 – 9.81)	2.98 (0.79 – 11.2)
Health contact	3.25 (0.90 – 11.7)	**3.50 (1.10 – 12.7)**	2.10 (0.53 – 8.28)
Emotional support contact	1.11 (0.36 – 3.36)	1.11 (0.36 – 3.36)	0.63 (0.14 – 2.82)
Free Time contact	3.21 (0.73 – 14.0)	3.31 (0.50 – 22.0)	3.09 (0.57 – 16.7)
Money contact	8.76 (0.92 – 23.2)	8.76 (0.92 – 83.2)	---
Food contact	3.81 (0.41 – 35.3)	3.81 (0.41 – 35.3)	---

* Reference group is young women without HIV+ social contacts
‡ Adjusted for previous HIV care, pre-ART CD4 count, and multiple testing

Brown et al, CROI 2017

Does tie strength matter?

- Tie strength is associated with influence[1]:
  - Weak ties are important for information spread and rumors
  - Strong ties are important for behavior change
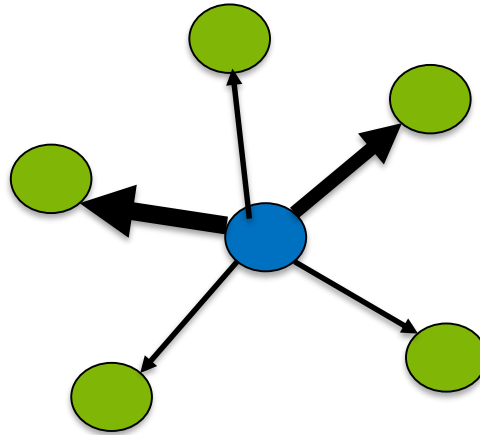
- Hypothesis: Strong ties will be more strongly associated with HIV clinical outcomes

[1]Valente *INSNA* 2018

Among youth (15 – 24 years), does having ≥1 network contact who was HIV+ and virally suppressed (HIV RNA <400 copies/ml) at baseline predict ART initiation and viral suppression after 3 years of follow-up?

Is the association greater for strong ties (network contacts named in more than one domain)?

Youth in the SEARCH Trial with HIV care-experienced contacts in their local social network have higher engagement in care and viral suppression

857 HIV+ youth who were ART-naïve at baseline and still alive and in the community after 3 yrs:

- **32%** named ≥1 **HIV+ contact** (15% had HIV+ strong ties)
- **9%** named ≥1 **virally suppressed contact** (4% had virally suppressed strong ties)

All contacts

HIV+
ART initiation: aOR 1.76 (95% CI 1.26-2.46)
Viral suppression: aOR 1.63 (95% CI 1.20-2.20)

HIV+ & virally suppressed
ART initiation: aOR 1.61 (95% CI 0.92-2.80)
Viral suppression: aOR 1.80 (95% CI 1.11-2.89)

Strong Ties

HIV+
ART initiation: aOR 2.07 (95% CI 1.27-3.37)
Viral suppression: aOR 1.48 (95% CI 0.99-2.19)

HIV+ & virally suppressed
ART initiation: aOR 1.56 (95% CI 0.65-3.71)
Viral suppression: aOR 2.53 (95% CI 1.18-5.42)

Adjusted for sex, region, new diagnosis, study arm

Summary

- Social Network Analysis is a novel and powerful method to understand individual outcomes in the context of social structures and their relationships with others

- Preliminary data suggest *who* HIV-infected youth in East Africa are connected to impacts their clinical outcomes (ART initiation, retention in care, and viral suppression)
  - HIV-infected household members
  - HIV-infected contacts in local social network
  - Virally-suppressed HIV-infected contacts

Conclusions and Next Steps

- HIV-infected youth may benefit from interventions that strengthen existing connections or make new connections between HIV care-experienced peers

- Next questions:
  - What are the characteristics of these care-experienced alters?
  - How does network structure mediate the influence of alters?

Acknowledgements

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