



KEY POPULATION AND THEIR ROLE IN STD/HIV TRANSMISSION DYNAMICS

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Organized by:

Sevgi Aral

Centers for Disease Control & Prevention (CDC), Atlanta, GA, U.S.A.

James Blanchard

University of Manitoba Winnipeg, Manitoba, Canada

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KEY POPULATION AND THEIR ROLE IN STD/HIV TRANSMISSION DYNAMICS

Organizers: Sevgi Aral and James Blanchard

Agenda

Sunday, July 10th, 2011		
Time	Topic	Chair / Presenter
8:45 – 9:00	Welcome	Chair: Sevgi Aral Centers for Disease Control & Prevention (CDC), Atlanta, GA
9:00 – 9:30	Importance of Key Populations in STD/HIV Transmission Dynamics	James Blanchard University of Manitoba Winnipeg, Manitoba, CANADA
9:30 – 10:00	Socio-demographic, contextual and behavioural factors leading to a risk of STIs and HIV among female sex workers in Pakistan	Faran Emmanuel University of Manitoba Winnipeg, Manitoba, CANADA
10:00 – 10:30	Integrated biological and behavioural surveillance for HIV and STIs among female sex workers in Germany – results and lessons learned from the first round of data collection and a call for input on future plans	Stine Nielsen Robert Koch-Institut, Berlin
10:30 – 11:00	Break	
11:00 – 11:30	Female sex workers and male clients: Recent temporal trends and their Role in STI transmission in the U.S.	Jami Leichter Centers for Disease Control & Prevention (CDC), Atlanta, GA
11:30 – 12:00	The brothers' study (HPTN) 061): A feasibility study of a multi-component intervention for American Black men who have sex with men	Kenneth Mayer The Fenway Institute, Fenway Health, Boston, MA
12:00 – 13:00	LUNCH	
13:00-17:00		Chair: Geoff Garnett Imperial College, London, United Kingdom
13:00 – 13:30	HIV epidemics among men who have sex with men are emerging in the Middle East and North Africa: Epidemiologic context and transmission links with other high risk-groups	Laith J. Abu-Raddad Weill Cornell Medical College New York, NY
13:30 – 14:00	Comparison of venue-based and respondent driven sampling methods for surveillance of sex workers	Sharon Weir University of North Carolina at Chapel Hill, North Carolina
14:00 – 14:30	Group sex events as sites which bridge key at-risk populations: A little-studied aspect of STI transmission networks and dynamics	Samuel Friedman National Development & Research Institutes, Inc. New York, NY
14:30 – 14:45	Break	
14:45 – 15:15	The distribution of STDs across age groups, changes in STD rates among youth across birth cohorts, and sexual mixing patterns by age: An analysis of STD surveillance data	Harrell Chesson Centers for Disease Control & Prevention (CDC), Atlanta, GA
15:15 – 15:45	Determinants of persistent spread of HIV in HCV-infected populations of injecting drug users	Anneke de Vos University Medical Centre Utrecht, The Netherlands
15:45 – 16:15	Estimating sources of infection in HIV epidemics: A comparative modeling analysis	Sharmistha Mishra Imperial College, London, United Kingdom
16:15 – 16:45	Neighborhood drug markets: A nexus for core groups and STI transmission?	Jacky Jennings Johns Hopkins University, Baltimore, MD
16:45 – 17:00	Concluding Remarks	James Blanchard & Sevgi Aral

ABSTRACTS

IMPORTANCE OF KEY POPULATIONS IN STD/HIV TRANSMISSION DYNAMICS

James Blanchard, MD, MPH, PhD, University of Manitoba Canada

A central concept in the theoretical bases for understanding the transmission dynamics of sexually transmitted infections and HIV (STI/HIV) relates to the importance of subsets of a population ("key populations") who have higher rates of partner change and concurrent sexual partnerships. However, there remain substantial gaps in knowledge relating to how different population sexual structures and variable configurations of sexual networks relate to epidemic potential and trajectory for different pathogens. These knowledge gaps encompass both the theoretical understanding of transmission dynamics and empirical descriptions of sexual structure as it relates to higher risk key populations. As a result, there is a lack of robust methods to explain epidemic heterogeneity within key populations, and with respect to the wider epidemic. This presentation will outline a range of issues related to building a stronger theoretical and empirical basis for understanding the role of key populations in STD/HIV transmission dynamics, including:

- Definition and descriptions of sexual structures related to key populations.
- Development of conceptual and analytic frameworks for understanding the role of key populations in transmission dynamics.
- Analytic challenges presented by the complexity inherent in key population networks.

SOCIO-DEMOGRAPHIC, CONTEXTUAL AND BEHAVIOURAL FACTORS LEADING TO A RISK OF STIS AND HIV AMONG FEMALE SEX WORKERS IN PAKISTAN

Faran Emmanuel¹*, James Blanchard*

¹ Presenting Author

*Centre for Global Public Health, University of Manitoba, Canada.

Presenting author email: faran@cc.umanitoba.ca

Introduction

Sex work in the Islamic republic of Pakistan, is a forbidden culture of sex-trade that dates back to the date of its existence in 1947, and over years has assumed the proportions of a commercial industry that exists as an open secret, although considered illegal. Data collected from various mapping studies were combined and extrapolated to estimate a total number of around 167,500 female sex workers in Pakistan. Due to the extreme hidden nature of the industry, there is a postulation that these estimates are slightly less, and the actual numbers might be slightly more than what has been calculated. Based on the way sex workers operate, various sub-typologies of Female sex workers were defined including Brothel-based FSWs, Kothikhana-based FSWs, Street-based FSWs, Home-based FSWs and Mobile phone based sex workers. In an Islamic state such as Pakistan, a wide range of contextual factors, demographic and social network of the society and personal behaviours of the sex workers themselves which puts them on a substantial risk to acquire various sexually transmitted infections and HIV.

Contextual factors

Originally the sex industry in Pakistan was housed in the historical red light areas (RLAs) in most of the major cities and towns all across the country, and ran under cover of singing and dancing. Early military governments and religious groups sought to reform these RLA's by enforcing a ban on these in 1977, and the industry spread out into residential areas of nearly all urban centres all across the country. In addition, as part of the Islamization process initiated in Pakistan in late 1970's, Hudood Ordinance was enacted which intended to implement Islamic Shari'a law, by enforcing punishments mentioned in the Quran and Sunnah for Zina (extramarital sex). The "hadood ordinance" has been criticized as being used against Sex workers many times. The exploiters, including traffickers, corrupt officials and even pimps and brothel owners have been making money not only from the sale of sex, but by harassing sex workers as well as their clients. The women involved are further victimized by the police and the legal system, which treat them as criminals. Incidences have been reported where women are booked under Hudood Ordinances and

heavy amounts have been charged. This also leads a higher dependence of sex workers on the various network operators and pimps who serve as their protectors from law and police, but at the same time don't allow sex workers to practice their rights and will.

Socio-demographic factors

Poverty and lack of economic opportunities are the major drivers for women entering sex trade. There are different routes for entry into sex work and there is a range of people playing a role in facilitating access to clients, including relatives, peers, pimps and network operators. The bulk of this community is made up of Pakistani girls, while a few Afghani women, women from Bangladesh and Bengal, as well as Russian states also have reported to operate in Pakistan. Among Pakistani sex workers, 22% do not belong to the city where they work and travel from one city to another city for sex work. The girls are often brought from rural areas by net work operators (NWOs), and in such cases are entirely managed by pimps and network operators without their own will or control over the work they do. Nearly all studies conducted with FSWs show that more than half of the FSWs are young females, between 20 to 29 years of age, with girls as young as 15 yrs of age also seen to work. More than two thirds of sex workers receive remarkably little education with higher numbers being illiterate. Most of the sex workers belong to a low socio-economic status (median monthly income approximately PKR 8,000 or USD 133 (average PKR 11,903 ± 11,568). It was also discovered that income had an inverse relationship with age (i.e., younger FSWs had higher incomes than the older FSWs. Approximately 45% of FSWs had an income source other than sex work, which shows that a large number of women are actually part time sex workers and since do not consider themselves as sex workers, don't utilize the services available for FSWs.

Behavioural factors

National data has suggested that 32% of the FSWs solicit clients by "roaming around" in public places such as busy streets and at intersections, bus and train stations, and marketplaces. If sex workers do not find clients independently, they forgo part of their earnings as commission to intermediaries, and in that case the entire operations of sex work stays within the control of these network operators. On an average the number of clients varies from 2 to 3 clients in a day. In addition to the clients, nearly 44% of the FSWs surveyed reported of having atleast one regular non paying partners. Insignificant levels of condom use with both clients as well as non paying partners were reported. Patchy knowledge on HIV, its routes of transmission and ways to protect HIV transmission was noted. A strong association between sex work and injection drug use was also reported. An overall 3% of all FSWs reported injecting drugs, while 21% had sex with clients who they knew to be IDUs and 15% had non-paying partners who were IDUs. Less than 10% of FSWs reported to have utilized STI and HIV prevention services provided by the AIDS control programs.

Conclusions

Notwithstanding progress made, the coverage, scale, quality and impact of HIV prevention interventions in sex work remains low. Pakistan faces several challenges to effectively implement sustainable and quality programs, due to the above mentioned structural, social, demographic and behavioural factors mentioned above. HIV transmission associated with sex work in Pakistan is contextually complex, with the impact of multiple concurrent vulnerabilities often difficult to assess. These diverse contexts, infection dynamics, political environments and resource constraints present challenges for an effective global response to HIV transmission in sex work.

The laws and policies against sex work, and lack of any protective legislation to protect the rights of sex workers has made sex work increasingly clandestine, making HIV AND AIDS and STI prevention and care activities nearly impossible to implement. Stigmatization and marginalization linked to sex workers, have restricted sex workers to openly approach any services and participate in them. Non existence of any concrete empowerment initiatives: sex worker associations/forums, cooperatives, community groups, self help groups, network support etc., Lack of access to health, social and legal services limits sex workers' options when seeking to care for their health. Even where such services are available to them, sex workers may not take advantage of them.

AN EFFECTIVE TARGETED RESPONSE IS NECESSARY IN ORDER TO PROMOTE SAFER BEHAVIOUR, IMPROVE ACCESS TO EFFECTIVE HEALTH AND SOCIAL SERVICES, AND TO ADDRESS THE UNDERLYING STRUCTURAL AND OCCUPATIONAL DIMENSIONS OF VULNERABILITY.

Integrated biological and behavioural surveillance for HIV and STIs among female sex workers in Germany – results and lessons learned from the first round of data collection and a call for input on future plans

Authors: Nielsen S¹, Haar K¹, Sailer A¹, Hamouda O¹

¹ HIV/AIDS, STIs and Blood-borne Infections Unit, Department for Infectious Disease Epidemiology, Robert Koch Institute, Berlin, Germany

Background

In Germany, the Robert Koch Institute is currently just about to finalise the first round of integrated biological and behavioural surveillance (IBBS) among female sex workers (FSW) attending low threshold STI testing sites. The ISSTD satellite meeting would be a unique opportunity to present our findings from this first round of data collection and moreover to discuss and get input from key international experts on the future plans for IBBS among FSW in Germany.

Methods

Since January 2010, we have collected data from 30 local health departments (LHD) located in 13 of the 16 German federal states. The LHD voluntarily submit quarterly reports with the number of FSW tested and found positive for any of the following STIs: HIV, Syphilis, Chlamydia, Gonorrhoea, Trichomoniasis and Bacterial vaginosis. LHDs are required by German law to undertake active outreach work in order to reach certain high-risk groups such as sex workers. However, the extent of outreach work performed varies from site to site depending on available resources.

In addition to the information about the number of FSW tested and found positive for any STIs, physicians fill out a basic questionnaire with information on e.g.: Knowledge of German language; health insurance; number of children; method of birth control currently used (if any); location(s) where clients are met (e.g. street, internet or ads, escort-services, brothels, bars, saunas or massage parlours); previous STI diagnoses; vaccination status; and number of HIV tests. In a separate questionnaire FSW provide more detailed behavioural information which can be matched to the physician's questionnaire through a numeric code. This questionnaire covers: Knowledge of HIV transmission and prevention; number and types of sex partners; condom use; drug use; how long the women has worked as sex workers; whether sex work is their main source of income; history of violence or abuse and more.

A list of the key variables collected in the two questionnaires is included below.

Results

Our data collection ends on March 31, so currently the data is still being collected and validated.

In 2010, more than 7,000 FSW were seen at the 30 LHDs. The number of tests and positive diagnosis is displayed in table 1.

We have received the basic (physician) questionnaire for more than 1300 FSW and more than 470 of these sex workers also filled out the additional behavioural questionnaire. However, as some of the data is still being validated, our findings presented here are based on data for 1142 basic questionnaires and 399 behavioural questionnaires. The analyses of our data will be finalised by June 2011.

Table 2 describes selected characteristics of the FSW included in our study.

Risk factors associated with a higher chance of testing positive for either HIV, Chlamydia, Gonorrhoea or Trichomoniasis include: poor knowledge of German language, OR=3.6 (2.5-5.0), meeting clients on the street, OR=3.5 (2.3-5.3) and increased number of clients per week. The risk of STI decreased with year of age, OR=0.95 (0.93-0.97), and was lower among FSW meeting clients on the internet, OR=0.5 (0.3-0.7) and FSW with health insurance, OR=0.4 (0.3-0.5).

Conclusions

We plan to continue and expand the IBBS among FSW in Germany – and in the fall of 2011 we will decide on how to possibly modify our recruitment strategies and our data collection tools. It would therefore be immensely valuable for us to present our key findings and to get feedback on any key issues which we have not yet addressed in our data collection as well as input on how to possibly better reach the most vulnerable FSW in our future surveys and ensuring comparability of our data with similar international studies.

Table 1: STI positivity rates

	HIV	Syphilis	Chlamydia	Gonorrhoea	Trichomoniasis	Bacterial Vaginosis
N (tested)	3037	3191	3807	4223	2529	2770
% positive	0.2%	1.3%	6.8%	3.0%	3.0%	32%

Table 2: Characteristics of the FSW included in our study (N=1142)

Variables	N (%)	Comments
Country of birth	Germany 318 (28%) Outside Germany* 816 (72%)	<p>* Among the women not born in Germany:</p> <ul style="list-style-type: none"> • 60% are from Central Europe (e.g. Romania, Bulgaria, Poland or Hungary) • 13% are from Eastern Europe • 12% are from Thailand • 11% from Latin America or the Caribbean • <2% from Africa <p>Groups of FSW who seem currently not to be reached very well through the LHDs in Germany include:</p> <ul style="list-style-type: none"> • very young women, • African women, • Injecting drug users
Age	<20 years 51 (5%) 20-24 251 (22%) 25-29 241 (21%) 30-39 279 (24%) 40-49 216 (19%) >49 104 (9%)	
Locations where clients are met (more answers are possible)	Brothels 376 (34%) Apartment 284 (26%) Internet or adds 188 (17%) Strip-club, bars or massage-parlours 125 (11%) Street 101 (9%) Window 89 (8%) Sauna-clubs 86 (8%) Escort-service 31 (3%)	
Number of clients per week (N=270)	1-7 73 (27%) 8-13 70 (26%) 14-25 66 (25%) 26-40 36 (13%) >40 25 (9%)	
Ever injected drugs (N=350)	17 (5%)	
Condom use (with clients) (N=325)	Vaginal sex ("always") 302 (93%)	

Key variables collected in the two main data collection tools:

A) Basic questionnaire filled out by doctor (N=1302)

1. Age,
2. Country of birth,
3. Level of German language (fluent, medium, poor),
4. Health insurance [59% have health insurance],
5. Number of children,
6. Method of birth control currently used (if any),

7. Site where clients are met (e.g. street, internet or adds, escort-services, brothels, bars, saunas or massage parlours),
8. Reasons for coming for STI testing,
9. Previous STI diagnoses,
10. Vaccination against Hepatitis B,
11. Pap smear test in the last 12 months,
12. Number of HIV tests (last 12 months and ever)
13. Laboratory results for STI tests: HIV, Syphilis, Chlamydia, Gonorrhoea, Trichomoniasis, Bacterial vaginosis, Hepatitis A, B and C,
14. Other STI diagnoses: HPV, HSV, PID etc.

B) KABP (Knowledge Attitudes, Behaviour and Practices) questionnaire filled by FSW (N=471)

15. Educational level
16. Knowledge about HIV and other STIs – a) HIV transmission, b) HIV prevention, c) sexual transmission of infections
17. Do you currently have a regular partner? If yes, for how long
18. Do you have sex with men, women or both?
19. Type of partners in the last 6 months: regular, casual, clients
20. Number of sex-partners (excluding clients) in the last 6 months
21. Condom-use with different types of partners for oral, vaginal and anal sex
22. Frequency of condom use with clients (always, mostly, rarely, never)
23. Reasons for using condoms
24. % of the last 10 male sex partners who asked for sex without a condom
o What happened the last time a client did not want to use a condom? [9% had sex without condom]
25. History of injecting drug use (ever and in the last 6 months)
26. Consumption of drugs or alcohol right before or during last sex
27. Country where commercial sex work was initiated
28. Number of months / years in sex work
29. Within the last 6 months, was sex work your main source of income?
30. Do you also work in other countries?
31. Is sex work regular (all-the-year) or sporadic / seasonal?
32. Number of clients per week
33. % of regular customers among last 10 clients
34. Did you ever experience unwanted abuse (from a client, pimp or other)

FEMALE SEX WORKERS AND MALE CLIENTS: RECENT TEMPORAL TRENDS AND THEIR ROLE IN STI TRANSMISSION IN THE U.S.

Jami S. Leichter, PhD, and Sevgi O. Aral, PhD, MS, MA

Division of STD Prevention, Centers for Disease Control and Prevention, Atlanta, GA, USA

Background

Little is known about female sex work on a national level in the United States (U.S.) and even less is known about the male clients of female sex workers (FSW). FSW and their clients may be considered members of a core group that sustains endemic or fuels epidemic transmission of STIs. We examined the demographic characteristics of FSW and male clients of FSW, the recent sexual behaviors of the two groups, and self-reported gonorrhea or chlamydia in the past year. Additionally, we examined recent temporal trends in reported sale and purchase of sexual services in the U.S. general population.

Methods

We used data from the National Survey of Family Growth (NSFG), a household survey of females and males age 15-44 years. NSFG over-samples several groups most at risk for STIs including blacks/African Americans, Hispanic/Latinos, and adolescents aged 15-19 years. The NSFG was administered in 2002 (N=12, 571) with a response rate of 79% and again in 2006-08 (N=13,495) with a response rate of 75%. In the audio computer assisted self-interview (ACASI) section of the survey, NSFG asks a series of

questions about sex work and other sexual risk behaviors with opposite-sex partners in the past 12 months for respondents who report at least one opposite-sex partner in the past year (sexually active). For females, two separate questions focusing on opposite-sex partners ask about being given money or drugs for sex (FSW) and giving money or drugs for sex (client of MSW). For males, two separate questions focusing on opposite-sex partners ask about being given money or drugs for sex (MSW) and giving money or drugs for sex (client of FSW). Our analysis focused on FSW and male clients of FSW (most commonly reported behaviors). Data analyses were conducted using SAS 9.2 and SUDAAN 10.0 to account for the complex sampling employed by NSFG. All data were weighted to represent the U.S. population age 15-44 years. First, we examined demographics and sexual risk behaviors of FSW and male clients separately using the 2002 data (estimates were more stable than in 2006-08). We used chi-squares and logistic regression models (variables $p < .10$ in bivariate). Next, we examined receipt of STD treatment and self-reported gonorrhea and chlamydia for FSW and male clients using chi-squares. Finally, we used chi-squares to examine the temporal trends in the percentage of respondents who reported FSW and male clients.

Results

In 2002, 2.3% (SE=0.2) of sexually active women reported receiving money or drugs for sex in the past 12 months, and 2.7% (SE=0.3) of sexually active men reported being a male client of FSW in the past 12 months. In bivariate analyses, FSW was associated with race, poverty level income (household income in relation to poverty level), marital status, sexual debut before age 15 years, having had sex with an injection drug user (IDU), having had sex with a bisexual partner, and having had sex with an HIV-positive partner. The only factors that remained significant in a multiple logistic regression model were being previously married (AOR=2.57, 95%CI=1.17-5.56) as compared to currently married, having had sex with an IDU (AOR = 52.50, 95%CI = 30.42-90.61) and having had sex with an HIV-positive partner (AOR=42.76, 95%CI = 15.41-118.62). In bivariate analyses, being a male client of a FSW was associated with race, poverty level income, marital status, sexual debut before age 15 years, having had sex with an IDU, and having had sex with an HIV-positive partner. In a multiple logistic regression model, being black (AOR=2.32, 95%CI = 1.28-4.23), previously married (AOR=2.92, 95%CI=1.47-5.80) and having had sex with an IDU (AOR=36.99, 95%CI = 19.44-70.39) remained significant.

Both FSW and male clients were more likely to report that they had received STI treatment in the past 12 months compared to respondents who did not report commercial sex; however, only male clients had significantly higher reports of gonorrhea (38.2%) and chlamydia (30.1%) in the past 12 months than their male counterparts (2.4% for each STI).

From 2002 to 2006-08, we found a significant decrease in reports of FSW in the past 12 months from 2.3% (SE=0.2) to 1.1% (SE=0.2) ($p=.0007$). However, there was a higher number of missing data in women in 2006-08; when this difference was taken into account; there was no difference in the percentage of women who did not report that they were given money or drugs for sex. In men, we found a significant decrease in reports of being a male client of FSW in the past 12 months from 2.7% (SE=0.3) in 2002 to 1.0% (SE=0.2) in 2006-08 ($p<.0001$). After accounting for missing data, when we examined the percentage of men who did not report that they had given money or drugs for sex, this significant difference remained.

Conclusions

In the U.S. general population, reports of receiving (women) and giving (men) money or drugs for sex are low. However, both FSW and male clients of FSW reported several sexual behaviors that place them at risk for STI acquisition and some sexual contacts (e.g., sex with a bisexual partner) have the potential to sustain STI transmission through bridges to other sexual networks. Our findings are similar to those from the UK where 1.3% of men reported paying for heterosexual sex in the past year (Ward et al, 2005). The decrease in reports of being a male client of a FSW in the past 12 months from 2002 to 2006-08 is consistent with a previous analysis that found a slight decrease in the median number of lifetime opposite-sex partners among men during this time frame (from 5.6 in 2002 to 5.1 in 2006-08).

THE BROTHERS' STUDY (HPTN 061): A FEASIBILITY STUDY OF A MULTI-COMPONENT INTERVENTION FOR AMERICAN BLACK MEN WHO HAVE SEX WITH MEN

Kenneth H. Mayer,¹ Beryl Koblin,² Darrell Wheeler,³ Lei Wang,⁴ Fang Gai,⁴ Hong Van Tieu,⁵ Vanessa Cummings,⁶ Sharon Mannheimer,⁷ Leo Wilton,⁸ Susan Buchbinder,⁹ Sam, Griffith,¹⁰ Vanessa Elharrar,¹¹ for the HPTN 061 Protocol Team

¹ *The Fenway Institute, Fenway Health, Boston, Mass, USA*

² *Infectious Disease Laboratory, New York Blood Center, New York, NY, USA*

³ *Department of Social Work, Hunter College, CUNY, New York, NY, USA*

⁴ *Vaccine and Infectious Disease Institute, Fred Hutchinson Cancer Research Center, Seattle, Washington, USA*

⁵ *Division of Infectious Diseases, Columbia University School of Medicine, New York, NY, USA*

⁶ *Department of Pathology, Johns Hopkins School of Medicine, Baltimore, Md, USA*

⁷ *Department of Medicine, Harlem Hospital, New York, NY, USA*

⁸ *Department of Psychology, State University of New York at Binghamton, New York, USA*

⁹ *HIV Research Section, San Francisco Department of Public Health, San Francisco, California*

¹⁰ *Family Health International, Research Triangle Park, NC, USA*

¹¹ *Division of AIDS, National Institute of Allergy and Infectious Diseases, Bethesda, Md, USA*

Although Black MSM are a minority within a minority, more than ¼ of recent HIV infections in the United States have occurred in this community. Millett and others have reviewed the varying hypotheses that have been developed to explain this disproportionate infection burden, and have noted that most studies suggest that individual risk behavior does not seem to be the major factor, since Black MSM tend to be less sexually risky than age-matched MSM from other racial and ethnic groups. Some studies suggest that because of real and perceived barriers to health care, Black MSM may be less likely to be aware of new HIV infections and other STDs, leading to longer periods of increased susceptibility and infectiousness. In addition, several studies have suggested that Black MSM are more likely to select other Black MSM as sexual partners, concentrating the spread of HIV within the population. These observations have led public health researchers to posit that effective interventions for Black MSM need to engage the networks of partners and social peers to change norms regarding testing and care seeking. The use of peer health system navigators was developed initially as a health promotion intervention to assist Black women in Harlem to increase their use of mammography (Freeman et al) several decades ago. The peers were members of the affected community who received specific training to help at risk women engage the health care system. This approach has been more recently used (Bradford et al) to assist HIV-infected persons to adhere to clinic visit appointments and their medication regimens.

HPTN 061 was a pilot evaluation of whether trained peer health system navigators could increase the uptake of HIV testing by Black MSM, facilitate their engagement in care if found to be HIV-infected, and their triage for prompt treatment of intercurrent STDs, and whether peer counseling and referral could result in decreased sexual risk taking behaviors. The study did not have a control group and was not powered to prove the efficacy of peer health system navigation, but was designed to assess the acceptability of this intervention in this population. The study also was designed to ask the men who their sexual partners and social network members were (i.e. whether there was concordance in terms of age, race/ethnicity and other demographic characteristics) and to evaluate their willingness to refer sexual partners into the study. In addition to trying to estimate HIV incidence changes that might be attributed to intervention, the study was also designed to describe sexual risk behaviors, the number of partners, the type and frequency of anal intercourse, the level of condom use among the different subsets of Black MSM and was also designed to describe social and sexual network size, composition, density and the overlap between social and sexual networks. The study also used qualitative research methods to examine individual, interpersonal, cultural, institutional, and geographic-specific processes that influence study participation and uptake of intervention components, and to understand how and to what extent stigma and discrimination (and other emergent themes) influence HIV testing and access to care by geographic region. Participants were seen at enrollment, and at 6 and 12 months, and filled out a detailed questionnaire by ACASI, and underwent HIV and STD screening including syphilis serologies, and NAAT for gonorrhea and Chlamydia from all mucosal sites. Nearly all participants were offered the opportunity to meet with a peer health system navigator and were asked if they would refer up to 5 of their sexual partners into the study. A subset of men underwent individual qualitative interviews and another subset participated in focus groups. The study was designed to assess the feasibility of each component of the intervention (i.e. willingness to enroll, to accept peer navigation, to be tested and treated for HIV and STDs, to change risk practices, to refer network partners)

in order to provide input for modeling the potential impact of the intervention if it was enacted on a sufficiently large scale. If the intervention package is deemed to have the potential to decrease HIV incidence on a population level, the next step would be a community-randomized proof of concept trial.

The study recruited 1555 Black MSM in Boston (Fenway Health), New York (New York Blood Center and Harlem Hospital), Washington, DC (George Washington University), Atlanta (Emory University), San Francisco (SF Health Department) and Los Angeles (UCLA) between September, 2009 and October, 2010. About 7% of the men were less than 20 and 26% were in their 20s. About 98% of the participants identified as male, with most of the rest being transgender. Thirty nine percent identified as bisexual. About $\frac{3}{4}$ of the MSM reported a family household income of less than \$30,000 per year. Twenty-two percent of the MSM indicated that they had exchanged sex for drugs or money in the prior year.

The study is still ongoing, but initial findings suggested that HIV and STDs were often detected among the men. A subset of the men was invited to refer sexual partners into the study, but less than 15% did so. The last 12 month follow-up for the participants will be in October 2011, but at this juncture, the study has found that it is feasible to recruit a large at-risk sample of Black MSM into this study, that high levels of undiagnosed HIV and STDs may be important drivers of the concentrated epidemic among Black MSM. The findings of the men in this study may not be generalizable to other samples of Black MSM, given that the volunteers were particularly economically disadvantaged. Although peer system navigation appeared acceptable and helpful for some of the men, for others, additional strategies to enhance its appeal may be needed to increase uptake. Interventions that address some of the social and economic challenges the men faced may be needed in order to decrease HIV and STD transmission in this population.

HIV EPIDEMICS AMONG MEN WHO HAVE SEX WITH MEN ARE EMERGING IN THE MIDDLE EAST AND NORTH AFRICA: EPIDEMIOLOGIC CONTEXT AND TRANSMISSION LINKS WITH OTHER HIGH RISK-GROUPS

Ghina Mumtaz,¹ Nahla Hilmi,² Willi McFarland,³ Rachel L. Kaplan,⁴ Francisca Ayodeji Akala,² Iris Semini,⁵ Gabriele Riedner,⁶ Oussama Tawil,⁵ David Wilson,⁷ and Laith J. Abu-Raddad^{1,8,9}

¹ *Infectious Disease Epidemiology Group, Weill Cornell Medical College - Qatar, Cornell University, Qatar Foundation - Education City, Doha, Qatar*

² *Human Development Sector, Middle East and North Africa Region; ⁷Global HIV/AIDS Program; World Bank, District of Columbia, USA*

³ *HIV Research Section, San Francisco Department of Public Health, San Francisco, California*

⁴ *Department of Social Welfare, School of Public Affairs, University of California, Los Angeles (UCLA)*

⁵ *Joint United Nations Programme on HIV/AIDS Regional Support Team, Middle East and North Africa, Cairo, Egypt*

⁶ *Regional Office of the Eastern Mediterranean, World Health Organization, Cairo, Egypt*

⁸ *Department of Public Health, Weill Cornell Medical College, Cornell University, New York, New York, USA*

⁹ *Vaccine and Infectious Disease Institute, Fred Hutchinson Cancer Research Center, Seattle, Washington, USA*

Background

Men who have sex with men (MSM) bear a disproportionately higher burden of HIV infection than the general population. While the global prevalence of HIV has stabilized, there seems to be a trend of increasing HIV prevalence among men who have sex with men with new, newly identified, and resurging HIV epidemics among MSM being documented in different parts of the world.

MSM in the Middle East and North Africa (MENA) endure pervasive stigma, harassment, and discrimination at the social and political levels that can limit our ability to assess infection transmission patterns among them. There is a widely held perception of virtually nonexistent data on MSM and HIV in this region.

Objective

The objective of this study was to review, analyze, and synthesize for the first time the evidence on the epidemiology of HIV among MSM in MENA.

Methodology

This was a systematic review of all biological, behavioral, and contextual data on HIV and MSM in MENA. Sources of data included PubMed (Medline), international organizations' reports and databases, country-level reports and databases including governmental and non-governmental organizations publications, as well as various other institutional documents.

Data was extracted on the prevalence of male same-sex sex, HIV prevalence, the contribution of anal sex as a mode of HIV transmission, risk behavior, and HIV/AIDS knowledge and attitudes among MSM in MENA. Longitudinal data, when available, were highlighted, as well as any evidence linking HIV epidemics between MSM and other high risk groups. A triangulation approach was used to analyze the multiple lines of evidence.

Results

This study showed that there are considerable data on MSM and HIV in MENA, with several integrated bio-behavioral surveys (IBBS) incorporating state of the art sampling techniques for hard-to-reach populations being implemented in the last few years. The proportion of the male population engaging in anal sex with males in MENA seemed to be consistent with reported global levels of roughly 2-3%; with higher rates being documented among select populations such as truck drivers and prisoners (in occasions reaching more than 50%).

HIV transmission among MSM has been documented in most MENA countries. Available data indicate that anal sex between males contributes by considerable proportions to HIV transmission of up to 20% in a number of countries such as in Egypt, Lebanon, and Yemen. Also, by 2008, the contribution of MSM transmission to the total HIV notified cases increased in several countries such as Egypt, Lebanon, Oman, Syria, and Tunisia.

While HIV prevalence continues at rather low levels among different MSM groups, HIV epidemics appear to be emerging in at least few countries where data from the earlier years indicate nil or very limited HIV prevalence, but recent studies report considerable rates reaching up to 14.8% in Iran and 9.3% in Sudan. In Egypt, the two rounds of IBBS in 2006 and 2010 indicate a concentrated epidemic among MSM that seems stable at about 6-7% prevalence, while in the three rounds of IBBS in Pakistan, HIV prevalence among hijra transgender individuals increased from 0.8% in 2005 to 1.8% in 2006 to 6.4% in 2008. An HIV prevalence of about 4% was also reported among MSM in Lebanon and Morocco.

The considerable levels of risk behavior (4-14 partners on average in the last six months among different MSM populations) and of biomarkers of risks (such as Herpes Simplex Virus Type 2 at 3-54%), the overall low rate of consistent condom use (generally below 25%), the relative frequency of male sex work (20-76%), and the overall low levels of comprehensive HIV/AIDS knowledge among MSM in MENA, all suggest potential for further HIV spread.

MSM risk behaviors in MENA overlapped considerably with other high risk groups such as injecting drug users (IDUs) and female sex workers (FSWs). Overall, 1-53% of MSM reported injecting drugs and 2-42% of IDUs reported having had anal sex with a male. Similarly, up to 48% of MSM in several studies reported having had sex with FSWs. This overlap is a key factor facilitating bridging of the infection between different high risk groups. For example, recent phylogenetic analyses in Pakistan have linked the emerging epidemic among MSM to that which emerged earlier in this decade among IDUs in this country. Similarly in Iran, where IDU is the main mode of HIV transmission, an HIV prevalence of 15% has been recently reported among MSM, 53.0% of whom reported injecting drugs in the last month, suggesting that the overlap may have contributed to HIV transmission among MSM in this country. A reverse trend may have happened in Egypt where the emerging HIV epidemic among IDUs (HIV prevalence increased from 0.6% in 2006 to 7-8% in 2010) appears to have materialized following the rise of the epidemic among MSM earlier in the decade.

Conclusions

This study indicated that after apparently several years of limited transmission, HIV epidemics appear to be emerging among MSM in at least a few countries and could be already in a concentrated state among several MSM groups. The very low HIV prevalence still found among some MSM populations is most often likely to reflect recent or lack of virus introduction into these populations, possibly due to the isolation of

these populations, rather than lack of epidemic potential, as suggested by the high risk and vulnerability context. There is an urgent need to expand HIV surveillance and access to HIV testing, prevention, and treatment services in a rapidly narrowing window of opportunity to prevent the worst of HIV transmission among this population group in MENA.

COMPARISON OF VENUE-BASED AND RESPONDENT DRIVEN SAMPLING METHODS FOR SURVEILLANCE OF SEX WORKERS

Sharon S Weir, M. Giovanna Merli, Jing Li, Anisha D. Gandhi, William W Neely, Jessie K. Edwards, Chirayath M Suchindran, Gail E Henderson, Xiang-Sheng Chen

Affiliations: Weir, Gandhi, Suchindran, Henderson, Edwards: University of North Carolina; Merli: Duke University; Li, Chen: National Center for STD Control, Nanjing, China; Neely: Independent Consultant.

Every day nearly a million people acquire a sexually transmitted infection (STI), and each year 340 million people aged 15-49 are infected with a curable STI [1]. Syphilis epidemics are especially tragic because syphilis causes great harm, poses the largest risk for HIV transmission[2], and is preventable[3]. Individuals who engage in illegal or stigmatized behaviors— injecting drugs, exchanging sex for money, or having multiple same-sex partners— comprise a small percentage of the population but have a disproportionate role in the transmission of infection and a greater need for health services. The World Health Organization and the US Prevention Services Task Force recommend surveillance of most-at-risk hidden populations[4, 5].

Venue-based sampling and respondent driven sampling (RDS) are two strategies commonly used to obtain information on sex worker populations, however, the relative strengths and weaknesses of each are not completely understood. Venue-based sampling methods include methods such as time-space sampling [6] and the Priorities for Local AIDS Control Efforts (PLACE) method [7-9] . These methods construct a sampling frame of venues, use multi-stage sampling methods to select a representative sample, and analyze data with complex survey methods [10]. Venue-based methods miss sex workers who do not solicit from venues such as those who only recruit clients by telephone or internet. On the other hand, venue-based methods can reach other at venues such as female workers who deny sex work but may be at increased risk of infection.

RDS [11, 12] uses chain referral to recruit sex workers. RDS assumes that the chain referral process selects respondents with probability proportional to the number of sex workers in the respondent's social network and that recruitment meets other stringent conditions.

The authors compared the characteristics of the same sex worker population—female sex workers age 15 and older in Liuzhou, China—estimated by concurrent implementation of each method. In addition, PLACE described the population of female venue workers regardless of whether they reported receiving money in engage for sex work or not. Sociodemographic and behavioral characteristics were compared as well as the percentage sero-reactive for syphilis based on an antibody response to a treponemal antigen using whole blood obtained from a finger prick (Wantai anti-TP Antibody Rapid Test, Wantai Biological Pharmacy Enterprise, Beijing, China). A positive test indicates a current or previous infection.

We found that characteristics of the population differed according to sampling method. The percentage of sex workers with a positive non-treponemal rapid test was 24% according to the venue-based PLACE protocol and 8.5% according to the RDS protocol (prevalence ratio 3.3; 95% CI 1.5, 7.2). Among all workers at PLACE venues regardless of sex worker status the percentage was 6.8%. Among sex workers younger than 25, the venue-based estimate was an order of magnitude higher than the RDS estimate (23.9% vs. 2.5%) (Figure 1). The figure below shows the percentage with a positive rapid test among: 1) sex workers recruited by RDS, 2) sex workers sampled at PLACE venues; and 3) all female workers at PLACE venues regardless of whether they reported exchanging sex for money in the past four weeks or not (study definition of sex work.)

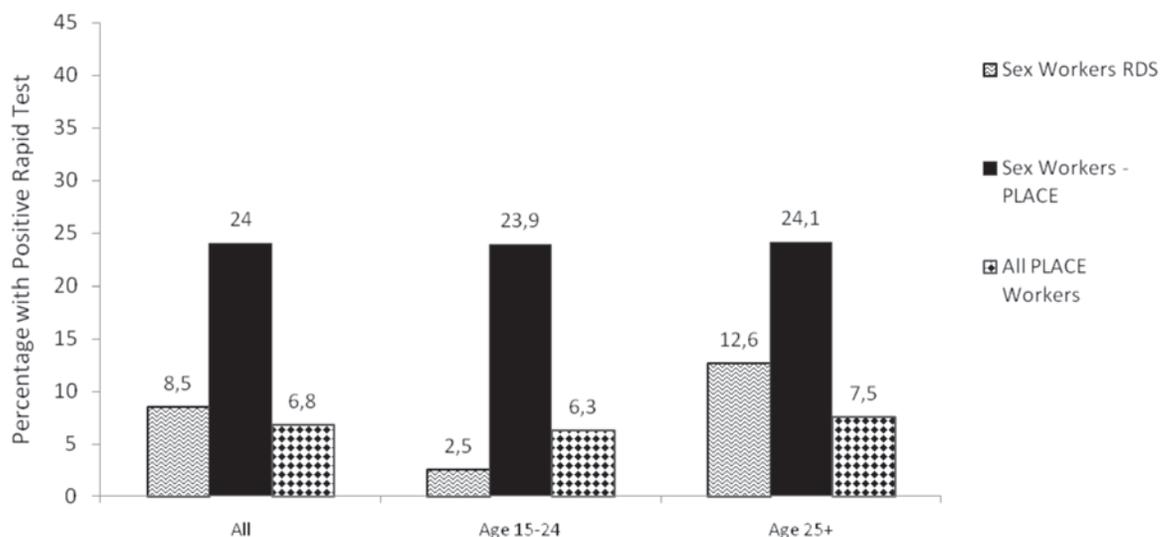


Figure 1 - Percentage of RDS and PLACE sex workers and all PLACE workers reactive to the syphilis rapid test

Socio-demographic characteristics (age, urban/rural residence and monthly income) also varied by sampling method. Exploratory analysis suggests that it is more likely that RDS underestimated the proportion with current or past syphilis infection than PLACE overestimated the proportion. The authors recommend that more attention be paid to improving the validity of surveillance data from hidden populations. Finally, 6.8% of female workers at venues identified as places where people meet new sexual partners had a positive rapid test for syphilis. These women may not have exchanged sex for money in the past four weeks, but they are at higher risk for STI than the general population and may include some women who will make the transition to sex work in the future.

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GROUP SEX EVENTS AS SITES WHICH BRIDGE KEY AT-RISK POPULATIONS: A LITTLE-STUDIED ASPECT OF STI TRANSMISSION NETWORKS AND DYNAMICS

Samuel R Friedman,* Maria Khan,** Milagros Sandoval,* Pedro Mateu-Gelabert*

* National Development and Research Institutes, Inc., New York, NY

** Department of Epidemiology and Biostatistics, University of Maryland, College Park, MD

Relatively few studies have investigated the patterns of sexual networks at a community (sociometric) level. Even fewer have studied group sex event attendance, and fewer yet have done this in a network context. In addition, there has been very little qualitative research on what happens at group sex events other than those at gay-identified or brothel venues. This lack of research greatly hampers our ability to study sexual mixing patterns; sexual network ties among at-risk populations such as men who have sex with men, sex workers, high-risk drug users, and attendees at group sex events; and the extent to which some individuals fall into more than one of these categories of risk.

This is true despite a number of STI outbreaks having been attributed to group sex activities. These include a syphilis outbreak in a Georgia suburb (Rothenberg et al., 1998); a gonorrhea outbreak in Syracuse, NY (Welych et al., 1998); and two HIV clusters in rural New York and in a small Mississippi town (Centers for Disease Control and Prevention, 1999; Centers for Disease Control and Prevention, 2000; Holmberg, personal communication, November, 2000; St. Lawrence, personal communication, October, 2000).

In addition, there is considerable emerging evidence that group sex participation is quite common. Krauss et al. (2006) have studied teenagers and youth in New York City's Lower East Side. In one study of youth 24 and below, 34% had attended group sex events. They reported that drug use was common at these events, as was age mixing over a range of 12 to 27 years of age. These events lasted for 5 – 8 hours and had 8 – 15 participants. An ethnographic study in a rural North Carolina (USA) county by Zule et al (2007) of people who use drugs, men who have sex with men, and others "knowledgeable about drug use and/or male-to-male sexual activity" found that 46% had engaged in group sex. By contrast, in a respondent-driven sample survey, very few subjects reported having participated in group sex. Zule attributes the difference in participation rates to serious under-reporting in formal surveys (personal communication, June 2008).

Heterosexual GSEs (sometimes with female sex workers) are common in developing countries, including Kenya, Bangladesh, Chennai and New Delhi (India), and Buenos Aires, Argentina (Njue et al, 2009; Azim et al, 2006; Panchanadeswaran et al, 2008; Tripathi et al, 2010; Zapiola et al, 1996).

Our group has published two papers on group sex. Our first paper (Friedman et al, 2011) included data from a pilot study in which we conducted informal in-depth interviews with 28 adults who take part in group sex events. 14 of those interviewed were middle class alcohol and marijuana users, but many of them also told us that cocaine and other drug use occurs at group sex events they attend. The other 14 were non-injecting users of heroin, crack and/or other cocaine who attend group sex events. Staff members observed 3 private group sex events and one public commercial event. From this pilot study, it appears to be common that people have sex at some of these events with people whom they could not describe or name in a network study. The epidemiologic impacts of group sex events may be increased by rapid partner change at them. Many participants have sex with several others in an hour or less. Fingers, penises, and/or sex toys move rapidly among mouths, vaginas and/or anuses. As Gotz et al. (2005) suggested, bodily fluids on vectors like condoms or female condoms, fingers, toys, genitals, mouths, or anuses may transmit HIV or STI indirectly between people who never have sex together. Thus, an uninfected person's penis can potentially transmit someone else's infected fluids to a woman who only has sex once at the event—and she might later transmit HIV to her non-attending partners. Since men sometimes use the same condom during sex with several partners, health messages that focus only on using condoms would not prevent third-party transmission of materials on condoms among partners who never have sex together.

Our second paper was based on data from a sociometric network study of primarily-heterosexual Bushwick (Brooklyn, NY) adults (Friedman et al 2008) that studied sexual links and drug-injection links among people 18 and older, starting from 2 sets of "seeds." One set was 66 seeds from a population-representative sample of 18 – 24 years old in the community, and the other set of 38 seeds was a convenience sample of injection drug users. (Late in the study, we added 8 seeds who were recruited as participants in a gay

sex party subculture.) We asked about drug use and about group sex participation (using ethnographically based questions to improve self-reporting on group sex.) Over 40% of both non-injecting crack smokers and also of non-injecting users of other cocaine and/or heroin had been to one or more group sex events in the last year, as had 35% of people who inject drugs and a fourth of those who had never used heroin, crack or cocaine. Many of the group sex events are bridge locations through which HIV and other STIs might spread across epidemiologic categories: The same events were attended by men who have sex with men (MSM) and also with women (MSM/W), women who have sex with women, and also with men (WSW/M), women who have sex only with men, and men who have sex only with women, people who inject drugs, other drug users, and non-users of drugs. In many cases, members of these different groups had sex with each other. Subjects who attended GSEs together—whether sex partners or not—had STI/HIV discordancy rates of 45% for herpes-2, 12% for HIV, and 21% for chlamydia.

Unpublished data from this study provide additional insights into group sex event participation by men and by women who do and do not engage in sex work. 73% of the men who engage in sex work had been to at least one group sex event in the last 12 months, as had 59% of the women who engage in sex work. Of those who both attend group sex events and are sex workers, the percents testing positive on various infections were:

Infection	Chlamydia	HSV-2	Syphilis	HIV
Men	13%	46%	2.6%	24%
Women	11%	71%	13%	8%

In interpreting the HIV results, it is important to remember that the sample includes both men who have sex with men and injection drug users.

Men who attended group sex events and also engaged in sex work reported a median of 5 sex partners in the last 3 months (and a mean of 13). Women who attended group sex events and also engaged in sex work reported a median of 5.5 sex partners in the last 3 months (and a mean of 40). Non-sex-worker men who attended group sex events reported a median of 2 partners in the last 3 months (mean 2.27) and non-sex-worker women who attended reported a median of 10 partners and a mean of 17.4. As indicated in our pilot study, however, it is likely that these are under-reports of numbers of partners due to difficulties remembering who you had sex with at group sex events.

“Condom use all the time with the most frequent type of sex partner”—that is, with same-sex partners or opposite-sex partners, whichever is greater in number—is 40% or less among men in each of four categories: Those who attend group sex events and engage in sex work, those who attend but do not engage in sex work, those who do not attend group sex events and engage in sex work, and those who neither attend nor engage in sex work. For women, all four of these categories report 50% or less consistent condom use.

Conclusions

Most research and modeling to date fails to take account of the extent of group sex that occurs among heterosexuals (as well as among men who have sex with men.) This means that it understates the extent of bridging across different sociodemographic and behavioral population groups. It probably means that estimates of numbers of partners are underestimates among the sizable proportion of people who attend group sex events. The possibility of third- and perhaps fourth- party transmission of STIs between group sex participants who never have sex with each other means that current estimates of concurrency are probably underestimates for this reason as well as for under-reporting of numbers of sex partners. Research on the extent of such third- and fourth-party transmission should be conducted, but model-based parameters might be useful in the interim period to assist mathematical modeling. Consistent condom use is 50% or less in all categories of sex workers and group sex attendees; and, as mentioned, may not prevent third-party transmission. The data on sex workers’ participation in group sex events is somewhat lacking in detail, but does suggest that sex workers are at high infection risk themselves and that their group sex participation may greatly increase network connectivity and transmission at the community level.

In sum, group sex attendees are quite numerous, and behavioral patterns and mixing patterns at group sex events make them important for both research and intervention. Research on them should be a high priority for public health and for STI and HIV prevention.

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THE DISTRIBUTION OF STDs ACROSS AGE GROUPS, CHANGES IN STD RATES AMONG YOUTH ACROSS BIRTH COHORTS, AND SEXUAL MIXING PATTERNS BY AGE: AN ANALYSIS OF STD SURVEILLANCE DATA

Harrell Chesson, Division of STD Prevention, CDC, Atlanta

Background

Adolescents and young adults are typically at higher risk for STDs than older adults. However, in recent years age disparities in STD rates have decreased, in the US and elsewhere. In this study, we used surveillance data to examine the distribution of STDs across age groups over time, changes in STD rates across birth cohorts, and mixing patterns by age.

Methods

Examining the distribution of STDs across age groups over time

We used Gini coefficients and Lorenz curves to analyze changes in the distribution of STDs across age groups over time. The Gini coefficient can range from 0 (no inequality in the distribution of a given STD across age groups) to 1 (complete inequality such that one age group accounts for all cases of the given STD). We used national-level gonorrhea, chlamydia, and primary and secondary (P&S) syphilis rates from 1981 to 2009 (1995 to 2009 for chlamydia).

Changes in STD rates among youth across birth cohorts

We examined STD rates at three different age ranges (15 to 19 years, 20 to 24 years, and 25 to 29 years) for four different age cohorts: (1) those born 1962 to 1966, (2) those born 1967 to 1971, (3) those born 1972 to 1976, and (4) those born 1977 to 1981. We used national-level gonorrhea and P&S syphilis rates from 1981 to 2009.

Exploring sexual mixing patterns by age

Reported STD rates for a given age group would be expected to be correlated with reported STD rates for another age group because of (1) factors that influence STD rates that are common to both age groups and (2) sexual mixing between the two age groups. In this analysis, we attempted to control for the factors that influence state-level, age-specific STD rates in order to assess the degree of mixing across age groups.

We used a fixed-effects regression analysis of state-level gonorrhea rates from 1981 to 1995 to examine the association of gonorrhea rates across three age groups (ages 15 to 19, ages 20 to 24, and ages 25 and up), controlling for factors that influence state-level gonorrhea rates such as national trends in gonorrhea rates and state-level socio-demographic factors.

Results

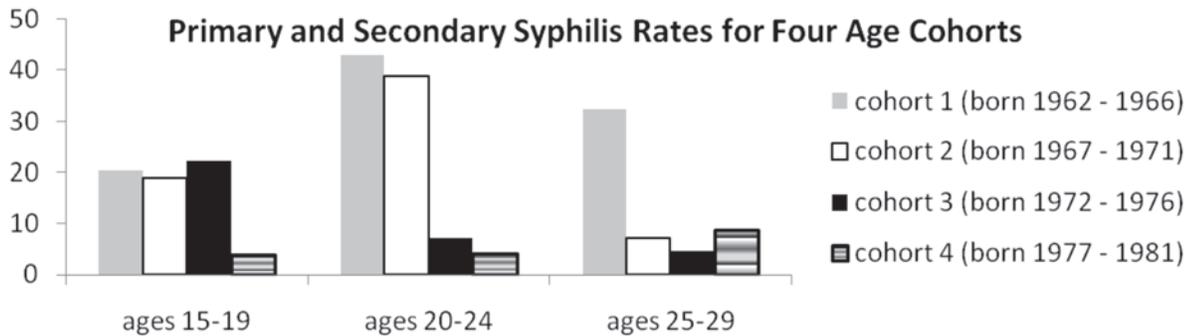
Examining the distribution of STDs across age groups over time

For syphilis, the average Gini coefficient from 1981 to 2009 was 0.315 (range: 0.243 to 0.377) overall, 0.288 (range: 0.208 to 0.360) for men, and 0.397 (range: 0.318 to 0.468) for women.

For gonorrhea, the average Gini coefficient from 1981 to 2009 was 0.543 (range: 0.510 to 0.589) overall, 0.468 (range: 0.443 to 0.501) for men, and 0.639 (range: 0.593 to 0.666) for women.

For chlamydia, the average Gini coefficient from 1995 to 2009 was 0.666 (range: 0.655 to 0.678) overall, 0.590 (range: 0.584 to 0.596) for men, and 0.695 (range: 0.685 to 0.706) for women.

Changes in STD rates among youth across birth cohorts



Exploring sexual mixing patterns by age

Annual changes in gonorrhoea rates were correlated across age groups. Generally, changes in gonorrhoea rates for a given sex were correlated with changes in gonorrhoea rates of the opposite sex in the same age group. Further, changes in gonorrhoea rates in males tended to be correlated with changes in gonorrhoea rates among females in younger age groups, whereas changes in gonorrhoea rates in females tended to be correlated with changes in gonorrhoea rates in males in older age groups.

Conclusions

In general, syphilis is more evenly distributed across age groups than gonorrhoea and chlamydia, although the Gini coefficient for each STD varies over time. STD rates at a given age range (e.g., 15 to 19 years, 20 to 24 years) can vary across birth cohorts (e.g., those born between 1962 and 1966 vs. those born between 1977 and 1981). Annual changes in state-level gonorrhoea rates were correlated across age groups in a pattern consistent with our current understanding of sexual mixing by age: males tend to have partners the same age or younger, whereas women tend to have partners the same age or older.

DETERMINANTS OF PERSISTENT SPREAD OF HIV IN HCV-INFECTED POPULATIONS OF INJECTING DRUG USERS

Anneke de Vos¹, Jannie van der Helm², Maria Prins^{2,3}, Mirjam Kretzschmar^{1,4}

¹ University Medical Centre Utrecht, Utrecht, The Netherlands

² Public Health Service, Amsterdam, the Netherlands

³ Academic Medical Center, University of Amsterdam, Amsterdam, the Netherlands

⁴ Centre for Infectious Disease Control, RIVM, Bilthoven, The Netherlands

Background

Hepatitis C virus (HCV) and human immunodeficiency virus (HIV) share common transmission routes in populations of injecting drug users (IDU) through the sharing of contaminated syringes. Prevalence of HCV is high in most IDU populations, whereas HIV prevalence varies considerably across populations. Understanding the dynamics of these interacting infections may allow us to use HCV prevalence as an indicator for the risk of persistent spread of HIV in yet HIV-uninfected populations.

Methods

We developed a mathematical model that describes the spread of both HCV and HIV in an IDU population. The model allows for HCV-HIV co-infection and increased disease related mortality for both infections. Based on parameters estimated from the Amsterdam Cohort Study (ACS) of drug users we analyzed the basic reproduction number R_0 as a function of HCV equilibrium prevalence. Using this model we investigated how the successful introduction of HIV into a HCV infected population depends on level and heterogeneity of injecting risk behaviour.

Results

We found that there is a threshold HCV prevalence at which HIV can invade into an IDU population; below threshold HIV cannot spread. This threshold depends strongly on heterogeneity of risk behaviour in the population, as well as on whether sharing is more likely to occur within or between risk behaviour groups. Fitting to behavioral data from the ACS we found that HIV can persistently spread at a HCV prevalence of around 50% when we assume no assortative mixing. With 90% of all risk contacts occurring among IDU of the same risk level (assortative mixing), the threshold value lowers to around 30% HCV prevalence, which is comparable with empirical relationships between HCV and HIV prevalence as described by Vickerman et al (2010).

Conclusions

The basic reproduction number R_0 for HIV is very sensitive to how risk behaviour, in particular sharing of syringes, is distributed among and within population subgroups, whereas HCV equilibrium prevalence is determined more by the overall level of exchange of syringes. Therefore, although HCV prevalence can be used as an indicator of risk for successful HIV introduction into an IDU population, information on risk heterogeneity is necessary in order to more exactly determine the risk and best prevention strategies for HIV infection.

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ESTIMATING SOURCES OF INFECTION IN HIV EPIDEMICS: A COMPARATIVE MODELING ANALYSIS

Sharmistha Mishra¹, Michael Pickles^{1,2}, Peter Vickerman², Stephen Moses³, James F. Blanchard³, Marie-Claude Boily¹

¹ School of Public Health, Imperial College

² London School of Hygiene and Tropical Medicine

³ Centre for Global Public Health, Dept of Community Health Science, University of Manitoba

Introduction

Effective HIV prevention strategies require that interventions be provided to the right populations at the right scale. To guide decisions on where to focus prevention efforts, the static Modes of Transmission (MoT) model has been used to predict the expected distribution of new infections by population risk groups. However, estimates of where new infections manifest in the short-term does not necessarily reflect the 'source' of infections and therefore can lead to interventions being focused on the wrong populations. To examine this issue, we used a simple dynamic HIV transmission model to simulate hypothetical HIV epidemics (concentrated and generalized) and compare predicted source of infections from the MoT and dynamic models.

Methods

We developed a heterosexual HIV transmission model that incorporates three levels of sexual activity representing commercial, casual (multiple partners/year), and low-activity (1 partner/year) sex with mixing between and within activity groups. To account for simple temporal dynamism in a person's sexual life course, women and men enter into the commercial or casual activity class, but after an average of five and ten years respectively, they cease high-risk activity and enter the low-activity population. We assumed that 0.5% of adult females are selling sex at any given time, which corresponds to a prior history of sex work in 3% of low-activity females. Fifteen percent of men are currently buying sex, and 26% of low-activity males have a history of previously buying sex. We examined two epidemic scenarios: a concentrated epidemic that requires commercial sex for HIV to become established and persist in the population ($R_0 < 1$ in the absence of sex work), and a generalized epidemic where HIV can establish and persist in the population in the absence of commercial sex ($R_0 > 1$ in the absence of sex work). We performed the MoT synthesis using the same subgroups and input parameters as used in, or generated by, the dynamic model to reflect the early, growth, and late phase of the epidemics. We compared the 1-year distribution

of new infections along subgroups using both models, and dynamic model predictions of 1-year and cumulative population attributable fraction (PAF) to overall transmission due to corresponding partnerships, measured from the time of each MoT prediction. Partnerships were defined as commercial (sex between a current female sex worker [FSW] and males), casual (sex between individuals in the casual activity class), clients and non-commercial (sex between a client and his regular or casual partners), sex between individuals in the casual activity class and their non-casual partners, and low-risk partnerships. Low-risk partnerships are distinguished for partnerships that include at least one individual with a prior history of high-risk activity.

Results

The majority of new infections in the concentrated epidemic arose among clients and low-activity individuals. In the generalized epidemic, infections predominated among clients in the early phase, while in the late phase, most infections occurred among individuals in the casual activity group (Fig. 1). By the late phase, 6.5% and 1.1% of low-activity partnerships were serodiscordant in the generalized and concentrated epidemics respectively. In both epidemic scenarios, > 70% of low-activity serodiscordant partnerships comprised of at least one individual with a prior history of casual or commercial sex. Under the assumption that MoT input parameters (including HIV prevalence) were identical to those used in the dynamic model, the two models predicted similar 1-year distribution of new infections for both scenarios. The contribution of corresponding partnerships to overall transmission over a 1-year period was similar to the distribution of new infections (Fig. 2). The majority of transmission within low-risk partnerships in both epidemics was due to sex among low-activity couples where at least one individual had previously engaged in high-risk activity. The cumulative PAF of commercial and casual partnerships increased over time in both scenarios and irrespective of epidemic phase, whereas the cumulative contribution of low-activity partnerships remained stable (Fig. 3).

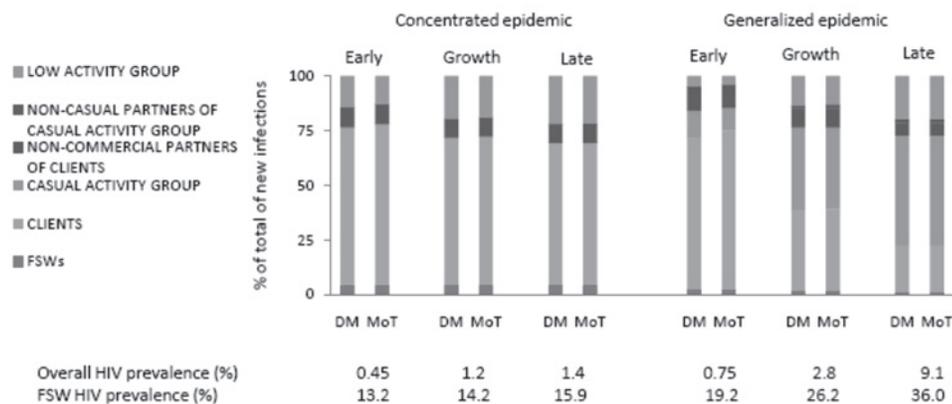


Figure 1 - Predicted distribution of new infections over 1 year along subgroups as predicted by the dynamic (DM) and Modes of Transmission (MoT) model.

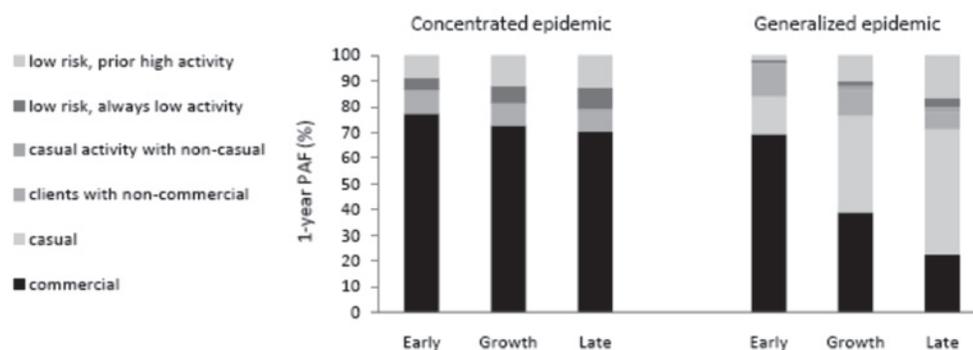


Figure 2 - One-year population attributable fraction (PAF) of partnerships to overall transmission.

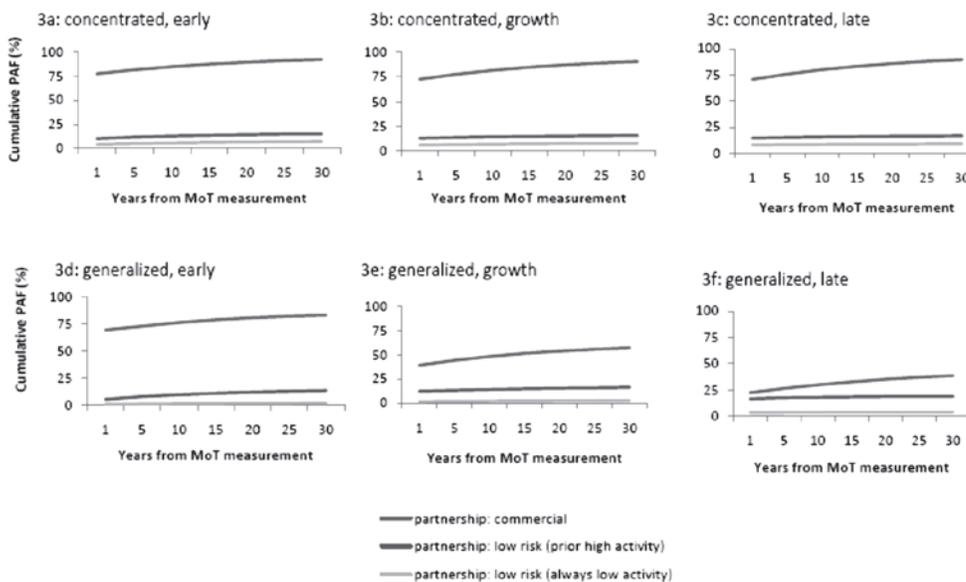


Figure 3 - Comparison of the cumulative population attributable fraction (PAF) of commercial and low-risk partnerships to overall HIV transmission.

Discussion

The distribution of new HIV infections in the short-term is commonly referred to as the source of infections, or driver of incidence. While this distribution is reflected in the sources of transmission as estimated by the dynamic model over a 1-year period, it does not capture the chain of onward transmissions, and therefore underestimates the cumulative PAF of high transmission partnerships such as commercial sex. It also fails to account for a persons' prior high-risk activity and its contribution to current transmission within the low-risk group. The proximal source of infection and epidemic drivers, i.e. sexual behaviour that enables HIV to establish and persist in a population are better identified by estimating the cumulative long-term PAF of partnerships from dynamic models. Long-term PAF estimates may be more informative for focusing prevention efforts because they are more likely to reflect risk activities that give rise to onward transmission. They can be translated to the potential fraction of cumulative infections prevented with a 100% effective intervention focused on the specified partnerships. Hence, there is a greater incremental benefit of focusing interventions on epidemic drivers because contribution of high transmission partnerships to overall infections increases over time.

NEIGHBORHOOD DRUG MARKETS: A NEXUS FOR CORE GROUPS AND STI TRANSMISSION?

Jacky M. Jennings, Ph.D., M.P.H. (1), Ralph B. Taylor, Ph.D. (2), Debra M. Furr-Holden, Ph.D. (1), Jonathan M. Ellen, M.D. (1)

(1) Johns Hopkins University, Baltimore, MD, U.S.; (2) Temple University, Philadelphia, PA, U.S.

Background

Core transmitters are widely accepted as critical actors in generating endemic and epidemic rates of sexually transmitted infections (STIs) including HIV.(1-4) Reducing infection among core transmitters and their sex partners, i.e. core groups, is seen as key to effectively reducing population levels of STIs. Practitioners of STI prevention and control, however, have had difficulty in identifying and thus, targeting core groups. This has led some STI epidemiologists to shift their focus to the identification of geographic areas with high STI rates and/or counts with the hypothesis that core groups are most likely to be found in these areas. Research, largely ecologic in design, has shown that STI prevalence varies by geography within a city and that the rates are associated with sociodemographic factors.(5-13) Recently, we have demonstrated using a multilevel study that geography is not just a proxy for the individual STI-related risk behaviors of residents

(e.g., higher prevalence of inconsistent condom users) but is a marker for the prevalence of STIs in the potential pool of sex partners in a neighborhood available to residents of that neighborhood.(14) The goal of this research is to examine what may account for geographic variation in the availability of high prevalence sex partner pools. We hypothesize that neighborhood drug markets are one such potential pathway.

Neighborhood drug markets may increase the local prevalence of core transmitters and change local sexual networks, thereby increasing STI transmission. Drug markets are defined as areas with intensive illicit drug dealing and potentially, use (e.g., heroin, crack-cocaine, and/or marijuana). Notably because of the underlying economy of drug markets and addictive properties of drugs, these areas may be more likely to also have commercial sex work and/or the exchange of drugs for sex or money. The objectives of this study were to investigate if neighborhood drug markets were associated with a high-risk sex partnership and separately, with an incident bacterial STI among a household sample of urban youth, controlling for individual level STI risk factors. Additionally we determined whether the significance of drug markets was independent of neighborhood socioeconomic status (SES). The setting for the current study, Baltimore City, MD, presents a unique opportunity to investigate the study objectives given the city's long history of syndemics of illicit drug use, STIs and poverty.

Methods

Data for this study were collected from a cross-sectional household study conducted from 2004 to 2007. The target population included English-speaking, sexually-active persons, 15 to 24 years of age who resided in 486 census block groups (CBGs), i.e. neighborhoods. The sampling strategy was conducted in two stages. In the first stage, among the 710 CBGs, 75% (533) CBGs were selected consisting of CBGs with > 25th percentile in gonorrhea prevalence. Eligible CBGs were further restricted to those with > 35 estimated eligible households (486 or 68%) using U.S. Census 2000 information. A final sample of 65 CBGs was selected using a stratified, systematic probability proportional to size sampling strategy. In the second stage, a total of 27,194 addresses within the 65 selected CBGs were obtained from three purchasable address lists.

Participants were interviewed using an ACASI and biologic testing was conducted for chlamydia or gonorrhea infection. Participants were provided with a hard-copy map of their CBG and asked to think about this area when asked questions regarding "their neighborhood." Participants were then asked via ACASI "In your neighborhood, are there any places like a street corner, block, house, club, bar, or other place where drug activity, like people selling or buying drugs, happens?" (yes/no). Individual responses within each neighborhood were aggregated to the proportion reporting yes within a neighborhood and then coded to greater than 50% of residents reporting yes (1) vs. less than or equal to 50% reporting yes (0). To supplement the measurement of neighborhood drug markets, additional information was obtained from systematic social observations and publicly available drug arrest data. A series of weighted multilevel, nonlinear probability models were generated to test the main hypotheses.

Heterosexual participants (n=568) from 63 neighborhoods were included in this analysis. The results suggest that living in neighborhoods with household survey-reported drug markets increased the likelihood of having a high-risk sex partnership after controlling for individual level factors including age and gender (Odds Ratio [OR] 2.30, 95% Confidence Interval [CI] 1.23, 4.70, P=0.023) and neighborhood socioeconomic status (OR 2.43, 95% CI 1.13, 5.21, P=0.024). Further, living in neighborhoods with survey-reported drug markets increased the likelihood of having a current bacterial STI after controlling for individual level demographic (age, gender) and behavioral (condom use, no. of sex partners) factors (OR 6.54, 95% CI 1.85, 23.13, P=0.005) and neighborhood socioeconomic status (OR 10.89, 95% CI 1.87, 63.31, P=0.009). In weighted bivariate analyses, the average report of drug activity by systematic social observations was not significantly associated with a high-risk sex partnership (OR 0.83, 95% CI 0.57, 1.10, P=0.232) or a current bacterial STI (OR 0.89, 95% CI 0.56, 1.43, P=0.629). Similarly, neighborhood drug arrest counts for drug possession or trafficking were not significantly associated with a high-risk sex partnership (OR 1.00, 95% CI 0.98, 1.01, P=0.490) or a current bacterial STI (OR 1.00, 95% CI 0.99, 1.01, P=0.642).

Conclusions

The results suggest that structural-level factors, specifically neighborhood drug markets, may increase the presence of core transmitters and their sex partners, i.e. core groups, and in doing so create a risk environment for STIs. Patterns observed appeared dependent on the type of drug market indicator used. Future studies should continue to explore how drug markets may alter the structure of sexual networks and whether specific types of drug markets are particularly important. Future work also should seek to determine whether changes in neighborhood drug markets cause changes in sexual networks and ultimately individual level risks for STIs.

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