

Social network strategy (SNS) for HIV testing: a new approach for identifying individuals with undiagnosed HIV infection in Tanzania

Oscar Ernest Rwabiyago, Allen Katale, Trista Bingham, Jonathan M. Grund, Ona Machangu, Amy Medley, Zeye M. Nkomela, Alick Kayange, Galal Naphtal King'ori, James McOlogi Juma, Abbas Ismail, Upendo Kategile, Eniko Akom, Neema Tabian Mlole, Nicolas Schaad, Werner Maokola, Nyagonde Nyagonde, Daniel Magesa, Jaiving C. Kazitanga, Haruka Maruyama, Florence Temu, Sajida Kimambo, David Sando, Redempta Mbatia, Sally Talike Chalamila, Bernard Ediedu Ogwang, Marina Alois Njelekela, Kokuhumbya Kazaura, Vincent J. Wong, Ramadhani Gongo, Prosper Faustine Njau, Andrea Mbunda, Joseph Nondi, Moses Bateganya, Jessica Greene, Mark Breda, George Mgomella, Anath Rwebembera & Mahesh Swaminathan

To cite this article: Oscar Ernest Rwabiyago, Allen Katale, Trista Bingham, Jonathan M. Grund, Ona Machangu, Amy Medley, Zeye M. Nkomela, Alick Kayange, Galal Naphtal King'ori, James McOlogi Juma, Abbas Ismail, Upendo Kategile, Eniko Akom, Neema Tabian Mlole, Nicolas Schaad, Werner Maokola, Nyagonde Nyagonde, Daniel Magesa, Jaiving C. Kazitanga, Haruka Maruyama, Florence Temu, Sajida Kimambo, David Sando, Redempta Mbatia, Sally Talike Chalamila, Bernard Ediedu Ogwang, Marina Alois Njelekela, Kokuhumbya Kazaura, Vincent J. Wong, Ramadhani Gongo, Prosper Faustine Njau, Andrea Mbunda, Joseph Nondi, Moses Bateganya, Jessica Greene, Mark Breda, George Mgomella, Anath Rwebembera & Mahesh Swaminathan (2024) Social network strategy (SNS) for HIV testing: a new approach for identifying individuals with undiagnosed HIV infection in Tanzania, *AIDS Care*, 36:sup1, 201-210, DOI: [10.1080/09540121.2024.2307383](https://doi.org/10.1080/09540121.2024.2307383)

To link to this article: <https://doi.org/10.1080/09540121.2024.2307383>




This work was authored as part of the Contributor's official duties as an Employee of the United States Government and is therefore a work of the United States Government. In accordance with 17 U.S.C. 105, no copyright protection is available for such works under U.S. Law.





Published online: 19 Mar 2024.




Submit your article to this journal [↗](#)

 Article views: 1906

 [View related articles](#) 

 [View Crossmark data](#) 

 Citing articles: 2 [View citing articles](#) 

Social network strategy (SNS) for HIV testing: a new approach for identifying individuals with undiagnosed HIV infection in Tanzania

Oscar Ernest Rwabiyago^a, Allen Katala^a, Trista Bingham^b, Jonathan M. Grund^a, Ona Machangu^c, Amy Medley^b, Zeye M. Nkomela^c, Alick Kayange^d, Galal Naphtal King'ori^a, James McOlogi Juma^c, Abbas Ismail^a, Upendo Kategile^e, Eniko Akom^{f,g}, Neema Tabian Mlole^h, Nicolas Schaad^a, Werner Maokola^c, Nyagonde Nyagonde^a, Daniel Magesa^a, Jaiving C. Kazitanga^a, Haruka Maruyamaⁱ, Florence Temu^j, Sajida Kimambo^k, David Sando^l, Redempta Mbatia^m, Sally Taliqe Chalamilaⁿ, Bernard Ediedu Ogwang^o, Marina Alois Njelekela^p, Kokuhumbya Kazaura^a, Vincent J. Wong^q, Ramadhani Gongo^a, Prosper Faustine Njau^c, Andrea Mbunda^a, Joseph Nondi^d, Moses Bateganya^e, Jessica Greene^r, Mark Breda^d, George Mgomella^a, Anath Rwebembera^c and Mahesh Swaminathan^a

^aUnited States Centers for Disease Control and Prevention, Dar es Salaam, Division of Global HIV and TB, Dar es Salaam, Tanzania; ^bUnited States Centers for Disease Control and Prevention, Division of Global HIV and TB, Atlanta, Georgia, USA; ^cTanzania Ministry of Health: The National AIDS, STIs and Hepatitis Control Program, Dodoma, Tanzania; ^dUnited States Walter Reed Army Institute of Research/Department of Defense (WRAIR/DOD), Dar es Salaam, Tanzania; ^eUnited States Agency for International Development, Dar es Salaam, Tanzania; ^fU.S. Military HIV Research Program (MHRP), Walter Reed Army Institute of Research, Silver Spring, MD, USA; ^gThe Henry M. Jackson Foundation for the Advancement of Military Medicine, Bethesda, MD, USA; ^hPresident's Office, Regional Administration and Local Government, Dodoma, Tanzania; ⁱICAP at Columbia University, Dar es Salaam, Tanzania; ^jAMREF Health Africa, Dar es Salaam, Tanzania; ^kUSAID Afya Yangu Northern Project, Dar es Salaam, Tanzania; ^lManagement and Development for Health, Dar es Salaam, Tanzania; ^mTanzania Health Promotion Support, Dar es Salaam, Tanzania; ⁿHJF Medical Research International, Inc, Dar es Salaam, Tanzania; ^oMeeting Targets and Maintaining Epidemic Control (EpiC), Tanzania; ^pDeloitte Consulting, Dar es Salaam, Tanzania; ^qUnited States Agency for International Development, Office of HIV/AIDS, Washington DC, USA; ^rPEPFAR Coordination Office, Dar es Salaam, Tanzania

ABSTRACT

Social network strategy (SNS) testing uses network connections to refer individuals at high risk to HIV testing services (HTS). In Tanzania, SNS testing is offered in communities and health facilities. In communities, SNS testing targets key and vulnerable populations (KVP), while in health facilities it complements index testing by reaching unelicited index contacts. Routine data were used to assess performance and trends over time in PEPFAR-supported sites between October 2021 and March 2023. Key indicators included SNS social contacts tested, and new HIV-positives individuals identified. Descriptive and statistical analysis were conducted. Univariable and multivariable analysis were applied, and variables with *P*-values <0.2 at univariable analysis were considered for multivariable analysis. Overall, 121,739 SNS contacts were tested, and 7731 (6.4%) previously undiagnosed individuals living with HIV were identified. Tested contacts and identified HIV-positives were mostly aged ≥15 years (>99.7%) and females (80.6% of tests, 79.4% of HIV-positives). Most SNS contacts were tested (78,363; 64.7%) and diagnosed (6376; 82.5%) in communities. SNS tests and HIV-positives grew 11.5 and 6.1-fold respectively, from October-December 2021 to January-March 2023, with majority of clients reached in communities vs. facilities (78,763 vs. 42,976). These results indicate that SNS testing is a promising HIV case-finding approach in Tanzania.

ARTICLE HISTORY

Received 23 August 2023
Accepted 10 January 2024



KEYWORDS

Tanzania; social network strategy; HIV testing services; sub-Saharan Africa; SDG3

Introduction

Many countries in sub-Saharan Africa (SSA) are focused on reaching the Joint United Nations Programme (UNAIDS)'s 95-95-95 targets (UNAIDS, 2015), and responding to the United Nations Sustainable Development Goal (SDG) 3 (UN, 2023). A 2016–2017

national population-based household survey conducted in Tanzania showed that only 61.0% of people living with HIV (PLHIV) in Tanzania knew their status, (TACAIDS, 2018). To address this gap, the Government of Tanzania (GOT) through Ministry of Health (MOH) in collaboration with the U.S. President's Emergency

CONTACT Oscar Ernest Rwabiyago  oez4@cdc.gov  United States Centers for Disease Control and Prevention, Division of Global HIV and TB, Dar es Salaam, Tanzania

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

This work was authored as part of the Contributor's official duties as an Employee of the United States Government and is therefore a work of the United States Government. In accordance with 17 U.S.C. 105, no copyright protection is available for such works under U.S. Law. This is an Open Access article that has been identified as being free of known restrictions under copyright law, including all related and neighboring rights (<https://creativecommons.org/publicdomain/mark/1.0/>). You can copy, modify, distribute and perform the work, even for commercial purposes, all without asking permission. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

Plan for AIDS Relief (PEPFAR), prioritized more effective and targeted HIV case identification strategies, such as index testing, optimized provider-initiated testing and counseling (PITC), HIV self-testing and focused community HIV testing services (HTS) targeting key and vulnerable populations (KVP) at high risk of HIV infection (NACP, 2017, 2019). KVP is defined as groups at increased risk of HIV transmission/acquisition, i.e. female sex workers (FSW), men who have sex with men (MSM), and people who inject drugs (PWID), or long distance truck drivers, fisherfolks/fishing community and miners/mining community (NACP, 2017).

Reflecting on the HIV case identification strategies deployed after the Tanzania HIV Impact Survey 2016-2017 (TACAIDS, 2018), one potential modality to improve HTS and HIV case identification activities was index testing, a case finding modality that demonstrated great programmatic impact in identifying individuals with undiagnosed HIV infections across most sub-populations and age groups (Dalal et al., 2017; Kahabuka et al., 2017; Lyamuya et al., 2020; Mahachi et al., 2019; Sharma et al., 2018). Understanding that the challenges of reaching undiagnosed PLHIV increase as the identification gap decreases (Chamie et al., 2021), Tanzania considered social network strategy (SNS) testing for HTS as an additional modality to reach networks at high risk for HIV and to identify PLHIV who would otherwise not be diagnosed through routine HTS (McCree et al., 2013; PEPFAR, 2023; Stojanovski et al., 2021). In 2021, PEPFAR recommended SNS testing to enhance HIV case finding among networks of high-risk individuals (PEPFAR, 2021b), especially in countries with large gaps to reaching UNAIDS' first 95. These findings are consistent with The World Health Organization (WHO) and Centers for Disease Control and Prevention's (CDC) descriptions of SNS as a case-finding strategy that improves the identification of PLHIV who do not know their HIV status (CDC, 2023; WHO, 2019). Additionally, SNS testing promoted the uptake of HIV self-testing and Pre-exposure Prophylaxis (PrEP) (Chamie et al., 2021; Kwan et al., 2023; Lee & Schafer, 2023; Sheira et al., 2022), which are integral parts of HTS and HIV prevention, respectively. Tanzania's MOH, in collaboration with PEPFAR and its implementing partners (IPs), started to implement and report SNS testing data from both communities and facilities starting in October 2021 (PEPFAR fiscal year 2022) (PEPFAR, 2021a).

SNS testing has been implemented globally and in SSA (Chamie et al., 2021; Farquhar et al., 2022; Lee & Schafer, 2023) primarily targeting networks of KVP particularly MSM (Girault et al., 2015), PWID (Denisiuk et al., 2023), FSW, and other as identified

above (Sheira et al., 2022). SNS testing was also used to complement index testing, which is an established effective HIV case-finding modality. PEPFAR described this hybrid of modalities as "blended" where HIV-positive index clients were used as seeds/recruiters, who were given HTS referral coupons to take to index contacts who would not be elicited or reached through routine index testing program (PEPFAR, 2023). The elicitation of index contacts who, for different reasons, cannot be identified through index testing are elicited as social contacts by SNS testing (Grimsrud et al., 2023; PEPFAR, 2021a). This includes age-discordant sexual partnerships (Ritchwood et al., 2016), in which due to social and or legal barriers a sexual contact is identified as a social contact/network under SNS testing.

This paper describes the performance of SNS testing scale-up, its trend over time and factors associated with uptake of SNS testing in Tanzania from October 2021 to March 2023. Also, it highlights efforts by GOT supported by PEPFAR to ensure scale-up of SNS testing with fidelity and its potential impact on the overall HIV case-finding strategies toward reaching the HIV epidemic control.

Materials and methods

Overall HTS delivery and SNS testing implementation

HTS is provided by trained healthcare workers according to MOH-approved national HTS guidelines and standard operating procedures (SOPs) (NACP, 2019). Key case finding modalities reported by PEPFAR in Tanzania include: identifying, finding, and testing individuals exposed to HIV-positive clients (index testing), HIV testing at health facility TB clinics (TB Clinic), community HIV testing outreach activities (community mobile testing), provider-initiated HIV risk screening and testing (Optimized PITC), and SNS testing (NACP, 2019). Also, the two prevention monitoring HTS modalities that focused on prevention of mother to child transmission (PMTCT) are; HIV testing of pregnant women at their first antenatal care clinic for their current pregnancy (HIV testing at antenatal clinic (ANC)), and HIV testing of pregnant or breast feeding women after first ANC test up to 18 months post-delivery (Maternal retesting) (NACP, 2019; PEPFAR, 2021a). Tanzania started reporting SNS testing as a HTS modality in October 2021 which is the beginning of the PEPFAR fiscal year 2022). SNS testing has been implemented in both community and health facility settings. In communities, it targeted mainly KVP known as "seeds or

Table 1. HIV testing modalities and performance on new HIV cases identification, percentage positive yield and percentage of total HIV diagnoses, U.S. President's Emergency Program for AIDS Relief (PEPFAR) funded sites in Tanzania, October 2021 to March 2023.

HTS modality group	HTS Modality	HIV Tests	Tested positives	Percentage positive yield	Percentage contribution of tests	Percentage contribution of positives
Case finding	Index testing	1,045,418	139,600	13.4%	17.9%	53.4%
	TB Clinic	87,928	5730	6.5%	1.5%	2.2%
	Community mobile testing	420,717	24,203	5.8%	7.2%	9.3%
	Optimized PITC	1,940,914	67,632	3.5%	33.1%	25.9%
	SNS testing	121,739	7731	6.4%	2.1%	3.0%
Prevention monitoring	Testing at antenatal clinic (ANC)	1,816,467	16,003	0.9%	31.0%	6.1%
	Maternal retesting	423,277	567	0.1%	7.2%	0.2%
TOTAL		5,856,460	261,466	4.5%	100.0%	100.0%

Table 2. Performance of social network strategy (SNS) testing, stratified by testing setting, gender and age bands, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

Category	Social contacts tested	Social contacts tested positive	Percentage positive yield	Percentage contribution of SNS tests	Percentage contribution of SNS positives
Settings:					
Community	78,763	6376	8.1%	64.7%	82.5%
Facility	42,976	1355	3.2%	35.3%	17.5%
Total	121,739	7731	6.4%	100.0%	100.0%
Sex:					
Male	23,611	1591	6.7%	19.4%	20.6%
Female	98,128	6140	6.3%	80.6%	79.4%
Total	121,739	7731	6.4%	100.0%	100.0%
Course age bands (years):					
<15	241	20	8.3%	0.2%	0.3%
15+	121,483	7711	6.3%	99.8%	99.7%
Unknown Age*	15	-	0.0%	0.0%	0.0%
Total	121,739	7731	6.4%	100.0%	100.0%
Finer age bands (years):					
01-04	40	2	5.0%	0.0%	0.0%
05-09	27	1	3.7%	0.0%	0.0%
10-14	174	17	9.8%	0.1%	0.2%
15-19	10,201	329	3.2%	8.4%	4.3%
20-24	32,054	1356	4.2%	26.3%	17.5%
25-29	34,089	1751	5.1%	28.0%	22.6%
30-34	23,146	1597	6.9%	19.0%	20.7%
35-39	10,629	1034	9.7%	8.7%	13.4%
40-44	6230	733	11.8%	5.1%	9.5%
45-49	2583	476	18.4%	2.1%	6.2%
50+	2551	435	17.1%	2.1%	5.6%
Unknown Age*	15	-	0.0%	0.0%	0.0%
Total	121,739	7731	6.4%	100.0%	100.0%

*Unknown age: Age-related data are not fully collected.

Table 3. SNS testing by finer age bands and sex, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

age bands	HTS_TST		HTS_TST_POS		YIELD	
	Female	Male	Female	Male	Female	Male
01-04	19	21	2	-	10.5%	0.0%
05-09	18	9	1	-	5.6%	0.0%
10-14	108	66	2	15	1.9%	22.7%
15-19	9271	930	286	43	3.1%	4.6%
20-24	28,512	3542	1226	130	4.3%	3.7%
25-29	28,240	5849	1463	288	5.2%	4.9%
30-34	18,032	5114	1310	287	7.3%	5.6%
35-39	7437	3192	801	233	10.8%	7.3%
40-44	3772	2458	511	222	13.5%	9.0%
45-49	1416	1167	295	181	20.8%	15.5%
50+	1294	1257	243	192	18.8%	15.3%
Unknown Age*	9	6	-	-	0.0%	0.0%
Total	98,128	23,611	6,140	1,591	6.3%	6.7%

*Unknown age: Age-related data are not fully collected.

Table 4. Poisson Log-Linear Model showing characteristics associated with clients who received HIV/Testing through SNS testing, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

Factors	Crude Estimates	P-value	Adjusted Estimates	P-value
Sex:				
Male	Ref	<.0001	Ref	<.0001
Female	0.92(0.71–1.12)		0.83(0.59–1.07)	
Age:				
15–19	0.89(0.41,1.37)	0.0003	0.71(0.19,1.23)	0.01
20–24	1.64(1.04,2.23)	<.0001	1.58(0.92,2.23)	<.0001
25–29	1.58(0.99,2.16)	<.0001	1.55(0.90,2.21)	<.0001
30–34	1.27(0.66,1.88)	<.0001	1.23(0.58,1.88)	0.0002
35–39	0.68(0.15,1.21)	0.01	0.60(0.06,1.14)	0.03
40–44	0.40(–0.07,0.88)	0.10	0.30(–0.14,0.74)	0.18
45–49	–0.11(–0.53,0.31)	0.62	–0.23(–0.59,0.14)	0.23
50+	Ref		Ref	
Facility level:				
Dispensary	–0.33(–0.43, –0.23)	<.0001	–0.66(–0.76, –0.56)	<.0001
Health Centers	–0.08(–0.20,0.04)	0.18	–0.15(–0.27, –0.02)	0.02
Hospital	0.02(–0.12,0.16)	0.81	0.15(–0.01,0.31)	0.06
Community	Ref		Ref	

*Adjusted for region population size (census 2022) and implementation mechanisms.

recruiters” who were given coupons to share with their social contacts at high-risk for HIV acquisition and or transmission (NACP, 2017). Seeds or recruiters are often KVP themselves (HIV-positive or high-risk HIV negative clients) who are instructed to refer their high-risk network members for HTS (CDC, 2023; WHO, 2019). In facilities, SNS testing served as a practical extension of index testing to reach unelicited contacts who may be sexual partners or other high-risk network members of HIV-positive client. SNS testing cascade implies looking at performance in association

of seeds/recruiters, social contacts elicited, social contacts tested and testing results.

Data collection, recording and reporting

In Tanzania, the collection, recording and reporting of HTS data from community and health facility sites uses national HTS tools. HTS data are collected and reviewed for accuracy, completeness and consistency, then recorded in a PEPFAR-developed system called “Data for Accountability Transparency Impact

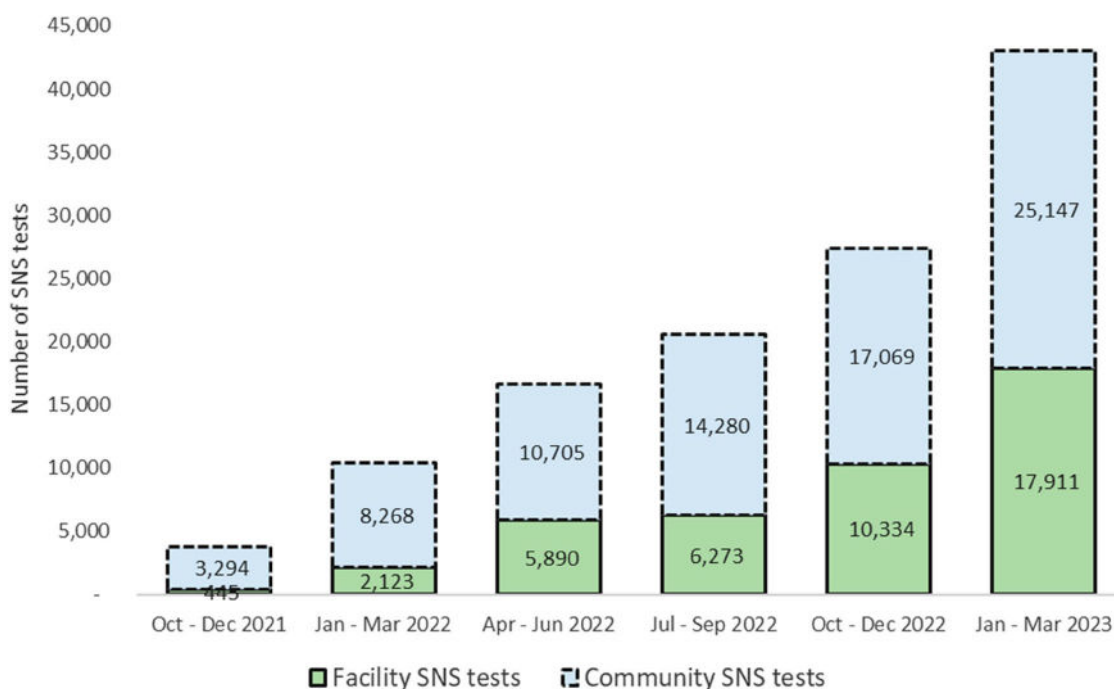


Figure 1. Quarterly trend of SNS tests disaggregated by community and facility, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

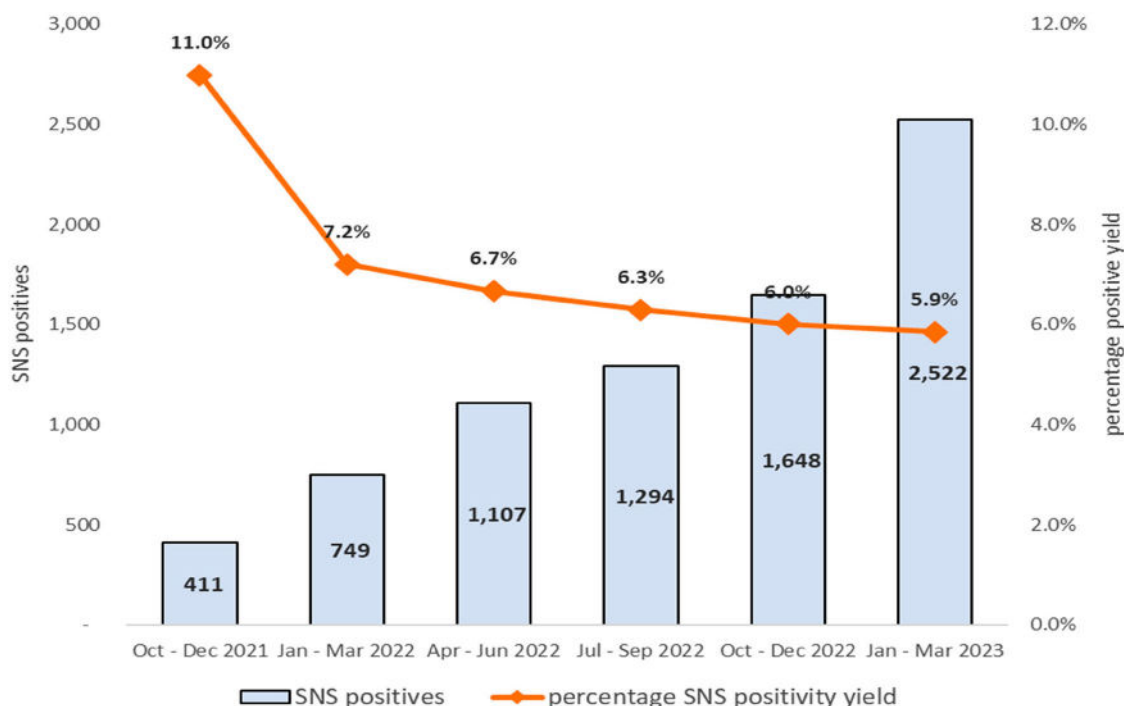


Figure 2. Quarterly trend of SNS testing HIV positives and percentage positivity yield, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

Monitoring (DATIM)”. DATIM serves as a centralized platform for data management and reporting, ensuring consistent and comprehensive reporting of HTS services across sites supported by PEPFAR. SNS testing is reported as an HTS service delivery

modality for community and health facility sites (PEPFAR, 2021a). SNS testing indicators collected include the number of SNS tests and the number of HIV positives identified disaggregated by age and sex.

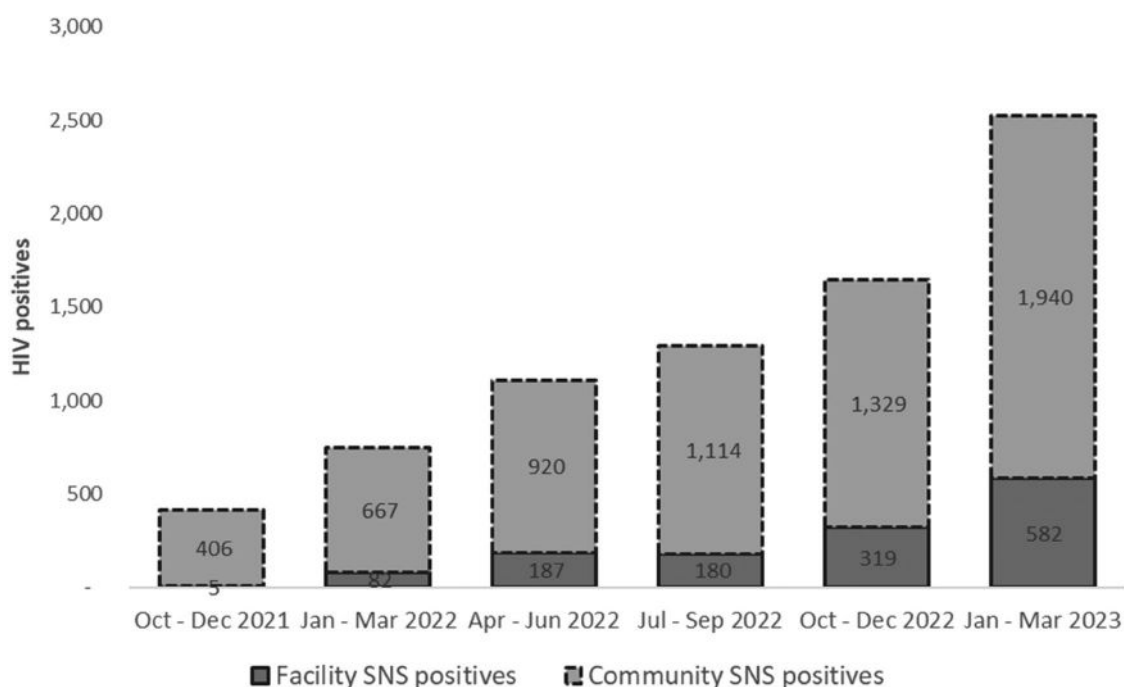


Figure 3. Quarterly trend of SNS testing HIV positives by community and facility settings, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

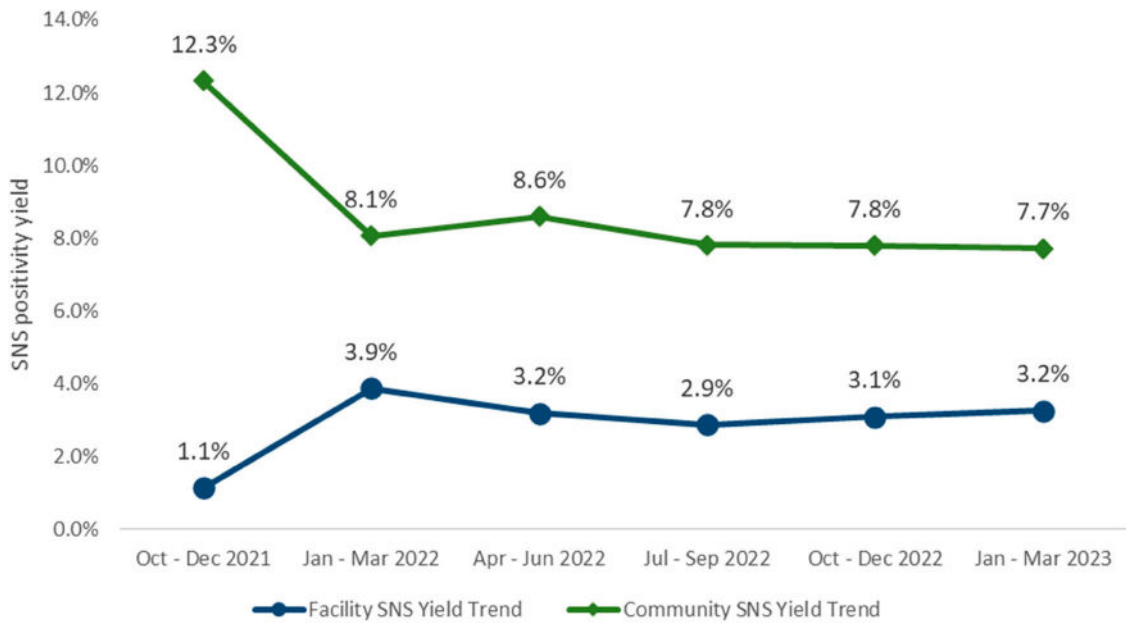


Figure 4. Quarterly trend of SNS positivity yield for community and facility settings, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

Data analysis

Programmatic data captured in DATIM were downloaded for the analysis period of interest. Site-level data were imported to generate pivot tables on a Microsoft (MS) Excel spreadsheet limited to HTS variables (indicators) reported over 18 months, i.e., October 2021 through March 2023. HIV positivity rate (“yield”) was calculated as the total HIV positives divided by the total HIV tests done. SNS testing contribution was calculated as SNS test results divided by total HIV test results from all HTS modalities together. Descriptive analyses were conducted using the Ms Excel software. Performance of each of the HTS modalities was done to show HIV tests, resulting in HIV positives,

was calculated as the total HIV positives divided by the total HIV tests done. SNS testing contribution was calculated as SNS test results divided by total HIV test results from all HTS modalities together. Descriptive analyses were conducted using the Ms Excel software. Performance of each of the HTS modalities was done to show HIV tests, resulting in HIV positives,

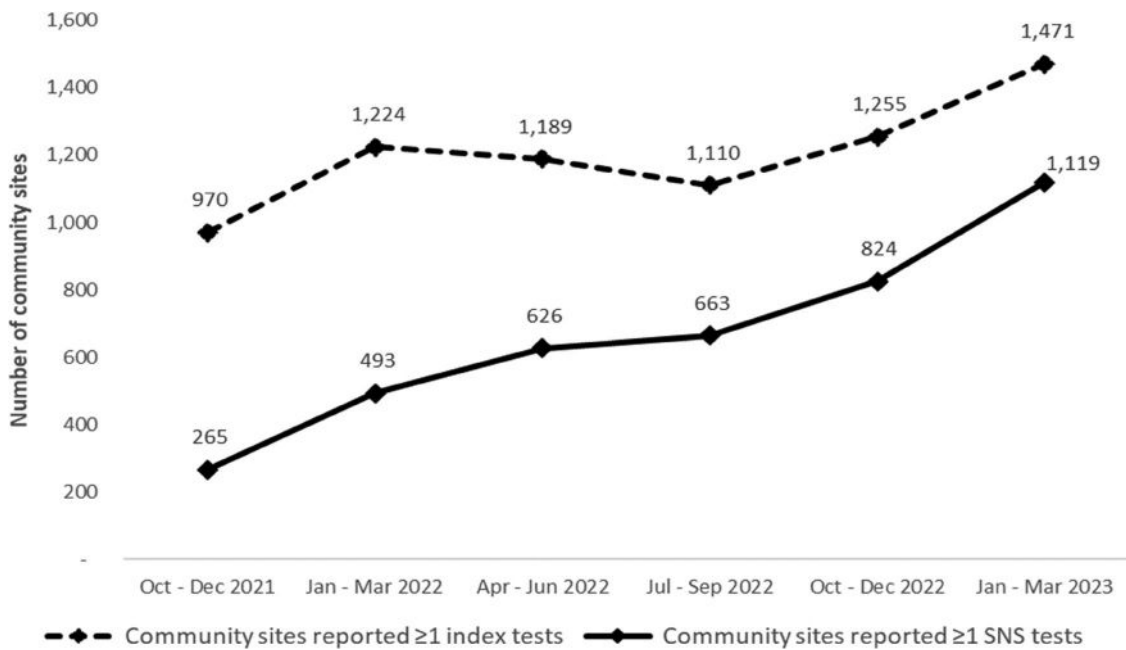


Figure 5. The quarterly trend of the number of community sites reported SNS tests against community sites which reported at least 1 index test, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

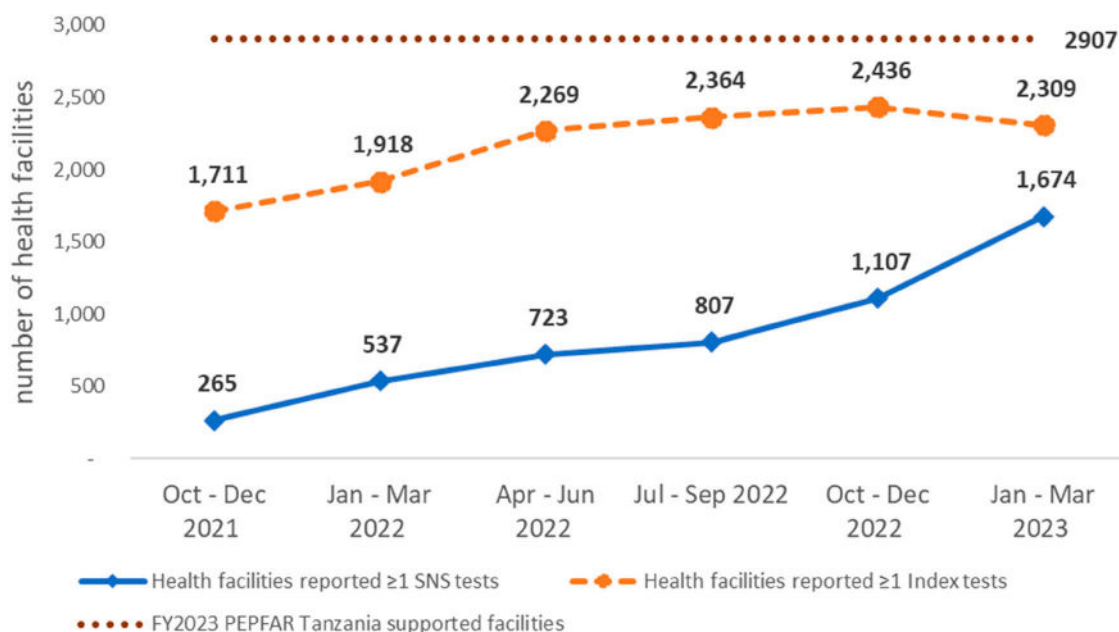


Figure 6. Quarterly trend of the number of health facilities reported SNS tests against PEPFAR-supported facilities and facilities reported at least 1 index test, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

percentages of HIV positives and percentage contribution for each HTS modality. Additionally, the performance of SNS testing was shown in terms of social contacts tested, HIV-positive identified and proportion of SNS testing to all modalities' total testing disaggregated by setting, sex and age. SNS testing trend analysis on a quarterly (3-month) basis for the reporting duration was conducted and further disaggregated by different attributes of setting (facility vs. community). The inferential analysis was conducted using Statistical Analysis System (SAS) version 9.4. Poisson log-linear model accounting for robust standard errors to assess factors associated with the number of people receiving HTS was used. The multivariable model was developed to control for the possible confounders that could exist for some of the factors with the outcome of interest. The independent variables for the regression model included age, sex and facility type and the dependent variable was HTS through SNS testing. The robust standard errors were opted to control for mild violation of the distribution assumption. Both univariable and multivariable analyses were applied, and variables with P -values < 0.2 at univariable analysis were considered for multivariable analysis.

Ethical clearance

This project received a non-research determination by the United States CDC [Accession #: CGH-SS-7/30/21-90609, Project ID: 0900f3eb81d90609].

Results

Overall results by modality, setting, sex and age

During the 18-month analysis period (October 2021–March 2023), PEPFAR Tanzania reported a total of 5,856,460 HIV tests conducted through all modalities and identified 261,466 new HIV cases. The index testing modality contributed over half (53.4%) of all HIV positives identified (Table 1). During this period, SNS testing reported 121,739 tests and 7731 new HIV positives. Approximately two-thirds (64.7%) of SNS tests and over three-quarters (82.5%) of HIV-positive cases identified were from communities. Also, over three-quarters of both SNS tests (80.6%) and HIV-positives cases (79.4%) were females and most were aged above 15 years (>99.7% for both tests and positives). The overall SNS testing positivity rate is 6.4%, with no significant difference between sexes (males 6.7%, females 6.3%), but with variations by settings i.e., community 8.1% and facility 3.2% (Table 2). The positivity rates were highest among females aged ≥ 35 years (>10.0%) and males ≥ 45 years (>15.0%) compared to other age groups above 15 years. Also, higher positivity rates were observed among children – females aged 1–4 years (10.5%) and males aged 10–14 years (22.7%) (Table 3). Dispensaries had a lower uptake of SNS testing, while health centers and hospitals were not significantly different from communities. The results also showed younger populations were testing more using SNS testing compared to older adults: age 15–19 years

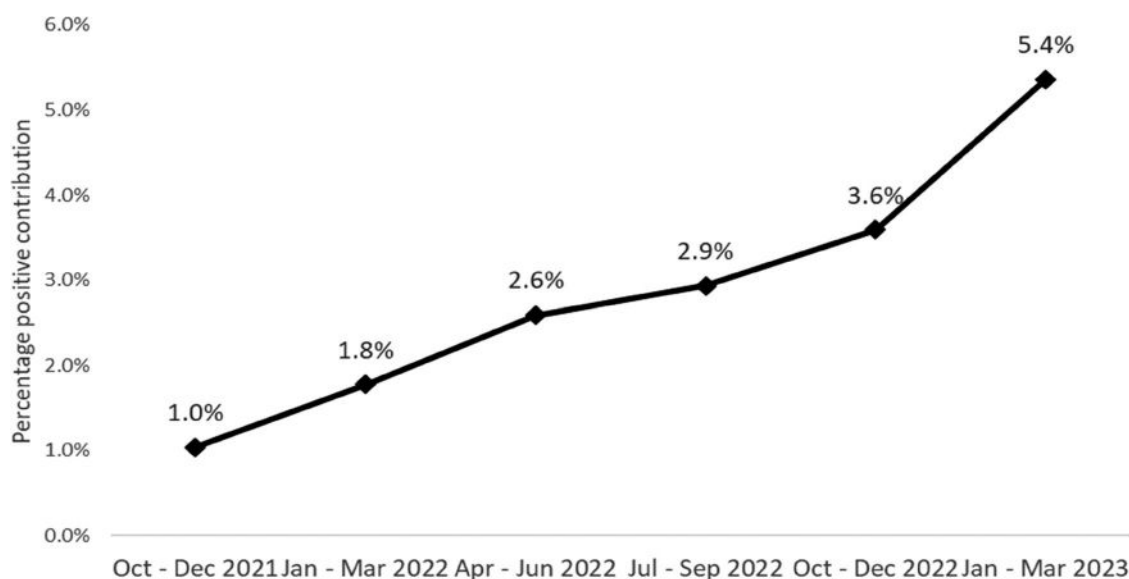


Figure 7. The quarterly trend of the proportion of new positives identified from the SNS testing modality to all positives, in PEPFAR-supported sites in Tanzania between October 2021 and March 2023.

[exp (0.71), $P = .01$], age 20–24 years [exp (1.58), $P < .0001$], age 25–29 years [exp (1.55), $P < .0001$], age 30–34 years [exp (1.23), $P = .0002$], age 35–39 years [exp (0.60), $P = .003$] (Table 4).

SNS testing scale-up performance trend

From the beginning of the analysis period, the quarter October–December 2021 to the quarter January–March 2023, SNS tests increased by 11.5-fold (43,058/3739). During the same period, SNS testing increased faster in facilities (40.2-fold) compared to community venues (7.6-fold) (Figure 1). The quarterly trend of positivity rate declined, from 11.0% in the quarter October–December 2021 to 5.9% in the quarter January – March 2023, while the number of HIV positives identified through SNS testing increased by 6.1-fold (2522/411) (Figure 2), with a 4.8-fold increase in the community (1940/406), and 116.4-fold increase in the facility (582/5) (Figure 3). The positivity rates trend showed variations by setting: $> 7.7\%$ in the community and $< 4.0\%$ in the facility (Figure 4).

SNS implementation coverage

Index testing is a HTS modality implemented extensively across all community and facility sites in Tanzania. SNS testing is expected to follow the footprint of index testing in terms of sites coverage, therefore, number of index testing sites were used as benchmark to measure the scale-up of SNS testing (Figures 5 & 6). Between quarters October–December 2021 and January–March 2023 community sites that reported at least

1 SNS test increased by 4.2-fold from 265 sites to 1119 sites, which is equivalent to 27.3% and 76.1% of all community sites implementing index testing, respectively (Figure 5). Figure 6 shows two benchmarks PEPFAR Tanzania used to measure SNS testing coverage in a facility setting, one is the total number of PEPFAR Tanzania-supported health facilities, and the other is facilities that reported at least 1 index test. Facility coverage of SNS testing against index testing facilities increased from 15.5% in the October–December 2021 quarter to 72.0% by January–March 2023 quarter and from 9.0% to 58.0% against PEPFAR-supported facilities for PEPFAR fiscal year 2023 (Figure 6). Correspondingly, the proportion of HIV HIV-positives identified from SNS testing out of all HIV-positives increased from 1.0% in the quarter of October–December 2021 to 5.4% in the quarter of January–March 2023 (Figure 7).

Discussion

This analysis highlighted the potential role of SNS testing, a HTS modality which showed exponential growth in identifying the previously undiagnosed individuals over six quarters. Though not fully implemented across community and facility sites, the contribution of HIV positives from SNS testing increased more than five times between quarters October–December 2021 and January–March 2023. The positivity rate from SNS testing was $> 6.0\%$, higher than the average positivity rate from the overall HTS program in Tanzania ($\sim 4.0\%$) (NACP, 2019), implying the effectiveness and efficiency of this model.

Community SNS testing contribution is higher compared to the facility most probably because the implementation started in the communities compared to the facility. The facility implementation rolled-out in a phased approach that started with high-volume facilities (hospitals), and down to low-volume facilities i.e., health centers and dispensaries, which is why uptake of SNS testing in hospitals equals the community. More females reached by SNS testing compared to males correlates with the overall Tanzania HTS program performance. The higher positivity rate of >10.0% among women aged >35 years and men aged >45 years (>15.0%), is consistent with results seen with the the index testing modality.

SNS testing has shown to be integrated well with other HIV case-finding modalities, particularly index testing and HIV self-testing as well as DREAMS and PrEP (Denisiuk et al., 2023; Farquhar et al., 2022; Girault et al., 2015; Kwan et al., 2023). SNS testing was used to reach unelicited sexual partners from index testing as social contacts and showed effectiveness in diagnosing new HIV infections among Adolescent Girls and Young Women (AGYW) in facility settings (i.e., 1,512 HIV-positive females aged 15–24 years identified through SNS testing with the positivity rate of >3% – more than average yield for AGYW) (NACP, 2017). These findings have potential benefits and opportunities to reduce new HIV infections in this priority age group.

Although children were not the target population for SNS testing, they were part of elicited social networks at risk of HIV. A total of 20 children living with HIV (CLHIV) aged ≤15 years were identified through SNS testing from 241 pediatric social contacts tested. The observed high positivity rate of 8.3% for identified CLHIV is about four times higher than the average rate for this population in Tanzania (~2.0%) (NACP, 2019). These findings prompted review of the program and data to better understand and apply SNS testing for HIV case finding among pediatric and adolescents.

Lack of systems that can support reporting of SNS testing in cascade and SNS testing outputs by sub-population type, are observed limitations of this modality. These should be considered in prospective reviews of standardized national data recording and reporting tools as they are essential components for SNS testing program oversight and impact measurement.

This analysis investigated SNS testing implementation in both communities and health facilities targeting KVP. Much of the published literature on SNS globally and in SSA has focused on Key Populations (Boyer et al., 2013; Farquhar et al., 2022; Girault et al., 2015; Kwan et al., 2023; Maina et al., 2018; McCree et al., 2013). The increased HIV identification as the model was scaled up underscores the potential of this HIV case-finding

approach in Tanzania. The findings from this analysis suggested that there are still potential opportunities to further scale up SNS testing in both communities and facilities, providing a solid signal to inspire full SNS testing roll-out and closer monitoring of the program impact.

Conclusion

SNS testing demonstrated its effectiveness in reaching high-risk individuals who would otherwise not been reached through existing HTS modalities in Tanzania. The program implementation coverage thus far indicated that there are still opportunities to scale up this modality in both community and facility settings. Nonetheless, closer tracking of facility implementation is needed to ensure fidelity to the SNS model due to the persistent lower positivity rate. For useful and impactful oversight of the program, HTS systems should be enabled to capture beneficiaries' population type and cascade of SNS testing. As Tanzania heads toward HIV epidemic control, the integration of innovative case-finding modalities as this is crucial to enhance identification of the undiagnosed PLHIV, and back-up the existing effective strategies like index testing.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This publication has been supported by the President's Emergency Plan for AIDS Relief (PEPFAR).

References

- Boyer, C. B., Hightow-Weidman, L., Bethel, J., Li, S. X., Henry-Reid, L., Futterman, D., Maturo, D., Straub, D. M., Howell, K., & Reid, S. (2013). An assessment of the feasibility and acceptability of a friendship-based social network recruitment strategy to screen at-risk African American and Hispanic/Latina young women for HIV infection. *JAMA Pediatrics*, 167(3), 289–296. <https://doi.org/10.1001/2013.jamapediatrics.398>
- CDC. (2023). *Social network strategy for HIV testing recruitment*. Retrieved July 1, 2023, from <https://www.cdc.gov/hiv/effective-interventions/diagnose/social-network-strategy/index.html>
- Chamie, G., Napierala, S., Agot, K., & Thirumurthy, H. (2021). HIV testing approaches to reach the first UNAIDS 95% target in sub-Saharan Africa. *The Lancet HIV*, 8(4), e225–e236. [https://doi.org/10.1016/S2352-3018\(21\)00023-0](https://doi.org/10.1016/S2352-3018(21)00023-0)
- Dalal, S., Johnson, C., Fonner, V., Kennedy, C. E., Siegfried, N., Figueroa, C., & Baggaley, R. (2017). Improving HIV test uptake and case finding with assisted partner

- notification services. *AIDS*, 31(13), 1867. <https://doi.org/10.1097/QAD.0000000000001555>
- Denisiuk, O., Pavlo, S., Batyrbekova, A., Dudnik, R., Denebayeva, A., Zhandybayeva, A., Kuznetsova, Y., & Tetyana, D. (2023). Social Network Strategy improves access to HIV testing and harm reduction programs for PWID and their partners in Kazakhstan. *The Journal of Infection in Developing Countries*, 17(03), 397–403. <https://doi.org/10.3855/jidc.16611>
- Farquhar, C., Masyuko, S., & Mugo, P. (2022). Social network-based strategies to improve uptake of HIV testing and linkage to care among men who have sex with men in Sub-Saharan Africa. *JAMA Network Open*, 5(2), e220155–e220155. <https://doi.org/10.1001/jamanetworkopen.2022.0155>
- Girault, P., Green, K., Clement, N. F., Rahman, Y. A. A., Adams, B., & Wambugu, S. (2015). Piloting a social networks strategy to increase HIV testing and counseling among men who have sex with men in greater Accra and Ashanti Region, Ghana. *AIDS and Behavior*, 19(11), 1990–2000. <https://doi.org/10.1007/s10461-015-1069-z>
- Grimsrud, A., Wilkinson, L., Ehrenkrantz, P., Behel, S., Chidarikire, T., Chisenga, T., Golin, R., Johnson, C. C., Milanga, M., & Onyekwena, O. (2023). The future of HIV testing in eastern and Southern Africa: Broader scope, targeted services. *Plos Medicine*, 20(3), e1004182. <https://doi.org/10.1371/journal.pmed.1004182>
- Kahabuka, C., Plotkin, M., Christensen, A., Brown, C., Njozi, M., Kisendi, R., Maokola, W., Mlangi, E., Lemwayi, R., & Curran, K. (2017). Addressing the first 90: A highly effective partner notification approach reaches previously undiagnosed sexual partners in Tanzania. *AIDS and Behavior*, 21(8), 2551–2560. <https://doi.org/10.1007/s10461-017-1750-5>
- Kwan, T. H., Chan, D. P. C., Wong, S. Y.-S., & Lee, S. S. (2023). Implementation cascade of a social network-based HIV self-testing approach for men who have sex with men: Cross-sectional study. *Journal of Medical Internet Research*, 25, e46514. <https://doi.org/10.2196/46514>
- Lee, J. A., & Schafer, M. H. (2023). Social network characteristics and HIV testing among older adults in South Africa. *Ageing and Society*, 43(3), 499–515. <https://doi.org/10.1017/S0144686X21000532>
- Lyamuya, F. S., Muro, E. P., Manongi, R., Mushi, D., Kiwelu, I., Katzenstein, T., & Theilgaard, Z. (2020). Outcomes of and factors associated with partner notification and HIV testing in Northeastern Tanzania.
- Mahachi, N., Mucedzi, A., Tafuma, T. A., Mawora, P., Kariuki, L., Semo, B. w., Bateganya, M. H., Nyagura, T., Ncube, G., & Merrigan, M. B. (2019). Sustained high HIV case-finding through index testing and partner notification services: Experiences from three provinces in Zimbabwe. *Journal of the International AIDS Society*, 22(S3), e25321. <https://doi.org/10.1002/jia2.25321>
- Maina, G., Strudwick, G., Lalani, Y., Boakye, F., Wilton, L., & Nelson, L. E. (2018). Characterizing the structure and functions of social networks of men who have sex with men in Ghana, West Africa: Implications for peer-based HIV prevention. *Journal of the Association of Nurses in AIDS Care*, 29(1), 70–82. <https://doi.org/10.1016/j.jana.2017.07.005>
- McCree, D. H., Millett, G., Baytop, C., Royal, S., Ellen, J., Halkitis, P. N., Kupprat, S. A., & Gillen, S. (2013). Lessons learned from use of social network strategy in HIV testing programs targeting African American men who have sex with men. *American Journal of Public Health*, 103(10), 1851–1856. <https://doi.org/10.2105/AJPH.2013.301260>
- NACP. (2017). *National guideline for comprehensive package of HIV interventions for key and vulnerable populations*. <https://hivpreventioncoalition.unaids.org/wp-content/uploads/2018/03/Tanzania-KP-GUIDELINE-1.pdf>.
- NACP. (2019). *National guidelines for HIV testing services in Tanzania*. Retrieved July 1, 2023, from <https://nacp.go.tz/download/national-comprehensive-guidelines-on-hiv-testing-services/>
- PEPFAR. (2021a). *Monitoring, evaluation, and reporting indicator reference guide*. <https://www.state.gov/wp-content/uploads/2021/09/FY22-MER-2.6-Indicator-Reference-Guide.pdf>
- PEPFAR. (2021b). *PEPFAR 2021 Country and Regional Operational Plan (COP/ROP) guidance for all PEPFAR countries*. <https://www.state.gov/wp-content/uploads/2020/12/PEPFAR-COP21-Guidance-Final.pdf>.
- PEPFAR. (2023). *2023 Country and regional operational plan guidance and technical considerations*. Retrieved June 29, 2023, from <https://www.state.gov/wp-content/uploads/2023/02/FY-2024-PEPFAR-Technical-Considerations-2.pdf>
- Ritchwood, T. D., Hughes, J. P., Jennings, L., MacPhail, C., Williamson, B., Selin, A., Kahn, K., Gómez-Olivé, F. X., & Pettifor, A. (2016). Characteristics of age-discordant partnerships associated with HIV risk among young South African women (HPTN 068). *Journal of Acquired Immune Deficiency Syndromes (1999)*, 72(4), 423.
- Sharma, M., Smith, J. A., Farquhar, C., Ying, R., Cherutich, P., Golden, M., Wamuti, B., Bukusi, D., Spiegel, H., & Barnabas, R. V. (2018). Assisted partner notification services are cost-effective for decreasing HIV burden in western Kenya. *Aids*, 32(2), 233–241. <https://doi.org/10.1097/QAD.0000000000001697>
- Sheira, L. A., Kwena, Z. A., Charlebois, E. D., Agot, K., Ayieko, B., Gandhi, M., Bukusi, E. A., Thirumurthy, H., & Camlin, C. S. (2022). Testing a social network approach to promote HIV self-testing and linkage to care among fishermen at Lake Victoria: Study protocol for the Owete cluster randomized controlled trial. *Trials*, 23(1), 463. <https://doi.org/10.1186/s13063-022-06409-3>
- Stojanovski, K., Naja-Riese, G., King, E. J., & Fuchs, J. D. (2021). A systematic review of the social network strategy to optimize HIV testing in key populations to end the epidemic in the United States. *AIDS and Behavior*, 25(9), 2680–2698. <https://doi.org/10.1007/s10461-021-03259-z>
- TACAIDS. (2018). *Tanzania HIV impact survey (THIS) 2016–2017: Final Report*. https://phia.icap.columbia.edu/wp-content/uploads/2019/06/FINAL_THIS-2016-2017_Final-Report_06.21.19_for-web_TS.pdf.
- UN. (2023). *The Sustainable Development Goals Report: Special edition*. <https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals-Report-2023.pdf>
- UNAIDS. (2015). *Understanding fast-track: Accelerating action to end the AIDS epidemic by 2030*. Retrieved June 30, 2023, from https://unaids.org/sites/default/files/media_asset/201506_JC2743_Understanding_FastTrack_en.pdf
- WHO. (2019). *WHO recommends social network-based HIV testing approaches for key populations as part of partner services package*. Retrieved June 30, 2023, from <https://www.who.int/publications/i/item/WHO-CDS-HIV-19.32>