



Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high risk young women in Phnom Penh, Cambodia

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-003095
Article Type:	Research
Date Submitted by the Author:	23-Apr-2013
Complete List of Authors:	Page, Kimberly; University of California San Francisco, Epidemiology and Biostatistics Stein, Ellen; UCSF, Epidemiology & Biotatistics Sansothy, Neth; NCHADS, Evans, Jennifer; UCSF, Epidemiology & Biotatistics Couture, Marie-Claude; UCSF, Epidemiology & Biotatistics Sichan, Keo; Cambodia Women's Development Assoc., Cockroft, Melissa; Cambodia Women's Development Assoc., Mooney-Somers, Julie; University of Sydney, Center for Values, Ethics and the Law in Medicine Phlong, Pisith; Royal University of Fine Arts, Kaldor, John; University of New South Wales, The Kirby Institute Maher, Lisa; The Kirby Institute,
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Epidemiology, Global health, HIV/AIDS, Public health
Keywords:	EPIDEMIOLOGY, HIV & AIDS < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES

SCHOLARONE™
Manuscripts

1 Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high
2 risk young women in Phnom Penh, Cambodia
3
4
5
6
7
8
9

10 Kimberly Page, Ph.D.¹, Ellen Stein, MPH¹, Neth Sansothy, M.D.², Jennifer Evans, M.S.¹,
11 Marie-Claude Couture, Ph.D.¹, Keo Sichan³, Melissa Cockroft, BA^{3*}, Julie Mooney-
12 Somers, Ph.D.^{4, 5}, Pisith Phlong, M.A.⁶, John Kaldor, Ph.D.⁴, Lisa Maher Ph.D.⁴, (on
13 behalf of the Young Women's Health Study Collaborative: John Kaldor, Ph.D.⁴, Serey
14 Phal Kien³, Kimberly Page, Ph.D.¹, Joel M. Palefsky M.D.⁷, Vonthanak Saphonn, M.D.²,
15 Mean Chhi Vun, M.D.²).

- 26 1. University of California San Francisco, Department of Epidemiology and Biostatistics;
27 San Francisco, and Global Health Sciences, 50 Beale St., 12th Floor, San Francisco, CA,
28 94105; USA
- 29 2. National Center for HIV/AIDS, Dermatology and STDs (NCHADS), #245H, Street 6A,
30 Phum Kean Khlang, Sangkat Prekleap Russey Keo, Phnom Penh, Cambodia
- 31 3. Cambodian Women's Development Association (CWDA); No. 19, Street 242, Boeung
32 Prolit, Khan 7 Makara, Phnom Penh, Cambodia
- 33 4. The Kirby Institute (formerly the National Centre in HIV Epidemiology and Clinical
34 Research); University of New South Wales, CFI building, corner of West and Boundary
35 Streets, Darlinghurst, NSW 2010, Australia
- 36 5. The Centre for Values, Ethics and the Law in Medicine, The University of Sydney
37 Level 1 of the Medical Foundation Building, 92-94 Parramatta Road, Camperdown, NSW,
38 Australia
- 39 6. Royal University of Fine Arts, 72 Street 19, Phnom Penh, Cambodia.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

7. University of California San Francisco, Department of Medicine; 513 Parnassus Ave,
Med Sci S-420; UCSF, San Francisco, San Francisco, CA. 94143 - 0654

*Melissa Cockroft is currently at Marie Stopes International in Phnom Pehn, Cambodia

Address correspondence to:

Kimberly Page, Ph.D., MPH, Dept. of Epidemiology and Biostatistics, Global Health
Sciences, University of California San Francisco, CA 94105; 50 Beale St., 12th Floor, San
Francisco, CA USA, 94105. kpage@psg.ucsf.edu

Word count: Abstract: 296; Text 3444; 3 Tables, 2 Figures.

Key words: Cambodia, female sex workers, HIV, STI, risk, amphetamine-type
stimulant, alcohol, policy effects

Short title: HIV infection and risk in two samples of FSW in Phnom Penh, Cambodia

Abstract

Objectives: HIV prevalence among Cambodian female sex workers (FSW) is among the highest in Southeast Asia. We describe HIV prevalence and associated risk exposures in FSW sampled serially in Phnom Penh, Cambodia (Young Women's Health Study (YWHS), before and after the implementation of a new law designed to combat human trafficking and sexual exploitation.

Design: Cross-sectional analysis of baseline data from two prospective cohorts.

Setting: Community-based study in Phnom Penh, Cambodia.

Participants: Women aged 15-29 years, reporting ≥ 2 sexual partners in the last month and/or engaged in transactional sex in the last 3 months, were enrolled in the studies in 2007 (N=161; YWHS-1), and 2009 (N=220; YWHS-2) following information sessions where 285 and 345 women attended.

Primary outcomes: HIV prevalence, sexual risk behaviour, amphetamine-type stimulant (ATS) and alcohol use, and work-related factors were compared the two groups, enrolled before and after implementation of the new law.

Results: Participants and in the two cohorts were similar in age (median 25 years), but YWHS-2 women reported fewer sex partners, more alcohol use, and less ATS use. A higher proportion of YWHS-2 compared to YWHS-1 women worked in entertainment-based venues (68% vs. 31%, respectively). HIV prevalence was significantly lower in the more recently sampled women: 9.2% (95% CI 4.5, 13.8) vs. 23% (95% CI 16.5, 29.7).

Conclusions: Sex work context and risk has shifted among young FSW in Phnom Penh, following implementation of anti-prostitution and anti-trafficking laws. While both cohorts were recruited using the same eligibility criteria, more recently sampled women had lower prevalence of sexual risk and HIV infection. Women engaged more directly in transactional sex have become harder to sample and access. Future prevention

1 research and programs need to consider how new policies and demographic changes in
2
3
4 FSW impact HIV transmission.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Article summary

Article Focus

- HIV prevalence and incidence in two serial samples of young female sex workers in Phnom Penh, Cambodia (2007-2008, and 2009-2010);
- Comparison of baseline risk and HIV outcomes, including sexual behavior, drug and alcohol use in the two cohorts sampled before and after implementation of anti-trafficking and sexual exploitation laws in 2008;
- Impact of anti-trafficking and sexual exploitation legislation on female sex workers and HIV risk.

Key Messages

- Women sampled using the same eligibility criteria and outreach methods in differed with respect to risk exposures and HIV outcomes;
- Changes in sex work typology and environment are evident after enactment of the anti-trafficking laws, including very few brothel-based FSW and significantly more FSW based in the entertainment sector;
- Shifts in the context of sex work and risk highlight the ongoing need and challenges for HIV and drug prevention for young women engaged in sex work.

Strengths and Limitations

- Two comparably sampled groups of young FSW suggest changing trends in HIV risk;
- Comparison of cross-sectional samples is ecological and does not prove temporal effects;
- Criminalization and suppression of sex work and a flourishing entertainment-based sex work industry set new and conflicting stage for HIV prevention.

1 Author Contributions: All authors contributed to the design and implementation of the
2
3 YWHS-1 and -2 studies. Authors KP, ES, JE, and LM compiled the first draft of the
4
5 manuscript, which was reviewed by NS, M-CC, KS, MC, JM_S, PP, JK. The primary
6
7 statistical analysis was conducted by JE and M-CC; KS and MC provided supplemental
8
9 data review, and KP reviewed all data analyses. All authors contributed to and have
10
11 approved the final manuscript. The YWHS Collaborative is a steering committee who
12
13 reviewed and approved the study protocols, and provided expertise into some or all of
14
15 the studies' methods and implementation.
16
17
18
19
20
21

22 Data Sharing: no additional data available.
23
24
25

26 Funding sources and conflicts of interest: The Young Women's Health Study-1 and
27
28 YWHS-2 were supported by Awards 1R21DA025441 from the National Institute on Drug
29
30 Abuse, and R01NR010995 from the National Institute of Nursing Research. M-C Couture
31
32 was also supported by the Canadian Institutes of Health Research (postdoctoral
33
34 fellowship award). Professors Lisa Maher and John Kaldor are supported by Australian
35
36 National Health and Medical Research Council (NHMRC) Research Fellowship. The Kirby
37
38 Institute is affiliated with the Faculty of Medicine, University of New South Wales and is
39
40 funded by the Australian Government Department of Health and Ageing. The content is
41
42 solely the responsibility of the authors and does not necessarily represent the official
43
44 views of the National Institutes of Health, nor the Australian Government. The authors
45
46 have no conflicts to disclose.
47
48
49
50
51
52
53

54 Acknowledgments: The authors would like to acknowledge the coordinated efforts and
55
56 dedication of the research teams at the National Center for HIV/AIDS, Dermatology,
57
58 and STDs and the Cambodian Women's Development Agency. We are indebted to all the
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Cambodian women who agreed to participate in this study and grateful for the privilege to work with them.

For peer review only

Introduction

There have been significant declines in HIV prevalence in Cambodia since the epidemic peaked in around 2000, a success widely attributed to measurable increases in condom use, declines in the number and frequency of commercial sex transactions reported by men, access to HIV voluntary counseling & testing (VCT) and uptake of antiretroviral therapy.¹⁻³ In 2010, the National Center for HIV/AIDS, Dermatology and STDs (NCHADS) revised the national estimate of HIV prevalence to 0.8% (in 15-49 year olds), reflecting a significant decline after the peak estimate of 2.4% in 1998.⁴ However, HIV prevalence in Cambodian women, especially young women, is among the highest in Southeast Asia and heterosexual sex remains the main route of transmission.⁵⁻⁹ Since 2006, women have accounted for over half (52%) of all HIV infections in Cambodia¹⁰, higher than in Asia and the Pacific in general (35%).¹¹ Limited income generating activities, a highly mobile workforce, trafficking in women and girls and widespread transactional sex, poverty, and sexually transmitted infections (STI) have been identified as key drivers of the epidemic among female sex workers (FSW).^{1 5 6 10 12-15} As in many countries, FSW in Cambodia can be hard to reach and difficult to provide prevention services to. In recent years significant economic and policy changes have affected the sex work landscape, with notable shifts in sex work venues, typologies, and more women engaged in transactional sex than ever before.¹⁶⁻²⁰

Until 2008, FSW in Cambodia were categorized as "direct" and were mostly brothel-based, or "indirect". Indirect FSW were distinguished from direct FSW, generally working in entertainment establishments as beer promotion girls, waitresses, hostesses, or karaoke girls for example, and engaged in occasional transactional sex for supplementary income.²¹⁻²³ In 1997, an estimated 5,300 women worked in the entertainment/service sector and 6,000 were brothel-based FSW. Following the passage

1 and implementation of the "Law on Suppression of Human Trafficking and Sexual
2 Exploitation" in February, 2008, brothel-based sex work was banned, and the direct sex
3 trade went "underground".¹⁰ The number of women involved in entertainment-based
4 sex work increased dramatically to an estimated 41,622 women, a more than threefold
5 increase from the 2008 estimate of 12,762 (NCHADS, personal communication). Along
6 with the overt enforcement against FSW, the 2008 anti-trafficking legislation had other
7 consequences. For instance, official terminology used by governmental and non-
8 governmental organizations (NGO) to describe FSW labeled all women engaged in sex
9 and entertainment work as "entertainment workers", or EW*. Historically, brothel-based
10 FSW were easily accessed and monitored for HIV prevention efforts, including HIV and
11 behavioral surveillance. NGOs working in HIV prevention reported that as transactional
12 sex was displaced to a wider range of settings, women at highest risk became harder to
13 reach for both prevention and service delivery.^{16 24 25} These factors pose significant
14 challenges to HIV prevention and threaten to undermine progress achieved to date.

15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36 HIV prevalence is extremely high among Cambodian FSW with prevalence among
37 younger women is particularly troubling as their infection is likely to be more recent and
38 indicative of incidence.^{5 8 9 21} A cornerstone of HIV prevention in Cambodia was the
39 100% Condom Use campaign^{26 27}, primarily directed at brothel-based FSW. With
40 changes in sex work venues, this prevention approach is likely less effective, failing to
41 reach the large number of women now engaged in transactional sex in entertainment

42
43
44
45
46
47
48
49
50 * The term 'female sex worker' is no longer used in Cambodia. Terminology was changed in 2008
51 to designate high risk women working in service and entertainment venues as "entertainment
52 workers" or EW. No new HIV surveillance data has been published on FSW, and Behavioral
53 Surveillance Survey (BSS) methods have been changed to recognize only indirect sex workers-
54 'EW', and determining whether or not they are selling sex by the average number of reported
55 sex partners per week (10. UNAIDS. Cambodia Country Progress Report: Monitoring the
56 Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS.
57 Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United
58 Nations General Assembly Special Session (UNGASS).
59 <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012..

1 establishments. Indeed, measures of self-reported condom use have declined according
2
3 to monitoring data reported by UNAIDS.¹⁰ New risk factors have also emerged,
4
5 especially amphetamine-type stimulant (ATS) use, in the form of “yama”, (pills) and
6
7 “ice” (a crystalline form).²⁸⁻³⁸ ATS use is associated with increased sexual risk behavior
8
9 and STI incidence among these young women^{5 39}, similar to that seen in other
10
11 populations and locales.⁴⁰⁻⁴⁴
12
13
14
15
16

17 We conducted two prospective studies of high-risk young women engaged in
18
19 transactional sex in Phnom Penh, assessing HIV infection and associated health risks.
20
21 The first, Young Women’s Health Study (YWHS-1), was conducted in 2007-2008 and the
22
23 second, YWHS-2, in 2009-2010.^{5 16 39 45 46} In this paper, we explore the changing HIV
24
25 risk landscape by comparing and contrasting the two cohorts of FSW sampled prior to,
26
27 and following, legislative changes designed to combat human trafficking and sexual
28
29 exploitation in Cambodia.
30
31
32
33
34
35

36 **Methods**

37 ***Study setting***

38 The YWHS-1 and YWHS-2 were both prospective studies of young women engaged in
39
40 sex work in Phnom Penh, Cambodia. Methods have been described in detail previously.⁵
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Study population and recruitment

1 The target population in both studies was young women engaged in transactional sex in
2
3 Phnom Penh. Inclusion criteria were: aged 15-29 years, Khmer language
4
5 comprehension, ≥ 2 different sexual partners in the last month *or* engaged in
6
7 transactional sex (sex in exchange for money, goods, services, or drugs) within the last
8
9 three months, no plans to move in the next 12 months, biologically female, and able to
10
11 provide voluntary informed consent. YWHS-1 aimed to sample 160 women to provide
12
13 80% power to estimate a point prevalence of HIV at 15% with a 95% confidence
14
15 interval (CI) of 9.7% to 23.0%. Based on results of YWHS-1, YWHS-2 aimed to sample
16
17 220 women to detect an estimated HIV prevalence of 23% (95% CI, 17.3%, 30.5%).
18
19
20
21
22
23

24 Recruitment and enrollment procedures were the same in both studies.⁵ CWDA field
25
26 assistants provided study information and conducted eligibility screening via information
27
28 meetings in neighborhoods where sex work was prevalent. Eligible women were invited
29
30 to a community location used by various sex-worker organizations where study
31
32 information was described in more detail and informed consent was obtained. Enrolled
33
34 participants were given appointment cards to present to the YWHS clinic field-site and
35
36 free transportation was offered.
37
38
39
40
41

42 **Data collection**

43 All data collection occurred at the YWHS clinic, which was staffed by a physician,
44
45 nurses, counselors and a laboratory technician. A structured questionnaire was
46
47 administered in Khmer by trained interviewers. Survey items were similar in both
48
49 studies, and covered socio-demographic characteristics, occupational and sexual risk
50
51 history, alcohol and drug use. HIV testing was conducted at each visit. In YWHS-1,
52
53 urine specimens were tested for Chlamydia trachomatis (CT) and *Neisseria gonorrhoea*
54
55 (GC). In YWHS-2, women were tested for HPV infection. STI treatment was provided at
56
57
58
59
60

1 no cost, and women with HIV and HPV infection were referred to a local provider for
2
3
4 free medical evaluation and treatment.
5
6
7

8 **Laboratory testing**

9
10 HIV serology was performed using two rapid tests; Uni-Gold Recombigen ^(TM) HIV rapid
11
12 HIV test (Trinity Biotech USA, Jamestown, NY) and the Clairview HIV 1/2 STAT-PAK
13
14 (Inverness Medical Diagnostics, Waltham, MA). HIV positive and discordant samples
15
16 were confirmed by HIV-1 immunoblot. CT and GC were assessed from urine samples
17
18 using BDProbeTecTM strand displacement amplification assay (Becton Dickinson, Sparks,
19
20 MD) at the NCHADS STD laboratory.⁵ Cervical specimens for HPV testing were collected
21
22 using a standard cytobrush.⁴⁷ Client-centered risk reduction counseling was provided in
23
24 association with all testing.
25
26
27
28
29
30

31 **Ethical review**

32
33 The study protocols were reviewed and approved by Institutional Review Board of the
34
35 Committee on Human Research at UCSF, the Cambodian National Ethics Committee,
36
37 and the University of New South Wales Human Research Ethics Committee in
38
39 accordance with ethical standards (institutional and national) and with the Helsinki
40
41 Declaration of 1975, as revised in 2000.
42
43
44
45
46

47 **Measures**

48
49 Both studies aimed to estimate HIV infection, ATS use, and sexual risk behavior and
50
51 included questions on sociodemographic factors, work history, income, and duration of
52
53 sex work, and whether they currently had an employer (manager, boss or supervisor).
54
55 Women were asked if they had ever and/or were currently working: as a beer promoter,
56
57 in a beer garden, as a waitress or hostess in a karaoke bar, nightclub or snooker bar, in
58
59
60

1 a massage parlor, brothel, as a freelance sex worker using space at a brothel, as a
2
3 freelance sex worker in the park or on the street, or to specify 'other' location. They
4
5 were asked about age at first sex, number of partners (last month) and condom use
6
7 with last partners (paying and non-paying). Paying partners were defined as male
8
9 clients with whom respondents traded sex for money, goods or drugs. Condom use was
10
11 classified as "consistent" if the participant reported always using a condom. Participants
12
13 were asked about the number of days in which alcohol was drunk and the number of
14
15 days in which they were "affected" by alcohol or were "drunk" in the past month. ATS
16
17 use (ever and last 3 months) was assessed with questions regarding use of *yama* and
18
19 crystal (ice).
20
21
22
23
24
25

26 **Analyses**

27
28 Prevalence estimates were calculated using exact binomial confidence intervals (CI).
29
30 Chi-square and Fisher's Exact Tests were used to examine differences in baseline socio-
31
32 demographic, occupational, sexual, and alcohol/drug use exposures and prevalent HIV
33
34 and STI between the two cohorts. The only longitudinal data compared was HIV
35
36 incidence, with the HIV incidence rate calculated using the number of seroconversions
37
38 per 100 person-years of observation (PYO) assuming a Poisson distribution. Analyses
39
40 were performed using STATA 9.0 (STATA, College Station, TX).
41
42
43
44
45
46

47 **Results**

48
49 In YWHS-1, 285 women attended community information sessions, 161 (56%) eligible
50
51 women were recruited to the group information/consent meeting, and 160 (99%)
52
53 consented to participate. In YWHS-2, 220 (64%) women consented out of 345 who
54
55 attended information sessions. Sixty-seven women from YWHS-1 also enrolled in
56
57 YWHS-2; they were not included in the YWHS-2 comparison group, leaving 153 in the
58
59
60

1 analysis. Table 1 shows baseline socio-demographic and occupational factors, as well as
2 sexual and substance use risk exposures, in the two cohorts. The cohorts were similar
3 with respect to age (median 25 years), and age of sexual debut (median 17 and 18
4 years, respectively), but differed significantly in years of education and marital status.
5 Compared to women in YWHS-1, women in YWHS-2 had more education (median of 5
6 years (IQR 2,7) vs. 2 years (IQR 0,4)), and were more likely to be married or
7 cohabitating with a partner (31.4% vs. 15%, respectively).
8
9

10 Women in YWHS-2 had been involved in sex work for significantly less time (median of
11 3 years (IQR 1.7, 5)) than YWHS-1 women (median of 4.3 years (IQR 2.5, 6.3)). More
12 YWHS-2 women were currently (last 30 days) working in entertainment venues and
13 fewer in brothels, or as freelance FSW (including in parks, guest houses, or on the
14 street). These differences were also reflected in the significantly higher proportion of
15 YWHS-2 women who reported having a manager or boss (81.6%) compared to YWHS-1
16 (46%). Figure 1 shows the distribution and range of work venues women reported 'ever'
17 working in. Women in YWHS-2 also reported significantly fewer sexual partners in the
18 past 30 days: a median of 5 compared to 30 in YWHS-1 (Table 1). Despite these
19 differences, women in the two samples reported similar income distributions. Self-
20 reported consistent condom use, with both paying and non-paying partners, did not
21 differ between cohorts. Alcohol and ATS use differed significantly: women in YWHS-2
22 reported more alcohol use, but fewer days drunk in the past month than in YWHS-1;
23 and fewer women in YWHS-2 reported ever using ATS, although recent use was similar
24 in both groups (Table 1). Both alcohol and ATS use varied by cohort and work venue:
25 entertainment-based women in YWHS-2 reported less of both, whereas brothel and
26 freelance-based women in YWHS-2 reported significantly more ATS use (Figure 2).
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1 HIV prevalence was significantly ($p < 0.01$) lower in women sampled in YWHS-2
2
3 compared to YWHS-1: 9.2% (95% CI 4.5%, 13.8%; $p < 0.01$) vs. 23% (95% CI 16.5%,
4
5 29.7%) (Table 2). HIV incidence was also lower: 0.8/100 pyo (95% CI 0.1, 6.0) vs.
6
7 3.6/100 pyo (95% CI 1.2, 11.1), but not significantly ($p = 0.26$). In YWHS-1, prevalence
8
9 of Chlamydia infection was 11.5% (95% CI 6.0%, 17.1%) and Gonorrhoea infection was
10
11 7.8% (95% CI 3.5%, 12.3%). Women in YWHS-2 were not tested for these STI, but
12
13 41.1% were HPV. HIV prevalence differed significantly by work venue and by cohort,
14
15 but over 30% of freelance-based women tested positive in both cohorts (Table 2).
16
17
18 In both cohorts, 20% reported being tested for HIV in the past 3 months but more
19
20 YWHS-2 women had a history of testing (Table 3). More women in YWHS-1 reported not
21
22 knowing their HIV test results: 11 of the 84 women (13.1%) who reported being
23
24 negative tested positive and 4 of 12 women (33.3%) who reported they did not know
25
26 their previous HIV results tested positive. In YWHS-2, 5 of 114 (4.4%) who reported
27
28 testing negative, and 2 of 4 (50%) who did not know their previous results, tested
29
30 positive. Among women who reported no history of HIV testing, 31% (18/58) and
31
32 12.9% (4/31) tested HIV positive in YWHS-1 and -2, respectively.
33
34
35
36
37
38
39
40
41

42 Discussion

43
44 In these two samples of young FSW, recruited using the same eligibility criteria and
45
46 outreach methods, we observed important differences in socio-demographics, risk
47
48 exposures and HIV infection outcomes. Most notably, women sampled more recently
49
50 were more educated, had fewer sex partners, less time working in sex work and had
51
52 significantly lower prevalence of HIV. Where women worked was also very different in
53
54 the two cohorts: a much higher proportion of women sampled in 2009-10 compared to
55
56 2007-8 worked in entertainment-based establishments and fewer were brothel-based or
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

freelance FSW. These differences point to the notable changes in sex work typology and environment that occurred following the enactment and enforcement in 2008 of anti-trafficking legislation in Cambodia¹⁶. Brothel closures and increases in policing have been acknowledged as a cause of significant social and occupational upheaval among FSW, driving many women, especially former brothel-based FSW, “underground”.¹⁰ Both government agencies and NGOs in Phnom Penh have reported negative impacts of the legislation on FSW including: displacement and harassment and reduced access to condoms and health care.^{10 20 24} In our qualitative research, women confirmed these impacts, describing how they moved to new venues or locales for sex work transactions including apartments or houses rented by brothel owners following brothel closures¹⁶, raising concerns about increased risks of HIV transmission as a result of the increasingly clandestine nature of direct sex work.

The differences in HIV prevalence, risk profiles, and sex work environments reported by these two samples are consistent with both quantitative and qualitative research demonstrating how socio-political and environmental factors can increase vulnerability to HIV among FSW.⁴⁸⁻⁵¹ The time period in which these two cohorts were sampled, corresponded with increased criminalization of sex work which impacted the number and settings of transactional sex. These shifts can have mixed effects. First, women engaged in entertainment-based work have lower risk profiles than women engaged in freelance sex work.⁵ The shorter duration of sex work reported by entertainment-based FSW likely contributes to the lower HIV prevalence in this group. Protective effects of entertainment-based work may include having a boss or manager; odds of HIV among women who say they have a boss or manager are lower compared to women who do not (OR: 0.40; 95% CI 0.19, 0.90).⁵ We also explored these factors in qualitative interviews with FSW.¹⁶ Brothel and entertainment-based sex workers reported that the

1 'boss/manager" mitigated risk of violence from clients and problems with police. Also,
2
3 women working in entertainment establishments report earning up to three times more
4
5 (US \$50-\$60 or in \$200,000-\$240,000 Cambodian Riel) per client than women who
6
7 worked in brothels or streets and parks.¹⁶ This is substantiated by the two cohorts'
8
9 report of similar income levels despite differences in the number of sex partners. It is
10
11 also possible that entertainment-based FW have lower risk partners than brothel-based
12
13 and freelance FSW. Despite the lower individual risk among this growing group of FSW,
14
15 there is potential for amplified population attributable risk for HIV, given the significant
16
17 increase in the population of women exposed to transactional sex as well as male
18
19 partners, who may also bridge to the general population.
20
21
22
23
24
25
26

27 The two cohorts also showed differences in drug and alcohol use exposures. Our group
28
29 has identified ATS use as a significant independent risk factor for HIV related risk
30
31 behaviour including number of sex partners (Adjusted Risk Ratio (ARR): 1.49; 95% CI
32
33 1.0, 2.21) and incident STI (AOR: 5.41; 95% CI 1.15, 25.48)³⁹. Alcohol use is also
34
35 emerging as a potential HIV-related risk factor¹⁶, although not well quantified among
36
37 FSW, especially those working in entertainment establishments (or their male partners).
38
39 Entertainment venues largely revolve around alcohol, and women working at these are
40
41 generally employed as hostesses, waitresses, or as "promoters" such as "beer
42
43 promotion girls" in a variety of venues.^{16 21} Women who were working in the
44
45 entertainment sector were more likely to both report more days of drinking, and more
46
47 days intoxicated, than brothel or street-based FSW. Alcohol use can be a barrier to
48
49 effective condom use and condom negotiation in the transactional context.^{16 52}
50
51 Consistent with this, we have shown that women who report heavy alcohol use are also
52
53 significantly more likely to report inconsistent condom use.³⁹ Given how entwined drug
54
55 and alcohol use are with sex work, especially in the growing entertainment-based
56
57
58
59
60

1 sector, there is a significant need to better elucidate ways to mitigate HIV-associated
2 risks among women whose livelihood depends on working in these establishments.
3
4 Designing and implementing prevention in these contexts will require input, not only
5
6 from working women, but also from the wider business sector, as well as male clients.⁴⁸
7
8

9
10 53-56
11

12
13
14
15 The differences in HIV and risk profiles between the women in our two samples, as well
16 as outreach efforts by HIV prevention organizations, may be a result of reaching “low
17 hanging fruit” resulting from both substantive increases in the number of women
18 working in entertainment establishments, and the increased challenges of engaging
19 women with higher risk and who are HIV infected for the reasons described above. FSW
20 in Phnom Penh have historically been easily accessed for prevention and surveillance
21 efforts. However, recent changes in the sex work landscape suggest that alternative
22 sampling methods, such as respondent driven sampling, may result in better access to
23 higher risk women who are more hidden and therefore hard to reach in this new legal
24 climate.⁵⁷
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

40 HIV prevention remains an important and essential priority for all women engaged in
41 transactional sex. A recent systematic review confirms that FSW in Asia have the
42 highest odds of infection compared to women of reproductive age in the general
43 population.⁵⁸ In addition to new structural interventions aimed at reducing risk in the
44 work-based environment, the very high prevalence and risk of HIV among FSW in
45 Cambodia suggests a need for combination HIV prevention interventions including
46 biomedical (pre-exposure prophylaxis, microbicides, and treatment as prevention),
47 behavioural and development approaches (such as microfinance or income generating
48 opportunities).⁵⁹⁻⁶⁴
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Several limitations of these analyses should be noted. First results presented here are
5
6 cross-sectional and thus associations do not reflect causality. The comparison of the
7
8 serial samples is ecological in nature and does not prove temporal effects. The sample
9
10 sizes are small and thus subject to limitations with respect to generalizability. Many
11
12 exposures are self-reported and thus may reflect social desirability bias, especially
13
14 condom use which we have found has been over-reported based on biomarker data.⁶⁵
15
16 On the other hand, we have found that self-reported ATS use is accurate compared to
17
18 urine toxicology screening, suggesting that measures of drug and alcohol use in this
19
20 group are accurate.⁶⁶
21
22
23
24
25
26

27 Results from this analysis provide important insights into recent shifts in the context of
28
29 sex work and risk in young FSW in Phnom Penh and highlight the challenges to HIV
30
31 prevention in this environment. Conflicting trends, including the criminalization and
32
33 suppression of direct sex work while the indirect entertainment-based sex work industry
34
35 is flourishing, set a new stage. Unless there is acknowledgment and access to women
36
37 who are more directly engaged in sex work, these women will be poorly represented in
38
39 any national HIV or behavioural surveillance. They will remain hidden and stigmatized,
40
41 subject to repression, violence and potentially with less access to prevention or care.
42
43 While the 100% condom use program had its criticisms, that policy at least
44
45 acknowledged the existence and need for HIV prevention at a multisectoral level for
46
47 FSW. The current socio-political climate has potentially reversed these benefits, by
48
49 denying the existence of FSW. The exponential growth of entertainment-based sex work
50
51 has the potential to result in an expanding HIV epidemic among young women in
52
53 Cambodia. From a programmatic perspective entertainment-based FSW are much easier
54
55 to reach but likely require different HIV prevention interventions than the 100% condom
56
57
58
59
60

1 use program. Implementation of research and programmatic efforts that integrate
2 health, social empowerment, and safe work environments for HIV prevention remain a
3 high priority for women engaged in sex work in Cambodia.⁶⁷
4
5
6
7
8
9

10 **Funding**

11 Funded by U.S. National Institutes of Health.

12 **Competing Interests**

13 None

14 **Contributorship**

15 All authors contributed to the design and implementation of the YWHS-1 and -2 studies. Authors KP,
16 ES, JE, and LM compiled the first draft of the manuscript, which was reviewed by NS, M-CC, KS,
17 MC, JM_S, PP, JK. The primary statistical analysis was conducted by JE and M-CC; KS and MC
18 provided supplemental data review, and KP reviewed all data analyses. All authors contributed to and
19 have approved the final manuscript. The YWHS Collaborative is a steering committee who reviewed
20 and approved the study protocols, and provided expertise into some or all of the studies' methods and
21 implementation.
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

38 **Data sharing**

39 No additional data are available.
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

References

1. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Annual Report 2009: National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/report.php>; Accessed July 8, 2011, 2011.
2. Saphonn V, Sopheab H, Sun LP, Vun MC, Wantha SS, Gorbach PM, et al. Current HIV/AIDS/STI epidemic: intervention programs in Cambodia, 1993-2003. *AIDS Educ Prev* 2004;16(3 Suppl A):64-77.
3. NCHADS. Behavioral Sentinel Surveillance 2010. *Cambodia National Center for HIV, AIDS, Dermatology and STD Dissemination Conference, December 30, 2010* 2011.
4. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Estimation of the HIV prevalence among the general population in Cambodia. : National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/index.php?id=20&event=146> Accessed July 8, 2011, 2011.
5. Couture MC, Sansothy N, Saphonn V, Phal S, Sichan K, Stein E, et al. Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine-type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis* 2011;38(1):33-9.
6. Sopheab H, Saphonn V, Chhea C, Fylkesnes K. Distribution of HIV in Cambodia: findings from the first national population survey. *AIDS* 2009;23(11):1389-95.
7. Sopheab H, Morineau G, Neal JJ, Saphonn V, Fylkesnes K. Sustained high prevalence of sexually transmitted infections among female sex workers in Cambodia: high turnover seriously challenges the 100% Condom Use Programme. *BMC Infect Dis* 2008;8:167.
8. Sopheab H, Gorbach PM, Gloyd S, Leng HB. Rural sex work in Cambodia: work characteristics, risk behaviours, HIV, and syphilis. *Sex Transm Infect* 2003;79(4):e2.
9. Saphonn V, Parekh BS, Dobbs T, Mean C, Bun LH, Ly SP, et al. Trends of HIV-1 Seroincidence Among HIV-1 Sentinel Surveillance Groups in Cambodia, 1999-2002. *J Acquir Immune Defic Syndr* 2005;39(5):587-92.
10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012.
11. UNAIDS. HIV in Asia and the Pacific: Getting to Zero. http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/20110826_APGettingToZero_en.pdf 2011;Accessed December 20, 2011.
12. Samnang P, Leng HB, Kim A, Canchola A, Moss A, Mandel JS, et al. HIV prevalence and risk factors among fishermen in Sihanouk Ville, Cambodia. *Int J STD AIDS* 2004;15(7):479-83.
13. Nishigaya K. Female garment factory workers in Cambodia: migration, sex work and HIV/AIDS. *Women Health* 2002;35(4):27-42.
14. Patterson D. Southeast Asia: national policy audits on HIV and migration. *HIV AIDS Policy Law Rev* 2005;10(3):31, 33.
15. Hor LB, Detels R, Heng S, Mun P. The role of sex worker clients in transmission of HIV in Cambodia. *Int J STD AIDS* 2005;16(2):170-4.

- 1 16. Maher L, Mooney-Somers J, Phlong P, Couture MC, Stein E, Evans J, et al. Selling
2 sex in unsafe spaces: Sex work risk environments in Phnom Penh, Cambodia.
3 *Harm Reduct J* 2011;8(1):30.
- 4 17. Plummer R. The sex industry in Cambodia: the traffic police. . *The Economist* June
5 11, 2009.
- 6 18. UNIAP. United Nations Inter-Agency Project on Human Trafficking (Phase III).
7 Cambodia: Exodus to the sex trade? Effects of the global financial crisis on
8 women's working conditions and opportunities. *Report* [http://www.no-
10 trafficking.org/reports_docs/siren/siren_cb-04.pdf](http://www.no-
9 trafficking.org/reports_docs/siren/siren_cb-04.pdf); Accessed August 31, 2009.
- 11 19. UNAIDS pr. More women in Cambodia turning to sex trade amid financial crisis – UN
12 report.
13 [http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking
15 &Cr1=](http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking
14 &Cr1=) 2009.
- 16 20. KHANA. Mapping the pattern of sex workers, entertainment establishments, and
17 men who have sex with men in Cambodia. Accessed July 9, 2011. Report by Hor
18 Bun Leng, M.D, and Tuot Sovaranny, March. 2008.
- 19 21. Kim AA, Sun LP, Chhorvann C, Lindan C, Van Griensven F, Kilmarx PH, et al. High
20 prevalence of HIV and sexually transmitted infections among indirect sex workers
21 in Cambodia. *Sex Transm Dis* 2005;32(12):745-51.
- 22 22. Gorbach PM, Sopheab H, Chhorvann C, Weiss RE, Vun MC. Changing behaviors and
23 patterns among Cambodian sex workers: 1997-2003. *Journal of Acquired
24 Immune Deficiency Syndromes* 2006;42(2):242-7.
- 25 23. Ghys PD, Jenkins C, Pisani E. HIV surveillance among female sex workers. *Aids*
26 2001;15 Suppl 3:S33-40.
- 27 24. Francis C. HIV prevention and anti-trafficking in conflict? The public health
28 consequences of Cambodia's fight against trafficking. FHI (in collaboration with
29 PSI, Care, UNAIDS); December 2008.
- 30 25. FHI. SMARTgirl Program to Reduce Risk and Inspire Behavior Change. .
31 http://www.fhi.org/en/CountryProfiles/Cambodia/res_SMARTgirl.htm Accessed
32 July 15th, 2011.
- 33 26. Burke KP, Munshaw S, Osburn WO, Levine J, Liu L, Sidney J, et al. Immunogenicity
34 and cross-reactivity of a representative ancestral sequence in hepatitis C virus
35 infection. *J Immunol* 2012;188(10):5177-88.
- 36 27. Lamptey PR. Reducing heterosexual transmission of HIV in poor countries. *Bmj
37 Clinical Research Ed.* 2002;324(7331):207-11.
- 38 28. UNODC. Patterns and Trends of Amphetamine Type Stimulants and other drugs;
39 Asia and the Pacific. *The Global SMART Programme (Synthetics Monitoring:
40 Analyses, Reporting, Trends)*
41 <http://www.unodc.org/unodc/en/scientists/smart.html> (Accessed January 5,
42 2012) 2011.
- 43 29. Ahmad K. Increased use of amphetamine-type stimulants threatens east Asian
44 countries. *Lancet* 2002;359(9321):1927.
- 45 30. Ahmad K. Asia grapples with spreading amphetamine abuse. *Lancet*
46 2003;361(9372):1878-9.
- 47 31. Kulsudjarit K. Drug problem in southeast and southwest Asia. *Ann N Y Acad Sci*
48 2004;1025:446-57.
- 49 32. Farrell M, Marsden J, Ali R, Ling W. Methamphetamine: drug use and psychoses
50 becomes a major public health issue in the Asia Pacific region. *Addiction*
51 2002;97(7):771-2.
- 52
53
54
55
56
57
58
59
60

- 1 33. Mongkolsirichaikul D, Mokkhavesa C, Ratanabanangkoon K. The incidence of
2 amphetamine use among truck drivers from various regions of Thailand. *J Med*
3 *Assoc Thai* 1988;71(9):471-4.
- 4 34. Vongsheree S, Sri-Ngam P, Ruchusatsawat N, Thaisri H, Puangtabtim W,
5 Phutiprawan T, et al. High HIV-1 prevalence among metamphetamine users in
6 central Thailand, 1999-2000. *J Med Assoc Thai* 2001;84(9):1263-7.
- 7 35. Dayrit FM, Dumlao MC. Impurity profiling of methamphetamine hydrochloride drugs
8 seized in the Philippines. *Forensic Sci Int* 2004;144(1):29-36.
- 9 36. Lin SK, Ball D, Hsiao CC, Chiang YL, Ree SC, Chen CK. Psychiatric comorbidity and
10 gender differences of persons incarcerated for methamphetamine abuse in
11 Taiwan. *Psychiatry Clin Neurosci* 2004;58(2):206-12.
- 12 37. Lua AC, Lin HR, Tseng YT, Hu AR, Yeh PC. Profiles of urine samples from
13 participants at rave party in Taiwan: prevalence of ketamine and MDMA abuse.
14 *Forensic Sci Int* 2003;136(1-3):47-51.
- 15 38. Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, Beyrer C, et al. HIV
16 prevalence and risks among injection and noninjection drug users in northern
17 Thailand: need for comprehensive HIV prevention programs. *J Acquir Immune*
18 *Defic Syndr* 2003;33(2):259-66.
- 19 39. Couture MC, Evans JL, Sothy NS, Stein ES, Sichan K, Maher L, et al. Correlates of
20 amphetamine-type stimulant use and associations with HIV-related risks among
21 young women engaged in sex work in Phnom Penh, Cambodia. *Drug Alcohol*
22 *Depend* 2012;120(1-3):119-26.
- 23 40. Melbye K, Khamboonruang C, Kunawararak P, Celentano DD, Prapamontol T, Nelson
24 KE, et al. Lifetime correlates associated with amphetamine use among northern
25 Thai men attending STD and HIV anonymous test sites. *Drug Alcohol Depend*
26 2002;68(3):245-53.
- 27 41. Sattah MV, Supawitkul S, Dondero TJ, Kilmarx PH, Young NL, Mastro TD, et al.
28 Prevalence of and risk factors for methamphetamine use in northern Thai youth:
29 results of an audio-computer-assisted self-interviewing survey with urine testing.
30 *Addiction* 2002;97(7):801-8.
- 31 42. Buavirat A, Page-Shafer K, van Griensven GJ, Mandel JS, Evans J, Chuaratanaphong
32 J, et al. Risk of prevalent HIV infection associated with incarceration among
33 injecting drug users in Bangkok, Thailand: case-control study. *BMJ*
34 2003;326(7384):308.
- 35 43. Beyrer C, Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, et al.
36 Methamphetamine users in northern Thailand: changing demographics and risks
37 for HIV and STD among treatment-seeking substance abusers. *Int J STD AIDS*
38 2004;15(10):697-704.
- 39 44. Vanichseni S, Tappero JW, Pitisuttithum P, Kitayaporn D, Mastro TD, Vimutisunthorn
40 E, et al. Recruitment, screening and characteristics of injection drug users
41 participating in the AIDS-VAX B/E HIV vaccine trial, Bangkok, Thailand. *Aids*
42 2004;18(2):311-6.
- 43 45. Maher L, Phlong P, Mooney-Somers J, Keo S, Stein E, Couture MC, et al.
44 Amphetamine-type stimulant use and HIV/STI risk behaviour among young
45 female sex workers in Phnom Penh, Cambodia. *Int J Drug Policy* 2011;22(3):203-
46 9.
- 47 46. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for
48 amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS
49 use among young female sex workers in Cambodia. *Masters Thesis for University*
50 *of California Berkeley, School of Public Health, MPH in Epidemiology and*
51 *Biostatistics. Completed May 15, 2011.*
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1 47. Chattergoon MA, Levine JS, Latanich R, Osburn WO, Thomas DL, Cox AL. High
2 plasma interleukin-18 levels mark the acute phase of hepatitis C virus infection. *J*
3 *Infect Dis* 2011;204(11):1730-40.
- 4 48. Yang C, Latkin C, Luan R, Nelson K. Condom use with female sex workers among
5 male clients in Sichuan Province, China: the role of interpersonal and venue-level
6 factors. *J Urban Health* 2010;87(2):292-303.
- 7 49. Erasquin JT, Reed E, Blankenship KM. Police-related experiences and HIV risk
8 among female sex workers in Andhra Pradesh, India. *J Infect Dis* 2011;204 Suppl
9 5:S1223-8.
- 10 50. Shannon K, Kerr T, Allinott S, Chettiar J, Shoveller J, Tyndall MW. Social and
11 structural violence and power relations in mitigating HIV risk of drug-using
12 women in survival sex work. *Soc Sci Med* 2008;66(4):911-21.
- 13 51. Shannon K, Kerr T, Strathdee SA, Shoveller J, Montaner JS, Tyndall MW. Prevalence
14 and structural correlates of gender based violence among a prospective cohort of
15 female sex workers. *BMJ* 2009;339:b2939.
- 16 52. Kalichman SC, Simbayi LC, Kaufman M, Cain D, Jooste S. Alcohol use and sexual
17 risks for HIV/AIDS in sub-Saharan Africa: systematic review of empirical findings.
18 *Prev Sci* 2007;8(2):141-51.
- 19 53. Morisky DE, Chiao C, Ksobiech K, Malow RM. Reducing alcohol use, sex risk
20 behaviors, and sexually transmitted infections among Filipina female bar workers:
21 effects of an ecological intervention. *J Prev Interv Community* 2010;38(2):104-
22 17.
- 23 54. Surratt HL, Inciardi JA. An effective HIV risk-reduction protocol for drug-using
24 female sex workers. *J Prev Interv Community* 2010;38(2):118-31.
- 25 55. Argento E, Reza-Paul S, Lorway R, Jain J, Bhagya M, Fathima M, et al. Confronting
26 structural violence in sex work: lessons from a community-led HIV prevention
27 project in Mysore, India. *Aids Care* 2011;23(1):69-74.
- 28 56. Reza-Paul S, Beattie T, Syed HU, Venukumar KT, Venugopal MS, Fathima MP, et al.
29 Declines in risk behaviour and sexually transmitted infection prevalence following
30 a community-led HIV preventive intervention among female sex workers in
31 Mysore, India. *Aids* 2008;22 Suppl 5:S91-100.
- 32 57. Johnston LG, Sabin K, Mai TH, Pham TH. Assessment of respondent driven sampling
33 for recruiting female sex workers in two Vietnamese cities: reaching the unseen
34 sex worker. *J Urban Health* 2006;83(6 Suppl):i16-28.
- 35 58. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV
36 among female sex workers in low-income and middle-income countries: a
37 systematic review and meta-analysis. *Lancet Infect Dis* 2012;12(7):538-49.
- 38 59. Merson M, Padian N, Coates TJ, Gupta GR, Bertozzi SM, Piot P, et al. Combination
39 HIV prevention. *Lancet* 2008;372(9652):1805-6.
- 40 60. Abdool Karim Q, Abdool Karim SS, Frohlich JA, Grobler AC, Baxter C, Mansoor LE, et
41 al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the
42 prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.
- 43 61. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure
44 chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J*
45 *Med* 2010;363(27):2587-99.
- 46 62. Dworkin SL, Blankenship K. Microfinance and HIV/AIDS prevention: assessing its
47 promise and limitations. *AIDS Behav* 2009;13(3):462-9.
- 48 63. Pronyk PM, Kim JC, Abramsky T, Phetla G, Hargreaves JR, Morison LA, et al. A
49 combined microfinance and training intervention can reduce HIV risk behaviour in
50 young female participants. *AIDS* 2008;22(13):1659-65.
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
64. Rosenberg MS, Seavey BK, Jules R, Kershaw TS. The Role of a Microfinance Program on HIV Risk Behavior Among Haitian Women. *AIDS Behav* 2011;15(5):911-8.
65. Evans J, Couture M-C, Stein ES, Sansothy N, Maher L, Page K, et al. Biomarker validation of recent unprotected sexual intercourse in a prospective study of young women engaged in sex work in Phnom Penh, Cambodia. *STD* in press.
66. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS use among young female sex workers in Cambodia. . *Addiction Science & Clinical Practice* 2012;7:11-25.
67. Tucker JD, Tuminez AS. Reframing the interpretation of sex worker health: a behavioral-structural approach. *J Infect Dis* 2011;204 Suppl 5:S1206-10.

Table 1: Selected socio-demographic characteristics, occupational, and risk exposures in two cohorts of high risk young women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2 N=153*		p-value
	Prevalence of characteristic		Prevalence of characteristic		
	N	%	N	%	
Age (years, median (IQR))	25 (21 – 27)		25 (22 – 28)		0.56
16-18	13	8.1	11	7.2	0.86
19-24	64	40.0	58	37.9	
25-29	83	51.8	84	54.9	
Marital status					
Never married	57	35.6	38	24.8	<0.01
Married-living together	24	15.0	48	31.4	
Widowed/Divorced/Separated	79	49.4	67	43.8	
Education (years)					
None	64	40.0	23	15.0	<0.01
Primary (1-6 years)	82	51.3	91	59.5	
Secondary (7+ years)	14	8.8	39	25.5	
Age at first sex (median (IQR))	17 (16 – 18)		18 (16 – 19)		0.03
≤ 15	32	20.1	22	14.5	0.19
> 15	127	79.9	130	85.5	
Length of employment as FSW (years, median (IQR))	4.3 (2.5 – 6.3)		3 (1.7 – 5)		<0.01
Current employment venue (last 30 days)					
Entertainment	51	31.9	113	74.3	<0.01†
Brothel	23	9.2	3	2.0	
Freelance	59	39.3	29	19.1	
Other/Multiple	27	16.9	7	4.6	
Have a manager, boss or supervisor					
No	82	53.6	28	14.4	<0.01
Yes	71	46.4	124	81.6	
Income in past month (US \$)					
Less than \$100	68	42.5	50	32.9	0.18
100-150\$	35	21.9	43	29.3	

Over 150\$	57	35.6	59	38.8	
Number of sex partners in last month (median (IQR))	30 (10 – 90)		5 (3 – 13)		<0.01
≤10	45	28.1	112	73.2	<0.01
11 – 50	53	33.1	41	26.8	
> 50	62	38.8	0	0	
Condom use with last paying partner					
Consistent (always)	108	85.7	86	87.8	0.66
Inconsistent	18	14.3	12	12.2	
Condom use with last non paying partner					
Consistent (always)	7	20.6	10	18.2	0.78
Inconsistent	27	79.4	45	81.8	
Number of days drink alcohol (last month)	15 (2 – 30)		18 (5 – 28)		0.76
0 – 4	65	40.6	36	23.5	<0.01
5 – 19	25	15.6	42	27.5	
≥ 20	70	43.7	75	49.0	
Number of days drunk (last month)	5 (1 – 20)		3 (1 – 10)		0.07
0 – 4	89	55.6	86	56.2	<0.01
5 – 19	33	20.6	50	32.7	
≥ 20	38	23.7	17	11.1	
ATS use (ever)					
No	92	57.5	107	69.9	0.02
Yes	68	42.5	46	30.1	
ATS use (last 3 months)					
No	116	73.4	117	76.5	0.54
Yes	42	26.6	36	23.5	
Ever used any drug prior to/during sex					
No	109	68.1	117	76.5	0.10
Yes	51	31.9	36	23.5	

* Excludes women who participated in YWHS-1

†Fisher Exact p-value

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 2: HIV prevalence overall and by current work venue in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	% (95% CI)	N	%	
HIV positive	37	23.1 (16.5 – 29.7)	14	9.2 (4.5 – 13.8)	<0.01
HIV positive by employment venue (n/N)					
Entertainment	5/51	9.8 (1.5 – 18.1)	5/113	4.4 (0.6 – 8.2)	<0.01
Brothel	4/23	17.4 (1.5 – 33.3)	0/3	0	
Freelance	22/59	37.3 (25.0 – 48.0)	9/29	31.0 (13.8 – 48.2)	
Other/Multiple	6/27	22.2 (6.2 – 38.3)	0/7	0	

* Excludes women who participated in YWHS-1

Table 3: HIV testing history and behaviors in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	%	N	%	
Ever tested for HIV					
No	58	36.5	31	20.3	<0.01
Yes	101	63.5	122	79.7	
HIV test in last 3 months					
No	126	79.3	119	77.8	0.75
Yes	33	20.7	34	22.2	
What was result of last HIV test?#					
Negative	84	84.0	114	93.4	0.04
Positive	4	4.0	4	3.3	
Don't know	12	12.0	4	3.3	
Where received last HIV test#					
Public hospital	35	34.7	55	34.0	0.10
Voluntary testing and counseling center	1	1.0	0	0	
NGO clinic	59	58.4	54	44.3	
Private hospital, clinic, or laboratory	6	5.9	13	10.7	

* Excludes women who participated in YWHS-1

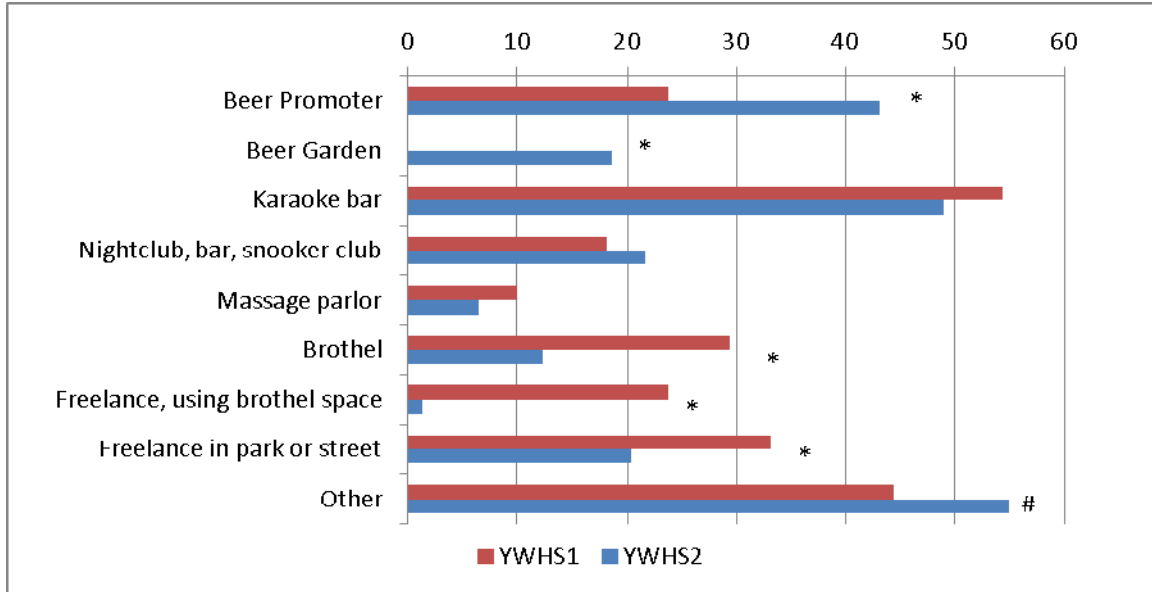
Among those who reported being previously tested for HIV

Figure Legend

Figure 1: Venues where women in YWHS-2 and YWHS-2 reported ever working

Figure 2. Alcohol use in the past month and ATS use in the past 3 months reported by women in YWHS-1 and YWHS-2 by work venue: (A) Entertainment-based; (B) Brothel-based; (C) Freelance

For peer review only



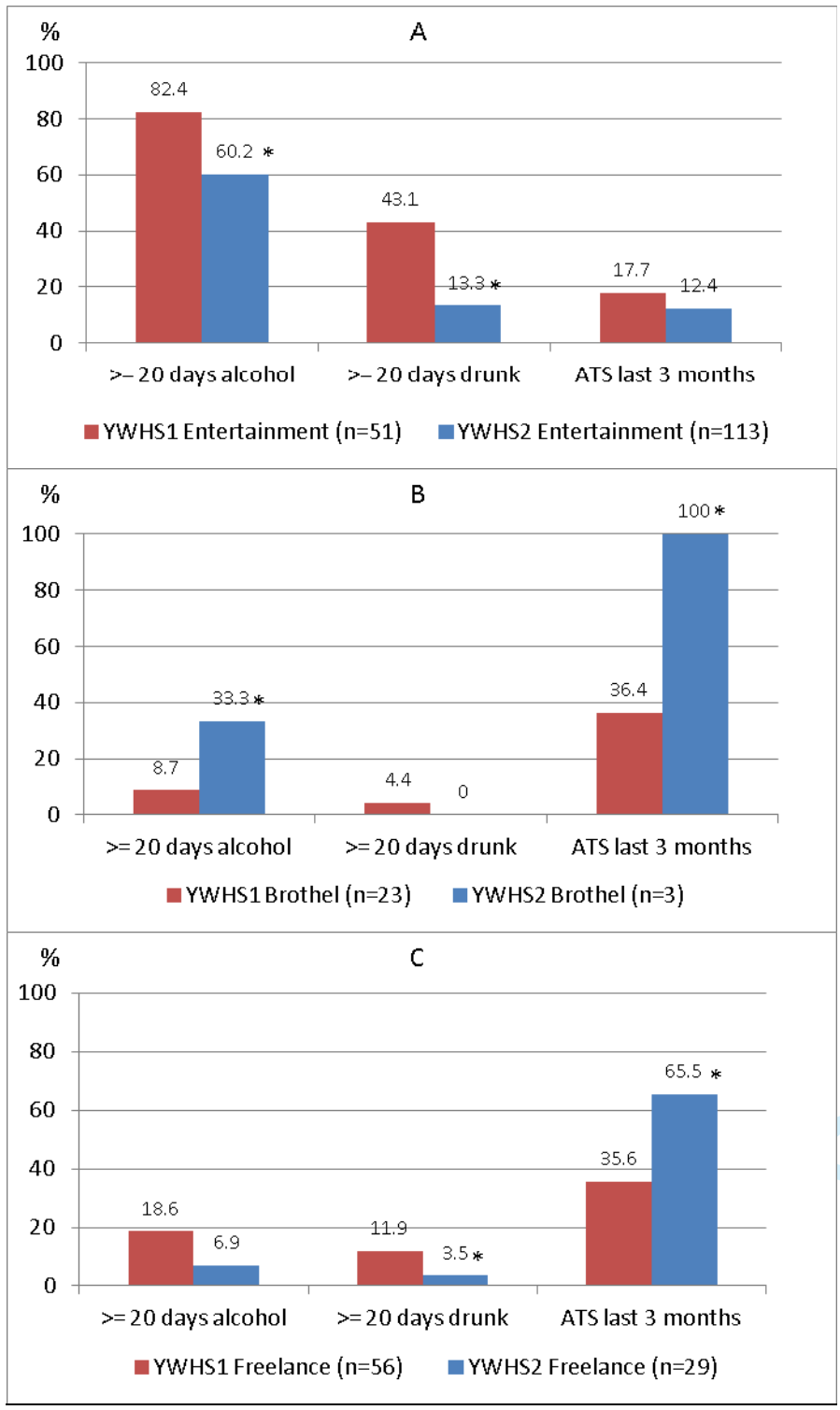
* p≤0.05; # p=0.06

Peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only



*p<0.05

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

Page et al., Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high risk young women in Phnom Penh, Cambodia

	Item No	Item, Section and PAGE NUMBER
Title and abstract	1	(a) Study's design with a commonly used terms – PAGE 1 (b) Provide in the abstract an informative and balanced summary of what was done and what was found – PAGE 3
Introduction		
Background/rationale	2	Scientific background and rationale for the investigation being reported – PAGE 7-9
Objectives	3	State specific objectives, including any prespecified hypotheses- PAGE 9
Methods		
Study design	4	Present key elements of study design early in the paper- PAGE 9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection- PAGE 9, 11
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up- PAGE 10 (b) For matched studies, give matching criteria and number of exposed and unexposed
Variables	7	Clearly define all outcomes, exposures, predictors, - PAGE 10-12
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group – PAGE 10-12
Bias	9	Describe any efforts to address potential sources of bias – NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Study size	10	Explain how the study size was arrived at – PAGE 10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why- PAGE 12
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding- PAGE 12 (b) Describe any methods used to examine subgroups and interactions- PAGE 12 (c) Explain how missing data were addressed- NA (BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (d) If applicable, explain how loss to follow-up was addressed NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (e) Describe any sensitivity analyses NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed- PAGE 12, 13 (b) Give reasons for non-participation at each stage NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (c) Consider use of a flow diagram NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders- PAGE 12, 13, and TABLE 1

		(b) Indicate number of participants with missing data for each variable of interest NA
		(c) Summarise follow-up time (eg, average and total amount) NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Outcome data	15*	Report numbers of outcome events or summary measures over time – TABLE 1 AND 2
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included. TABLES 1 AND 2 (b) Report category boundaries when continuous variables were categorized NA (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses –PAGE 13
Discussion		
Key results	18	Summarise key results with reference to study objectives – PAGE 14, 15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias – PAGE 18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence PAGE 14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results PAGE 18
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based PAGE 5

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.



Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high risk young women in Phnom Penh, Cambodia

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-003095.R1
Article Type:	Research
Date Submitted by the Author:	19-Jun-2013
Complete List of Authors:	Page, Kimberly; University of California San Francisco, Epidemiology and Biostatistics Stein, Ellen; UCSF, Epidemiology & Biostatistics Sansothy, Neth; NCHADS, Evans, Jennifer; UCSF, Epidemiology & Biostatistics Couture, Marie-Claude; UCSF, Epidemiology & Biostatistics Sichan, Keo; Cambodia Women's Development Assoc., Cockroft, Melissa; Cambodia Women's Development Assoc., Mooney-Somers, Julie; University of Sydney, Center for Values, Ethics and the Law in Medicine Phlong, Pisith; Royal University of Fine Arts, Kaldor, John; University of New South Wales, The Kirby Institute Maher, Lisa; The Kirby Institute,
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Epidemiology, Global health, HIV/AIDS, Public health
Keywords:	EPIDEMIOLOGY, HIV & AIDS < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES

SCHOLARONE™
Manuscripts

1 Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high
2 risk young women in Phnom Penh, Cambodia
3
4
5
6
7
8
9

10 Kimberly Page, Ph.D.¹, Ellen Stein, MPH¹, Neth Sansothy, M.D.², Jennifer Evans, M.S.¹,
11 Marie-Claude Couture, Ph.D.¹, Keo Sichan³, Melissa Cockroft, BA^{3*}, Julie Mooney-
12 Somers, Ph.D.^{4, 5}, Pisith Phlong, M.A.⁶, John Kaldor, Ph.D.⁴, Lisa Maher Ph.D.⁴, (on
13 behalf of the Young Women's Health Study Collaborative: John Kaldor, Ph.D.⁴, Serey
14 Phal Kien³, Kimberly Page, Ph.D.¹, Joel M. Palefsky M.D.⁷, Vonthanak Saphonn, M.D.²,
15 Mean Chhi Vun, M.D.²).
16
17
18
19
20
21
22
23
24
25
26
27
28

- 29 1. University of California San Francisco, Department of Epidemiology and Biostatistics;
30 San Francisco, and Global Health Sciences, 50 Beale St., 12th Floor, San Francisco, CA,
31 94105; USA
32
33
- 34 2. National Center for HIV/AIDS, Dermatology and STDs (NCHADS), #245H, Street 6A,
35 Phum Kean Khlang, Sangkat Prekleap Russey Keo, Phnom Penh, Cambodia
36
37
- 38 3. Cambodian Women's Development Association (CWDA); No. 19, Street 242, Boeung
39 Prolit, Khan 7 Makara, Phnom Penh, Cambodia
40
41
- 42 4. The Kirby Institute (formerly the National Centre in HIV Epidemiology and Clinical
43 Research); University of New South Wales, CFI building, corner of West and Boundary
44 Streets, Darlinghurst, NSW 2010, Australia
45
46
- 47 5. The Centre for Values, Ethics and the Law in Medicine, The University of Sydney
48 Level 1 of the Medical Foundation Building, 92-94 Parramatta Road, Camperdown, NSW,
49 Australia
50
51
- 52 6. Royal University of Fine Arts, 72 Street 19, Phnom Penh, Cambodia.
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

7. University of California San Francisco, Department of Medicine; 513 Parnassus Ave,
Med Sci S-420; UCSF, San Francisco, San Francisco, CA. 94143 - 0654

*Melissa Cockroft is currently at Marie Stopes International in Phnom Pehn, Cambodia

Address correspondence to:

Kimberly Page, Ph.D., MPH, Dept. of Epidemiology and Biostatistics, Global Health
Sciences, University of California San Francisco, CA 94105; 50 Beale St., 12th Floor, San
Francisco, CA USA, 94105. kpage@psg.ucsf.edu

Word count: Abstract: 296; Text 3444; 3 Tables, 2 Figures.

Key words: Cambodia, female sex workers, HIV, STI, risk, amphetamine-type
stimulant, alcohol, policy effects

Short title: HIV infection and risk in two samples of FSW in Phnom Penh, Cambodia

Abstract

Objectives: HIV prevalence among Cambodian female sex workers (FSW) is among the highest in Southeast Asia. We describe HIV prevalence and associated risk exposures in FSW sampled serially in Phnom Penh, Cambodia (Young Women's Health Study (YWHS), before and after the implementation of a new law designed to combat human trafficking and sexual exploitation.

Design: Cross-sectional analysis of baseline data from two prospective cohorts.

Setting: Community-based study in Phnom Penh, Cambodia.

Participants: Women aged 15-29 years, reporting ≥ 2 sexual partners in the last month and/or engaged in transactional sex in the last 3 months, were enrolled in the studies in 2007 (N=161; YWHS-1), and 2009 (N=220; YWHS-2) following information sessions where 285 and 345 women attended.

Primary outcomes: HIV prevalence, sexual risk behaviour, amphetamine-type stimulant (ATS) and alcohol use, and work-related factors were compared the two groups, enrolled before and after implementation of the new law.

Results: Participants and in the two cohorts were similar in age (median 25 years), but YWHS-2 women reported fewer sex partners, more alcohol use, and less ATS use. A higher proportion of YWHS-2 compared to YWHS-1 women worked in entertainment-based venues (68% vs. 31%, respectively). HIV prevalence was significantly lower in the more recently sampled women: 9.2% (95% CI 4.5, 13.8) vs. 23% (95% CI 16.5, 29.7).

Conclusions: Sex work context and risk has shifted among young FSW in Phnom Penh, following implementation of anti-prostitution and anti-trafficking laws. While both cohorts were recruited using the same eligibility criteria, more recently sampled women had lower prevalence of sexual risk and HIV infection. Women engaged more directly in transactional sex have become harder to sample and access. Future prevention

1 research and programs need to consider how new policies and demographic changes in
2
3
4 FSW impact HIV transmission.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Article summary

Article Focus

- HIV prevalence and incidence in two serial samples of young female sex workers in Phnom Penh, Cambodia (2007-2008, and 2009-2010);
- Comparison of baseline risk and HIV outcomes, including sexual behavior, drug and alcohol use in the two cohorts sampled before and after implementation of anti-trafficking and sexual exploitation laws in 2008;
- Impact of anti-trafficking and sexual exploitation legislation on female sex workers and HIV risk.

Key Messages

- Women sampled using the same eligibility criteria and outreach methods in differed with respect to risk exposures and HIV outcomes;
- Changes in sex work typology and environment are evident after enactment of the anti-trafficking laws, including very few brothel-based FSW and significantly more FSW based in the entertainment sector;
- Shifts in the context of sex work and risk highlight the ongoing need and challenges for HIV and drug prevention for young women engaged in sex work.

Strengths and Limitations

- Two comparably sampled groups of young FSW suggest changing trends in HIV risk;
- Comparison of cross-sectional samples is ecological and does not prove temporal effects;
- Criminalization and suppression of sex work and a flourishing entertainment-based sex work industry set new and conflicting stage for HIV prevention.

1 Author Contributions: All authors contributed to the design and implementation of the
2
3 YWHS-1 and -2 studies. Authors KP, ES, JE, and LM compiled the first draft of the
4
5 manuscript, which was reviewed by NS, M-CC, KS, MC, JM_S, PP, JK. The primary
6
7 statistical analysis was conducted by JE and M-CC; KS and MC provided supplemental
8
9 data review, and KP reviewed all data analyses. All authors contributed to and have
10
11 approved the final manuscript. The YWHS Collaborative is a steering committee who
12
13 reviewed and approved the study protocols, and provided expertise into some or all of
14
15 the studies' methods and implementation.
16
17
18
19
20
21

22 Data Sharing: no additional data available.
23
24
25

26 Funding sources and conflicts of interest: The Young Women's Health Study-1 and
27
28 YWHS-2 were supported by Awards 1R21DA025441 from the National Institute on Drug
29
30 Abuse, and R01NR010995 from the National Institute of Nursing Research. M-C Couture
31
32 was also supported by the Canadian Institutes of Health Research (postdoctoral
33
34 fellowship award). Professors Lisa Maher and John Kaldor are supported by Australian
35
36 National Health and Medical Research Council (NHMRC) Research Fellowship. The Kirby
37
38 Institute is affiliated with the Faculty of Medicine, University of New South Wales and is
39
40 funded by the Australian Government Department of Health and Ageing. The content is
41
42 solely the responsibility of the authors and does not necessarily represent the official
43
44 views of the National Institutes of Health, nor the Australian Government. The authors
45
46 have no conflicts to disclose.
47
48
49
50
51
52

53 Acknowledgments: The authors would like to acknowledge the coordinated efforts and
54
55 dedication of the research teams at the National Center for HIV/AIDS, Dermatology,
56
57 and STDs and the Cambodian Women's Development Agency. We are indebted to all the
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Cambodian women who agreed to participate in this study and grateful for the privilege to work with them.

For peer review only

Introduction

There have been significant declines in HIV prevalence in Cambodia since the epidemic peaked in around 2000, a success widely attributed to measurable increases in condom use, declines in the number and frequency of commercial sex transactions reported by men, access to HIV voluntary counseling & testing (VCT) and uptake of antiretroviral therapy.¹⁻³ In 2010, the National Center for HIV/AIDS, Dermatology and STDs (NCHADS) revised the national estimate of HIV prevalence to 0.8% (in 15-49 year olds), reflecting a significant decline after the peak estimate of 2.4% in 1998.⁴ However, HIV prevalence in Cambodian women, especially young women, is among the highest in Southeast Asia and heterosexual sex remains the main route of transmission.⁵⁻⁹ Since 2006, women have accounted for over half (52%) of all HIV infections in Cambodia¹⁰, higher than in Asia and the Pacific in general (35%).¹¹ Limited income generating activities, a highly mobile workforce, trafficking in women and girls and widespread transactional sex, poverty, and sexually transmitted infections (STI) have been identified as key drivers of the epidemic among female sex workers (FSW).^{1 5 6 10 12-15} As in many countries, FSW in Cambodia can be hard to reach and difficult to provide prevention services to. In recent years significant economic and policy changes have affected the sex work landscape, with notable shifts in sex work venues, typologies, and more women engaged in transactional sex than ever before.¹⁶⁻²⁰

Until 2008, FSW in Cambodia were categorized as "direct" and were mostly brothel-based, or "indirect". Indirect FSW were distinguished from direct FSW, generally working in entertainment establishments as beer promotion girls, waitresses, hostesses, or karaoke girls for example, and engaged in occasional transactional sex for supplementary income.²¹⁻²³ In 1997, an estimated 5,300 women worked in the entertainment/service sector and 6,000 were brothel-based FSW. The number of

1 women involved in entertainment-based sex work has grown dramatically in recent
2 years in Cambodia. Until 2008, the estimated number of women engaged in sex and
3 entertainment work was stable (12,762 women were enumerated in 2008), however by
4 2012, this had increased dramatically to an estimated 41,622 women, a more than
5 threefold increase from the 2008 estimate (NCHADS, personal communication). The
6 reasons for this growth have not been explored in detail, but may be associated with
7 changing economic factors during this time in Cambodia. Following the passage and
8 implementation of the "Law on Suppression of Human Trafficking and Sexual
9 Exploitation" in February, 2008, brothel-based sex work was banned, and the most
10 direct effect was on direct sex trade, which went "underground", or women moved into
11 indirect work.¹⁰ Along with the overt enforcement against FSW, the 2008 anti-
12 trafficking legislation had other consequences. For instance, official terminology used by
13 governmental and non-governmental organizations (NGO) to describe FSW labeled all
14 women engaged in sex and entertainment work as "entertainment workers", or EW*.
15 Historically, brothel-based FSW were easily accessed and monitored for HIV prevention
16 efforts, including HIV and behavioral surveillance. NGOs working in HIV prevention
17 reported that as transactional sex was displaced to a wider range of settings, women at
18 highest risk became harder to reach for both prevention and service delivery.^{16 24 25}
19 These factors pose significant challenges to HIV prevention and threaten to undermine
20 progress achieved to date.

21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

* The term 'female sex worker' is no longer used in Cambodia. Terminology was changed in 2008 to designate high risk women working in service and entertainment venues as "entertainment workers" or EW. No new HIV surveillance data has been published on FSW, and Behavioral Surveillance Survey (BSS) methods have been changed to recognize only indirect sex workers- 'EW', and determining whether or not they are selling sex by the average number of reported sex partners per week (10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012..

1 HIV prevalence is extremely high among Cambodian FSW with prevalence among
2 younger women is particularly troubling as their infection is likely to be more recent and
3 indicative of incidence.^{5 8 9 21} A cornerstone of HIV prevention in Cambodia was the
4 100% Condom Use campaign^{26 27}, primarily directed at brothel-based FSW. With
5 changes in sex work venues, this prevention approach is likely less effective, failing to
6 reach the large number of women now engaged in transactional sex in entertainment
7 establishments. Indeed, measures of self-reported condom use have declined according
8 to monitoring data reported by UNAIDS.¹⁰ New risk factors have also emerged,
9 especially amphetamine-type stimulant (ATS) use, in the form of “yama”, (pills) and
10 “ice” (a crystalline form).²⁸⁻³⁸ ATS use is associated with increased sexual risk behavior
11 and STI incidence among these young women^{5 39}, similar to that seen in other
12 populations and locales.⁴⁰⁻⁴⁴

13 We conducted two prospective studies of high-risk young women engaged in
14 transactional sex in Phnom Penh, the principal research questions focused on estimating
15 HIV and STI prevalence and incidence and associated risk factors. The first, Young
16 Women’s Health Study (YWHS-1), was conducted in 2007-2008 and the second, YWHS-
17 2, in 2009-2010.^{5 16 39 45 46} In this paper, we explore the changing HIV risk landscape by
18 comparing and contrasting the two cohorts of FSW sampled prior to, and following,
19 legislative changes designed to combat human trafficking and sexual exploitation in
20 Cambodia. We theorize that the demographic characteristics and HIV risk of FSW has
21 shifted as a result of socio-legal changes induced by the implementation of the new
22 legislation.

23 **Methods**

24 ***Study setting***

1 The YWHS-1 and YWHS-2 were both prospective studies of young women engaged in
2 sex work in Phnom Penh, Cambodia. Methods have been described in detail previously.⁵
3
4
5
6 ³⁹ Both studies were led by a multidisciplinary collaborative prevention research group
7
8 from NCHADS, the Cambodian Women's Development Association (CWDA), the
9
10 University of California in San Francisco (UCSF) in the United States, and the Kirby
11
12 Institute at the University of New South Wales (UNSW) in Australia.
13
14

15 16 17 **Study population and recruitment**

18
19 The target population in both studies was young women engaged in transactional sex in
20 Phnom Penh. Inclusion criteria were: aged 15-29 years, Khmer language
21
22 comprehension, ≥ 2 different sexual partners in the last month *or* engaged in
23
24 transactional sex (sex in exchange for money, goods, services, or drugs) within the last
25
26 three months, no plans to move in the next 12 months, biologically female, and able to
27
28 provide voluntary informed consent. YWHS-1 aimed to sample 160 women to provide
29
30 80% power to estimate a point prevalence of HIV at 15% with a 95% confidence
31
32 interval (CI) of 9.7% to 23.0%. Based on results of YWHS-1, YWHS-2 aimed to sample
33
34 220 women to detect an estimated HIV prevalence of 23% (95% CI, 17.3%, 30.5%).
35
36
37
38
39
40
41
42

43 Recruitment and enrollment procedures were the same in both studies.⁵ CWDA field
44
45 assistants provided study information and conducted eligibility screening via information
46
47 meetings in neighborhoods where sex work was prevalent. Eligible women were invited
48
49 to a community location used by various sex-worker organizations where study
50
51 information was described in more detail and written informed consent was obtained.
52
53 Enrolled participants were given appointment cards to present to the YWHS clinic field-
54
55 site and free transportation was offered. In both studies, women were remunerated
56
57 US\$5 at each study visit for their participation time.
58
59
60

Data collection

All data collection occurred at the YWHS clinic, which was staffed by a physician, nurses, counselors and a laboratory technician. A structured questionnaire was administered in Khmer by trained interviewers. Survey items were similar in both studies, and covered socio-demographic characteristics, occupational and sexual risk history, alcohol and drug use. HIV testing was conducted at each visit. In YWHS-1, urine specimens were tested for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea* (GC). In YWHS-2, women were tested for HPV infection. STI treatment was provided at no cost, and women with HIV and HPV infection were referred to a local provider for free medical evaluation and treatment.

Laboratory testing

HIV serology was performed using two rapid tests; Uni-Gold Recombigen[™] HIV rapid HIV test (Trinity Biotech USA, Jamestown, NY) and the Clairview HIV 1/2 STAT-PAK (Inverness Medical Diagnostics, Waltham, MA). HIV positive and discordant samples were confirmed by HIV-1 immunoblot. CT and GC were assessed from urine samples using BDProbeTec[™] strand displacement amplification assay (Becton Dickinson, Sparks, MD) at the NCHADS STD laboratory.⁵ Cervical specimens for HPV testing were collected using a standard cytobrush.⁴⁷ Client-centered risk reduction counseling was provided in association with all testing.

Ethical review

The study protocols were reviewed and approved by Institutional Review Board of the Committee on Human Research at UCSF, the Cambodian National Ethics Committee, and the University of New South Wales Human Research Ethics Committee in

1 accordance with ethical standards (institutional and national) and with the Helsinki
2 Declaration of 1975, as revised in 2000.
3
4
5
6
7

8 **Measures**

9
10 Both studies aimed to estimate HIV infection, ATS use, and sexual risk behavior and
11 included questions on sociodemographic factors, work history, income, and duration of
12 sex work, and whether they currently had an employer (manager, boss or supervisor).
13 Women were asked if they had ever and/or were currently working: as a beer promoter,
14 in a beer garden, as a waitress or hostess in a karaoke bar, nightclub or snooker bar, in
15 a massage parlor, brothel, as a freelance sex worker using space at a brothel, as a
16 freelance sex worker in the park or on the street, or to specify 'other' location. They
17 were asked about age at first sex, number of partners (last month) and condom use
18 with last partners (paying and non-paying). Paying partners were defined as male
19 clients with whom respondents traded sex for money, goods or drugs. Condom use was
20 classified as "consistent" if the participant reported always using a condom. Participants
21 were asked about the number of days in which alcohol was drunk and the number of
22 days in which they were "affected" by alcohol or were "drunk" in the past month. ATS
23 use (ever and last 3 months) was assessed with questions regarding use of *yama* and
24 crystal (ice).
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

47 **Analyses**

48
49 Prevalence estimates were calculated using exact binomial confidence intervals (CI).
50 Chi-square and Fisher's Exact Tests were used to examine differences in baseline socio-
51 demographic, occupational, sexual, and alcohol/drug use exposures and prevalent HIV
52 and STI between the two cohorts. The only longitudinal data compared was HIV
53 incidence. The HIV incidence rate calculated using the number of seroconversions per
54
55
56
57
58
59
60

1 100 person-years of observation (PYO) assuming a Poisson distribution. Analyses were
2 performed using STATA 9.0 (STATA, College Station, TX).
3
4
5
6
7

8 **Results**

9
10 In YWHS-1, 285 women attended community information sessions, 161 (56%) eligible
11 women were recruited to the group information/consent meeting, and 160 (99%)
12 consented to participate. In YWHS-2, 220 (64%) women consented out of 345 who
13 attended information sessions. Sixty-seven women from YWHS-1 also enrolled in
14 YWHS-2; they were not included in the YWHS-2 comparison group, leaving 153 in the
15 analysis. Table 1 shows baseline socio-demographic and occupational factors, as well as
16 sexual and substance use risk exposures, in the two cohorts. The cohorts were similar
17 with respect to age (median 25 years), and age of sexual debut (median 17 and 18
18 years, respectively), but differed significantly in years of education and marital status.
19 Compared to women in YWHS-1, women in YWHS-2 had more education (median of 5
20 years (IQR 2,7) vs. 2 years (IQR 0,4)), and were more likely to be married or
21 cohabitating with a partner (31.4% vs. 15%, respectively).
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

38 Women in YWHS-2 had been involved in sex work for significantly less time (median of
39 3 years (IQR 1.7, 5)) than YWHS-1 women (median of 4.3 years (IQR 2.5, 6.3)). More
40 YWHS-2 women were currently (last 30 days) working in entertainment venues and
41 fewer in brothels, or as freelance FSW (including in parks, guest houses, or on the
42 street). These differences were also reflected in the significantly higher proportion of
43 YWHS-2 women who reported having a manager or boss (81.6%) compared to YWHS-1
44 (46%). Figure 1 shows the distribution and range of work venues women reported 'ever'
45 working in. Women in YWHS-2 also reported significantly fewer sexual partners in the
46 past 30 days: a median of 5 compared to 30 in YWHS-1 (Table 1). Despite these
47 differences, women in the two samples reported similar income distributions. Self-
48
49
50
51
52
53
54
55
56
57
58
59
60

1 reported consistent condom use, with both paying and non-paying partners, did not
2
3 differ between cohorts. Alcohol and ATS use differed significantly: women in YWHS-2
4
5 reported more alcohol use, but fewer days drunk in the past month than in YWHS-1;
6
7 and fewer women in YWHS-2 reported ever using ATS, although recent use was similar
8
9 in both groups (Table 1). Both alcohol and ATS use varied by cohort and work venue:
10
11 entertainment-based women in YWHS-2 reported less of both, whereas brothel and
12
13 freelance-based women in YWHS-2 reported significantly more ATS use (Figure 2).
14
15
16
17
18
19

20
21 HIV prevalence was significantly ($p < 0.01$) lower in women sampled in YWHS-2
22
23 compared to YWHS-1: 9.2% (95% CI 4.5%, 13.8%; $p < 0.01$) vs. 23% (95% CI 16.5%,
24
25 29.7%) (Table 2). When the 67 women who had participated in both samples were
26
27 included in YWHS-2, HIV prevalence was 15.5% (95% CI 10.6, 20.3). HIV incidence
28
29 was also lower in YWHS-2: 0.8/100 pyo (95% CI 0.1, 6.0) vs. 3.6/100 pyo (95% CI
30
31 1.2, 11.1), but not significantly ($p = 0.26$). In YWHS-1, prevalence of Chlamydia infection
32
33 was 11.5% (95% CI 6.0%, 17.1%) and Gonorrhoea infection was 7.8% (95% CI 3.5%,
34
35 12.3%). Women in YWHS-2 were not tested for these STI, but 41.1% were HPV. HIV
36
37 prevalence differed significantly by work venue and by cohort, but over 30% of
38
39 freelance-based women tested positive in both cohorts (Table 2).
40
41
42
43

44 In both cohorts, 20% reported being tested for HIV in the past 3 months but more
45
46 YWHS-2 women had a history of testing (Table 3). More women in YWHS-1 reported not
47
48 knowing their HIV test results: 11 of the 84 women (13.1%) who reported being
49
50 negative tested positive and 4 of 12 women (33.3%) who reported they did not know
51
52 their previous HIV results tested positive. In YWHS-2, 5 of 114 (4.4%) who reported
53
54 testing negative, and 2 of 4 (50%) who did not know their previous results, tested
55
56
57
58
59
60

1 positive. Among women who reported no history of HIV testing, 31% (18/58) and
2
3
4 12.9% (4/31) tested HIV positive in YWHS-1 and -2, respectively.
5
6
7

8 9 **Discussion**

10
11
12 In these two samples of young FSW, recruited using the same eligibility criteria and
13
14 outreach methods, we observed important differences in socio-demographics, risk
15
16 exposures and HIV infection outcomes. Most notably, women sampled more recently
17
18 were more educated, had fewer sex partners, less time working in sex work and had
19
20 significantly lower prevalence of HIV. Where women worked was also very different in
21
22 the two cohorts: a much higher proportion of women sampled in 2009-10 compared to
23
24 2007-8 worked in entertainment-based establishments and fewer were brothel-based or
25
26 freelance FSW. These differences point to the notable changes in sex work typology and
27
28 environment that occurred following the enactment and enforcement in 2008 of anti-
29
30 trafficking legislation in Cambodia¹⁶. Brothel closures and increases in policing have
31
32 been acknowledged as a cause of significant social and occupational upheaval among
33
34 FSW, driving many women, especially former brothel-based FSW, "underground".¹⁰ Both
35
36 government agencies and NGOs in Phnom Penh have reported negative impacts of the
37
38 legislation on FSW including: displacement and harassment and reduced access to
39
40 condoms and health care.^{10 20 24} In our qualitative research, women confirmed these
41
42 impacts, describing how they moved to new venues or locales for sex work transactions
43
44 including apartments or houses rented by brothel owners following brothel closures¹⁶,
45
46 raising concerns about increased risks of HIV transmission as a result of the increasingly
47
48 clandestine nature of direct sex work. The significant increases in the number of women
49
50 involved in sex work also warrant attention.
51
52
53
54
55
56
57
58
59
60

1 The differences in HIV prevalence, risk profiles, and sex work environments reported by
2 these two samples are consistent with both quantitative and qualitative research
3 demonstrating how socio-political and environmental factors can increase vulnerability
4 to HIV among FSW.⁴⁸⁻⁵¹ The time period in which these two cohorts were sampled,
5 corresponded with increased criminalization of sex work which impacted the number
6 and settings of transactional sex. These shifts can have mixed effects. First, women
7 engaged in entertainment-based work have lower risk profiles than women engaged in
8 freelance sex work.⁵ The shorter duration of sex work reported by entertainment-based
9 FSW likely contributes to the lower HIV prevalence in this group. Protective effects of
10 entertainment-based work may include having a boss or manager; odds of HIV among
11 women who say they have a boss or manager are lower compared to women who do
12 not (OR: 0.40; 95% CI 0.19, 0.90).⁵ We also explored these factors in qualitative
13 interviews with FSW.¹⁶ Brothel and entertainment-based sex workers reported that the
14 'boss/manager' mitigated risk of violence from clients and problems with police. Also,
15 women working in entertainment establishments report earning up to three times more
16 (US \$50-\$60 or in \$200,000-\$240,000 Cambodian Riel) per client than women who
17 worked in brothels or streets and parks.¹⁶ This is substantiated by the two cohorts'
18 report of similar income levels despite differences in the number of sex partners. It is
19 also possible that entertainment-based FW have lower risk partners than brothel-based
20 and freelance FSW. Despite the lower prevalence of HIV and the lower number of male
21 sex partners reported by this growing group of FSW, there is significant potential for
22 amplified transmission of HIV at a population level, given the extraordinary growth in
23 the size of the population, especially if male partners bridge to women who are not
24 involved in transactional sex.
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1 The two cohorts also showed differences in drug and alcohol use exposures. Our group
2 has identified ATS use as a significant independent risk factor for HIV related risk
3 behaviour including number of sex partners (Adjusted Risk Ratio (ARR): 1.49; 95% CI
4 1.0, 2.21) and incident STI (AOR: 5.41; 95% CI 1.15, 25.48)³⁹. Alcohol use is also
5 emerging as a potential HIV-related risk factor¹⁶, although not well quantified among
6 FSW, especially those working in entertainment establishments (or their male partners).
7 Entertainment venues largely revolve around alcohol, and women working at these are
8 generally employed as hostesses, waitresses, or as “promoters” such as “beer
9 promotion girls” in a variety of venues.^{16 21} Women who were working in the
10 entertainment sector were more likely to both report more days of drinking, and more
11 days intoxicated, than brothel or street-based FSW. Alcohol use can be a barrier to
12 effective condom use and condom negotiation in the transactional context.^{16 52} Although
13 women in the two samples did not report differences in inconsistent condom use, we
14 have previously found that women who report heavy alcohol use are also significantly
15 more likely to report inconsistent condom use.³⁹ Given how entwined drug and alcohol
16 use are with sex work, especially in the growing entertainment-based sector, there is a
17 significant need to better elucidate ways to mitigate HIV-associated risks among women
18 whose livelihood depends on working in these establishments. Designing and
19 implementing prevention in these contexts will require input, not only from working
20 women, but also from the wider business sector, as well as male clients.^{48 53-56}

21 The differences in HIV and risk profiles between the women in our two samples, as well
22 as outreach efforts by HIV prevention organizations, may be a result of reaching “low
23 hanging fruit” resulting from both substantive increases in the number of women
24 working in entertainment establishments, and the increased challenges of engaging
25 women with higher risk and who are HIV infected for the reasons described above. FSW
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1 in Phnom Penh have historically been easily accessed for prevention and surveillance
2 efforts. However, recent changes in the sex work landscape suggest that alternative
3 sampling methods, such as respondent driven sampling, may result in better access to
4 higher risk women who are more hidden and therefore hard to reach in this new legal
5 climate.⁵⁷

6
7
8
9
10
11
12
13
14
15 HIV prevention remains an important and essential priority for all women engaged in
16 transactional sex. A recent systematic review confirms that FSW in Asia have the
17 highest odds of infection compared to women of reproductive age in the general
18 population.⁵⁸ In addition to new structural interventions aimed at reducing risk in the
19 work-based environment, the very high prevalence and risk of HIV among FSW in
20 Cambodia suggests a need for combination HIV prevention interventions including
21 biomedical (pre-exposure prophylaxis, microbicides, and treatment as prevention),
22 behavioural and development approaches (such as microfinance or income generating
23 opportunities).⁵⁹⁻⁶⁴

24
25
26
27
28
29
30
31
32
33
34
35
36
37
38 Several limitations of these analyses should be noted. First results presented here are
39 cross-sectional and thus associations do not reflect causality. The comparison of the
40 serial samples is ecological in nature and does not prove temporal effects. The sample
41 sizes are small and thus subject to limitations with respect to generalizability. Many
42 exposures are self-reported and thus may reflect social desirability bias, especially
43 condom use which we have found has been over-reported based on biomarker data.⁶⁵
44
45
46
47
48
49
50
51
52 On the other hand, we have found that self-reported ATS use is accurate compared to
53 urine toxicology screening, suggesting that measures of drug and alcohol use in this
54 group are accurate.⁶⁶

1 Results from this analysis provide important insights into recent shifts in the context of
2 sex work and risk in young FSW in Phnom Penh, highlight challenges to HIV prevention
3 in this environment, and also point to the need for more research. Conflicting trends,
4 including the criminalization and suppression of direct sex work while the indirect
5 entertainment-based sex work industry is flourishing, has potentially set a new stage.
6 Unless there is acknowledgment and access to women who are more directly engaged in
7 sex work, these women will be poorly represented in any national HIV or behavioural
8 surveillance. They will remain hidden and stigmatized, subject to repression, violence
9 and potentially with less access to prevention or care. While the 100% condom use
10 program had its criticisms, that policy at least acknowledged the existence and need for
11 HIV prevention at a multisectoral level for FSW. The current socio-political climate has
12 potentially reversed these benefits, by denying the existence of FSW. Further in-depth
13 research among both FSW, their male clients and among entertainment venue
14 management would help to elucidate the impacts, both positive and negative of these
15 new laws. The exponential growth of entertainment-based sex work has the potential to
16 result in an expanding HIV epidemic among young women in Cambodia. From a
17 programmatic perspective entertainment-based FSW are much easier to reach but likely
18 require different HIV prevention interventions than the 100% condom use program.
19 Implementation of research and programmatic efforts that integrate health, social
20 empowerment, and safe work environments for HIV prevention remain a high priority
21 for women engaged in sex work in Cambodia.⁶⁷

References

1. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Annual Report 2009: National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/report.php>; Accessed July 8, 2011, 2011.
2. Saphonn V, Sopheab H, Sun LP, Vun MC, Wantha SS, Gorbach PM, et al. Current HIV/AIDS/STI epidemic: intervention programs in Cambodia, 1993-2003. *AIDS Educ Prev* 2004;16(3 Suppl A):64-77.
3. NCHADS. Behavioral Sentinel Surveillance 2010. *Cambodia National Center for HIV, AIDS, Dermatology and STD Dissemination Conference, December 30, 2010* 2011.
4. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Estimation of the HIV prevalence among the general population in Cambodia. : National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/index.php?id=20&event=146> Accessed July 8, 2011, 2011.
5. Couture MC, Sansothy N, Saphonn V, Phal S, Sichan K, Stein E, et al. Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine-type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis* 2011;38(1):33-9.
6. Sopheab H, Saphonn V, Chhea C, Fylkesnes K. Distribution of HIV in Cambodia: findings from the first national population survey. *AIDS* 2009;23(11):1389-95.
7. Sopheab H, Morineau G, Neal JJ, Saphonn V, Fylkesnes K. Sustained high prevalence of sexually transmitted infections among female sex workers in Cambodia: high turnover seriously challenges the 100% Condom Use Programme. *BMC Infect Dis* 2008;8:167.
8. Sopheab H, Gorbach PM, Gloyd S, Leng HB. Rural sex work in Cambodia: work characteristics, risk behaviours, HIV, and syphilis. *Sex Transm Infect* 2003;79(4):e2.
9. Saphonn V, Parekh BS, Dobbs T, Mean C, Bun LH, Ly SP, et al. Trends of HIV-1 Seroincidence Among HIV-1 Sentinel Surveillance Groups in Cambodia, 1999-2002. *J Acquir Immune Defic Syndr* 2005;39(5):587-92.
10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012.
11. UNAIDS. HIV in Asia and the Pacific: Getting to Zero. http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/20110826_APGettingToZero_en.pdf 2011;Accessed December 20, 2011.
12. Samnang P, Leng HB, Kim A, Canchola A, Moss A, Mandel JS, et al. HIV prevalence and risk factors among fishermen in Sihanouk Ville, Cambodia. *Int J STD AIDS* 2004;15(7):479-83.
13. Nishigaya K. Female garment factory workers in Cambodia: migration, sex work and HIV/AIDS. *Women Health* 2002;35(4):27-42.
14. Patterson D. Southeast Asia: national policy audits on HIV and migration. *HIV AIDS Policy Law Rev* 2005;10(3):31, 33.
15. Hor LB, Detels R, Heng S, Mun P. The role of sex worker clients in transmission of HIV in Cambodia. *Int J STD AIDS* 2005;16(2):170-4.

16. Maher L, Mooney-Somers J, Phlong P, Couture MC, Stein E, Evans J, et al. Selling sex in unsafe spaces: Sex work risk environments in Phnom Penh, Cambodia. *Harm Reduct J* 2011;8(1):30.
17. Plummer R. The sex industry in Cambodia: the traffic police. . *The Economist* June 11, 2009.
18. UNIAP. United Nations Inter-Agency Project on Human Trafficking (Phase III). Cambodia: Exodus to the sex trade? Effects of the global financial crisis on women's working conditions and opportunities. *Report* http://www.no-trafficking.org/reports_docs/siren/siren_cb-04.pdf; Accessed August 31, 2009.
19. UNAIDS pr. More women in Cambodia turning to sex trade amid financial crisis – UN report. <http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking&Cr1=> 2009.
20. KHANA. Mapping the pattern of sex workers, entertainment establishments, and men who have sex with men in Cambodia. Accessed July 9, 2011. Report by Hor Bun Leng, M.D, and Tuot Sovaranny, March. 2008.
21. Kim AA, Sun LP, Chhorvann C, Lindan C, Van Griensven F, Kilmarx PH, et al. High prevalence of HIV and sexually transmitted infections among indirect sex workers in Cambodia. *Sex Transm Dis* 2005;32(12):745-51.
22. Gorbach PM, Sopheab H, Chhorvann C, Weiss RE, Vun MC. Changing behaviors and patterns among Cambodian sex workers: 1997-2003. *Journal of Acquired Immune Deficiency Syndromes* 2006;42(2):242-7.
23. Ghys PD, Jenkins C, Pisani E. HIV surveillance among female sex workers. *Aids* 2001;15 Suppl 3:S33-40.
24. Francis C. HIV prevention and anti-trafficking in conflict? The public health consequences of Cambodia's fight against trafficking. FHI (in collaboration with PSI, Care, UNAIDS); December 2008.
25. FHI. SMARTgirl Program to Reduce Risk and Inspire Behavior Change. . http://www.fhi.org/en/CountryProfiles/Cambodia/res_SMARTgirl.htm Accessed July 15th, 2011.
26. Burke KP, Munshaw S, Osburn WO, Levine J, Liu L, Sidney J, et al. Immunogenicity and cross-reactivity of a representative ancestral sequence in hepatitis C virus infection. *J Immunol* 2012;188(10):5177-88.
27. Lamptey PR. Reducing heterosexual transmission of HIV in poor countries. *Bmj Clinical Research Ed.* 2002;324(7331):207-11.
28. UNODC. Patterns and Trends of Amphetamine Type Stimulants and other drugs; Asia and the Pacific. *The Global SMART Programme (Synthetics Monitoring: Analyses, Reporting, Trends)* <http://www.unodc.org/unodc/en/scientists/smart.html> (Accessed January 5, 2012) 2011.
29. Ahmad K. Increased use of amphetamine-type stimulants threatens east Asian countries. *Lancet* 2002;359(9321):1927.
30. Ahmad K. Asia grapples with spreading amphetamine abuse. *Lancet* 2003;361(9372):1878-9.
31. Kulsudjarit K. Drug problem in southeast and southwest Asia. *Ann N Y Acad Sci* 2004;1025:446-57.
32. Farrell M, Marsden J, Ali R, Ling W. Methamphetamine: drug use and psychoses becomes a major public health issue in the Asia Pacific region. *Addiction* 2002;97(7):771-2.

- 1 33. Mongkolsirichaikul D, Mokkhaveva C, Ratanabanangkoon K. The incidence of
2 amphetamine use among truck drivers from various regions of Thailand. *J Med*
3 *Assoc Thai* 1988;71(9):471-4.
- 4 34. Vongsheree S, Sri-Ngam P, Ruchusatsawat N, Thaisri H, Puangtabtim W,
5 Phutiprawan T, et al. High HIV-1 prevalence among metamphetamine users in
6 central Thailand, 1999-2000. *J Med Assoc Thai* 2001;84(9):1263-7.
- 7 35. Dayrit FM, Dumlao MC. Impurity profiling of methamphetamine hydrochloride drugs
8 seized in the Philippines. *Forensic Sci Int* 2004;144(1):29-36.
- 9 36. Lin SK, Ball D, Hsiao CC, Chiang YL, Ree SC, Chen CK. Psychiatric comorbidity and
10 gender differences of persons incarcerated for methamphetamine abuse in
11 Taiwan. *Psychiatry Clin Neurosci* 2004;58(2):206-12.
- 12 37. Lua AC, Lin HR, Tseng YT, Hu AR, Yeh PC. Profiles of urine samples from
13 participants at rave party in Taiwan: prevalence of ketamine and MDMA abuse.
14 *Forensic Sci Int* 2003;136(1-3):47-51.
- 15 38. Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, Beyrer C, et al. HIV
16 prevalence and risks among injection and noninjection drug users in northern
17 Thailand: need for comprehensive HIV prevention programs. *J Acquir Immune*
18 *Defic Syndr* 2003;33(2):259-66.
- 19 39. Couture MC, Evans JL, Sothy NS, Stein ES, Sichan K, Maher L, et al. Correlates of
20 amphetamine-type stimulant use and associations with HIV-related risks among
21 young women engaged in sex work in Phnom Penh, Cambodia. *Drug Alcohol*
22 *Depend* 2012;120(1-3):119-26.
- 23 40. Melbye K, Khamboonruang C, Kunawararak P, Celentano DD, Prapamontol T, Nelson
24 KE, et al. Lifetime correlates associated with amphetamine use among northern
25 Thai men attending STD and HIV anonymous test sites. *Drug Alcohol Depend*
26 2002;68(3):245-53.
- 27 41. Sattah MV, Supawitkul S, Dondero TJ, Kilmarx PH, Young NL, Mastro TD, et al.
28 Prevalence of and risk factors for methamphetamine use in northern Thai youth:
29 results of an audio-computer-assisted self-interviewing survey with urine testing.
30 *Addiction* 2002;97(7):801-8.
- 31 42. Buavirat A, Page-Shafer K, van Griensven GJ, Mandel JS, Evans J, Chuaratanaphong
32 J, et al. Risk of prevalent HIV infection associated with incarceration among
33 injecting drug users in Bangkok, Thailand: case-control study. *BMJ*
34 2003;326(7384):308.
- 35 43. Beyrer C, Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, et al.
36 Methamphetamine users in northern Thailand: changing demographics and risks
37 for HIV and STD among treatment-seeking substance abusers. *Int J STD AIDS*
38 2004;15(10):697-704.
- 39 44. Vanichseni S, Tappero JW, Pitisuttithum P, Kitayaporn D, Mastro TD, Vimutisunthorn
40 E, et al. Recruitment, screening and characteristics of injection drug users
41 participating in the AIDS-VAX B/E HIV vaccine trial, Bangkok, Thailand. *Aids*
42 2004;18(2):311-6.
- 43 45. Maher L, Phlong P, Mooney-Somers J, Keo S, Stein E, Couture MC, et al.
44 Amphetamine-type stimulant use and HIV/STI risk behaviour among young
45 female sex workers in Phnom Penh, Cambodia. *Int J Drug Policy* 2011;22(3):203-
46 9.
- 47 46. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for
48 amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS
49 use among young female sex workers in Cambodia. *Masters Thesis for University*
50 *of California Berkeley, School of Public Health, MPH in Epidemiology and*
51 *Biostatistics. Completed May 15, 2011.*
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1 47. Chattergoon MA, Levine JS, Latanich R, Osburn WO, Thomas DL, Cox AL. High
2 plasma interleukin-18 levels mark the acute phase of hepatitis C virus infection. *J*
3 *Infect Dis* 2011;204(11):1730-40.
- 4 48. Yang C, Latkin C, Luan R, Nelson K. Condom use with female sex workers among
5 male clients in Sichuan Province, China: the role of interpersonal and venue-level
6 factors. *J Urban Health* 2010;87(2):292-303.
- 7 49. Erasquin JT, Reed E, Blankenship KM. Police-related experiences and HIV risk
8 among female sex workers in Andhra Pradesh, India. *J Infect Dis* 2011;204 Suppl
9 5:S1223-8.
- 10 50. Shannon K, Kerr T, Allinott S, Chettiar J, Shoveller J, Tyndall MW. Social and
11 structural violence and power relations in mitigating HIV risk of drug-using
12 women in survival sex work. *Soc Sci Med* 2008;66(4):911-21.
- 13 51. Shannon K, Kerr T, Strathdee SA, Shoveller J, Montaner JS, Tyndall MW. Prevalence
14 and structural correlates of gender based violence among a prospective cohort of
15 female sex workers. *BMJ* 2009;339:b2939.
- 16 52. Kalichman SC, Simbayi LC, Kaufman M, Cain D, Jooste S. Alcohol use and sexual
17 risks for HIV/AIDS in sub-Saharan Africa: systematic review of empirical findings.
18 *Prev Sci* 2007;8(2):141-51.
- 19 53. Morisky DE, Chiao C, Ksobiech K, Malow RM. Reducing alcohol use, sex risk
20 behaviors, and sexually transmitted infections among Filipina female bar workers:
21 effects of an ecological intervention. *J Prev Interv Community* 2010;38(2):104-
22 17.
- 23 54. Surratt HL, Inciardi JA. An effective HIV risk-reduction protocol for drug-using
24 female sex workers. *J Prev Interv Community* 2010;38(2):118-31.
- 25 55. Argento E, Reza-Paul S, Lorway R, Jain J, Bhagya M, Fathima M, et al. Confronting
26 structural violence in sex work: lessons from a community-led HIV prevention
27 project in Mysore, India. *Aids Care* 2011;23(1):69-74.
- 28 56. Reza-Paul S, Beattie T, Syed HU, Venukumar KT, Venugopal MS, Fathima MP, et al.
29 Declines in risk behaviour and sexually transmitted infection prevalence following
30 a community-led HIV preventive intervention among female sex workers in
31 Mysore, India. *Aids* 2008;22 Suppl 5:S91-100.
- 32 57. Johnston LG, Sabin K, Mai TH, Pham TH. Assessment of respondent driven sampling
33 for recruiting female sex workers in two Vietnamese cities: reaching the unseen
34 sex worker. *J Urban Health* 2006;83(6 Suppl):i16-28.
- 35 58. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV
36 among female sex workers in low-income and middle-income countries: a
37 systematic review and meta-analysis. *Lancet Infect Dis* 2012;12(7):538-49.
- 38 59. Merson M, Padian N, Coates TJ, Gupta GR, Bertozzi SM, Piot P, et al. Combination
39 HIV prevention. *Lancet* 2008;372(9652):1805-6.
- 40 60. Abdool Karim Q, Abdool Karim SS, Frohlich JA, Grobler AC, Baxter C, Mansoor LE, et
41 al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the
42 prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.
- 43 61. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure
44 chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J*
45 *Med* 2010;363(27):2587-99.
- 46 62. Dworkin SL, Blankenship K. Microfinance and HIV/AIDS prevention: assessing its
47 promise and limitations. *AIDS Behav* 2009;13(3):462-9.
- 48 63. Pronyk PM, Kim JC, Abramsky T, Phetla G, Hargreaves JR, Morison LA, et al. A
49 combined microfinance and training intervention can reduce HIV risk behaviour in
50 young female participants. *AIDS* 2008;22(13):1659-65.
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
64. Rosenberg MS, Seavey BK, Jules R, Kershaw TS. The Role of a Microfinance Program on HIV Risk Behavior Among Haitian Women. *AIDS Behav* 2011;15(5):911-8.
65. Evans J, Couture M-C, Stein ES, Sansothy N, Maher L, Page K, et al. Biomarker validation of recent unprotected sexual intercourse in a prospective study of young women engaged in sex work in Phnom Penh, Cambodia. *STD* in press.
66. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS use among young female sex workers in Cambodia. . *Addiction Science & Clinical Practice* 2012;7:11-25.
67. Tucker JD, Tuminez AS. Reframing the interpretation of sex worker health: a behavioral-structural approach. *J Infect Dis* 2011;204 Suppl 5:S1206-10.

Table 1: Selected socio-demographic characteristics, occupational, and risk exposures in two cohorts of high risk young women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2 N=153*		p-value
	Prevalence of characteristic		Prevalence of characteristic		
	N	%	N	%	
Age (years, median (IQR))	25 (21 – 27)		25 (22 – 28)		0.56
16-18	13	8.1	11	7.2	0.86
19-24	64	40.0	58	37.9	
25-29	83	51.8	84	54.9	
Marital status					
Never married	57	35.6	38	24.8	<0.01
Married-living together	24	15.0	48	31.4	
Widowed/Divorced/Separated	79	49.4	67	43.8	
Education (years)					
None	64	40.0	23	15.0	<0.01
Primary (1-6 years)	82	51.3	91	59.5	
Secondary (7+ years)	14	8.8	39	25.5	
Age at first sex (median (IQR))	17 (16 – 18)		18 (16 – 19)		0.03
≤ 15	32	20.1	22	14.5	0.19
> 15	127	79.9	130	85.5	
Length of employment as FSW (years, median (IQR))	4.3 (2.5 – 6.3)		3 (1.7 – 5)		<0.01
Current employment venue (last 30 days)					
Entertainment	51	31.9	113	74.3	<0.01†
Brothel	23	9.2	3	2.0	
Freelance	59	39.3	29	19.1	
Other/Multiple	27	16.9	7	4.6	
Have a manager, boss or supervisor					
No	82	53.6	28	14.4	<0.01
Yes	71	46.4	124	81.6	
Income in past month (US \$)					
Less than \$100	68	42.5	50	32.9	0.18
100-150\$	35	21.9	43	29.3	

Over 150\$	57	35.6	59	38.8	
Number of sex partners in last month (median (IQR))	30 (10 – 90)		5 (3 – 13)		<0.01
≤10	45	28.1	112	73.2	<0.01
11 – 50	53	33.1	41	26.8	
> 50	62	38.8	0	0	
Condom use with last paying partner					
Consistent (always)	108	85.7	86	87.8	0.66
Inconsistent	18	14.3	12	12.2	
Condom use with last non paying partner					
Consistent (always)	7	20.6	10	18.2	0.78
Inconsistent	27	79.4	45	81.8	
Number of days drink alcohol (last month)	15 (2 – 30)		18 (5 – 28)		0.76
0 – 4	65	40.6	36	23.5	<0.01
5 – 19	25	15.6	42	27.5	
≥ 20	70	43.7	75	49.0	
Number of days drunk (last month)	5 (1 – 20)		3 (1 – 10)		0.07
0 – 4	89	55.6	86	56.2	<0.01
5 – 19	33	20.6	50	32.7	
≥ 20	38	23.7	17	11.1	
ATS use (ever)					
No	92	57.5	107	69.9	0.02
Yes	68	42.5	46	30.1	
ATS use (last 3 months)					
No	116	73.4	117	76.5	0.54
Yes	42	26.6	36	23.5	
Ever used any drug prior to/during sex					
No	109	68.1	117	76.5	0.10
Yes	51	31.9	36	23.5	

* Excludes women who participated in YWHS-1

†Fisher Exact p-value

Table 2: HIV prevalence overall and by current work venue in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	% (95% CI)	N	%	
HIV positive	37	23.1 (16.5 – 29.7)	14	9.2 (4.5 – 13.8)	<0.01
HIV positive by employment venue (n/N)					
Entertainment	5/51	9.8 (1.5 – 18.1)	5/113	4.4 (0.6 – 8.2)	<0.01
Brothel	4/23	17.4 (1.5 – 33.3)	0/3	0	
Freelance	22/59	37.3 (25.0 – 48.0)	9/29	31.0 (13.8 – 48.2)	
Other/Multiple	6/27	22.2 (6.2 – 38.3)	0/7	0	

* Excludes women who participated in YWHS-1

Table 3: HIV testing history and behaviors in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	%	N	%	
Ever tested for HIV					
No	58	36.5	31	20.3	<0.01
Yes	101	63.5	122	79.7	
HIV test in last 3 months					
No	126	79.3	119	77.8	0.75
Yes	33	20.7	34	22.2	
What was result of last HIV test?#					
Negative	84	84.0	114	93.4	0.04
Positive	4	4.0	4	3.3	
Don't know	12	12.0	4	3.3	
Where received last HIV test#					
Public hospital	35	34.7	55	34.0	0.10
Voluntary testing and counseling center	1	1.0	0	0	
NGO clinic	59	58.4	54	44.3	
Private hospital, clinic, or laboratory	6	5.9	13	10.7	

* Excludes women who participated in YWHS-1

Among those who reported being previously tested for HIV

Figure Legend

Figure 1: Venues where women in YWHS-2 and YWHS-2 reported ever working

Figure 2. Alcohol use in the past month and ATS use in the past 3 months reported by women in YWHS-1 and YWHS-2 by work venue: (A) Entertainment-based; (B) Brothel-based; (C) Freelance

For peer review only

1 Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high
2 risk young women in Phnom Penh, Cambodia
3
4
5
6
7
8
9

10 Kimberly Page, Ph.D.¹, Ellen Stein, MPH¹, Neth Sansothy, M.D.², Jennifer Evans, M.S.¹,
11 Marie-Claude Couture, Ph.D.¹, Keo Sichan³, Melissa Cockroft, BA^{3*}, Julie Mooney-
12 Somers, Ph.D.^{4, 5}, Pisith Phlong, M.A.⁶, John Kaldor, Ph.D.⁴, Lisa Maher Ph.D.⁴, (on
13 behalf of the Young Women's Health Study Collaborative: John Kaldor, Ph.D.⁴, Serey
14 Phal Kien³, Kimberly Page, Ph.D.¹, Joel M. Palefsky M.D.⁷, Vonthanak Saphonn, M.D.²,
15 Mean Chhi Vun, M.D.²).
16
17
18
19
20
21
22
23
24
25
26
27
28

- 29 1. University of California San Francisco, Department of Epidemiology and Biostatistics;
30 San Francisco, and Global Health Sciences, 50 Beale St., 12th Floor, San Francisco, CA,
31 94105; USA
32
33
- 34 2. National Center for HIV/AIDS, Dermatology and STDs (NCHADS), #245H, Street 6A,
35 Phum Kean Khlang, Sangkat Prekleap Russey Keo, Phnom Penh, Cambodia
36
37
- 38 3. Cambodian Women's Development Association (CWDA); No. 19, Street 242, Boeung
39 Prolit, Khan 7 Makara, Phnom Penh, Cambodia
40
41
- 42 4. The Kirby Institute (formerly the National Centre in HIV Epidemiology and Clinical
43 Research); University of New South Wales, CFI building, corner of West and Boundary
44 Streets, Darlinghurst, NSW 2010, Australia
45
46
- 47 5. The Centre for Values, Ethics and the Law in Medicine, The University of Sydney
48 Level 1 of the Medical Foundation Building, 92-94 Parramatta Road, Camperdown, NSW,
49 Australia
50
51
- 52 6. Royal University of Fine Arts, 72 Street 19, Phnom Penh, Cambodia.
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

7. University of California San Francisco, Department of Medicine; 513 Parnassus Ave,
Med Sci S-420; UCSF, San Francisco, San Francisco, CA. 94143 - 0654

*Melissa Cockroft is currently at Marie Stopes International in Phnom Pehn, Cambodia

Address correspondence to:

Kimberly Page, Ph.D., MPH, Dept. of Epidemiology and Biostatistics, Global Health
Sciences, University of California San Francisco, CA 94105; 50 Beale St., 12th Floor, San
Francisco, CA USA, 94105. kpage@psg.ucsf.edu

Word count: Abstract: 296; Text 3444; 3 Tables, 2 Figures.

Key words: Cambodia, female sex workers, HIV, STI, risk, amphetamine-type
stimulant, alcohol, policy effects

Short title: HIV infection and risk in two samples of FSW in Phnom Penh, Cambodia

Abstract

Objectives: HIV prevalence among Cambodian female sex workers (FSW) is among the highest in Southeast Asia. We describe HIV prevalence and associated risk exposures in FSW sampled serially in Phnom Penh, Cambodia (Young Women's Health Study (YWHS), before and after the implementation of a new law designed to combat human trafficking and sexual exploitation.

Design: Cross-sectional analysis of baseline data from two prospective cohorts.

Setting: Community-based study in Phnom Penh, Cambodia.

Participants: Women aged 15-29 years, reporting ≥ 2 sexual partners in the last month and/or engaged in transactional sex in the last 3 months, were enrolled in the studies in 2007 (N=161; YWHS-1), and 2009 (N=220; YWHS-2) following information sessions where 285 and 345 women attended.

Primary outcomes: HIV prevalence, sexual risk behaviour, amphetamine-type stimulant (ATS) and alcohol use, and work-related factors were compared the two groups, enrolled before and after implementation of the new law.

Results: Participants and in the two cohorts were similar in age (median 25 years), but YWHS-2 women reported fewer sex partners, more alcohol use, and less ATS use. A higher proportion of YWHS-2 compared to YWHS-1 women worked in entertainment-based venues (68% vs. 31%, respectively). HIV prevalence was significantly lower in the more recently sampled women: 9.2% (95% CI 4.5, 13.8) vs. 23% (95% CI 16.5, 29.7).

Conclusions: Sex work context and risk has shifted among young FSW in Phnom Penh, following implementation of anti-prostitution and anti-trafficking laws. While both cohorts were recruited using the same eligibility criteria, more recently sampled women had lower prevalence of sexual risk and HIV infection. Women engaged more directly in transactional sex have become harder to sample and access. Future prevention

1 research and programs need to consider how new policies and demographic changes in
2
3
4 FSW impact HIV transmission.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Article summary

Article Focus

- HIV prevalence and incidence in two serial samples of young female sex workers in Phnom Penh, Cambodia (2007-2008, and 2009-2010);
- Comparison of baseline risk and HIV outcomes, including sexual behavior, drug and alcohol use in the two cohorts sampled before and after implementation of anti-trafficking and sexual exploitation laws in 2008;
- Impact of anti-trafficking and sexual exploitation legislation on female sex workers and HIV risk.

Key Messages

- Women sampled using the same eligibility criteria and outreach methods in differed with respect to risk exposures and HIV outcomes;
- Changes in sex work typology and environment are evident after enactment of the anti-trafficking laws, including very few brothel-based FSW and significantly more FSW based in the entertainment sector;
- Shifts in the context of sex work and risk highlight the ongoing need and challenges for HIV and drug prevention for young women engaged in sex work.

Strengths and Limitations

- Two comparably sampled groups of young FSW suggest changing trends in HIV risk;
- Comparison of cross-sectional samples is ecological and does not prove temporal effects;
- Criminalization and suppression of sex work and a flourishing entertainment-based sex work industry set new and conflicting stage for HIV prevention.

1 Author Contributions: All authors contributed to the design and implementation of the
2
3 YWHS-1 and -2 studies. Authors KP, ES, JE, and LM compiled the first draft of the
4
5 manuscript, which was reviewed by NS, M-CC, KS, MC, JM_S, PP, JK. The primary
6
7 statistical analysis was conducted by JE and M-CC; KS and MC provided supplemental
8
9 data review, and KP reviewed all data analyses. All authors contributed to and have
10
11 approved the final manuscript. The YWHS Collaborative is a steering committee who
12
13 reviewed and approved the study protocols, and provided expertise into some or all of
14
15 the studies' methods and implementation.
16
17
18
19
20
21

22 Data Sharing: no additional data available.
23
24
25
26

27 Funding sources and conflicts of interest: The Young Women's Health Study-1 and
28
29 YWHS-2 were supported by Awards 1R21DA025441 from the National Institute on Drug
30
31 Abuse, and R01NR010995 from the National Institute of Nursing Research. M-C Couture
32
33 was also supported by the Canadian Institutes of Health Research (postdoctoral
34
35 fellowship award). Professors Lisa Maher and John Kaldor are supported by Australian
36
37 National Health and Medical Research Council (NHMRC) Research Fellowship. The Kirby
38
39 Institute is affiliated with the Faculty of Medicine, University of New South Wales and is
40
41 funded by the Australian Government Department of Health and Ageing. The content is
42
43 solely the responsibility of the authors and does not necessarily represent the official
44
45 views of the National Institutes of Health, nor the Australian Government. The authors
46
47 have no conflicts to disclose.
48
49
50
51
52
53

54 Acknowledgments: The authors would like to acknowledge the coordinated efforts and
55
56 dedication of the research teams at the National Center for HIV/AIDS, Dermatology,
57
58 and STDs and the Cambodian Women's Development Agency. We are indebted to all the
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Cambodian women who agreed to participate in this study and grateful for the privilege to work with them.

For peer review only

Introduction

There have been significant declines in HIV prevalence in Cambodia since the epidemic peaked in around 2000, a success widely attributed to measurable increases in condom use, declines in the number and frequency of commercial sex transactions reported by men, access to HIV voluntary counseling & testing (VCT) and uptake of antiretroviral therapy.¹⁻³ In 2010, the National Center for HIV/AIDS, Dermatology and STDs (NCHADS) revised the national estimate of HIV prevalence to 0.8% (in 15-49 year olds), reflecting a significant decline after the peak estimate of 2.4% in 1998.⁴ However, HIV prevalence in Cambodian women, especially young women, is among the highest in Southeast Asia and heterosexual sex remains the main route of transmission.⁵⁻⁹ Since 2006, women have accounted for over half (52%) of all HIV infections in Cambodia¹⁰, higher than in Asia and the Pacific in general (35%).¹¹ Limited income generating activities, a highly mobile workforce, trafficking in women and girls and widespread transactional sex, poverty, and sexually transmitted infections (STI) have been identified as key drivers of the epidemic among female sex workers (FSW).^{1 5 6 10 12-15} As in many countries, FSW in Cambodia can be hard to reach and difficult to provide prevention services to. In recent years significant economic and policy changes have affected the sex work landscape, with notable shifts in sex work venues, typologies, and more women engaged in transactional sex than ever before.¹⁶⁻²⁰

Until 2008, FSW in Cambodia were categorized as "direct" and were mostly brothel-based, or "indirect". Indirect FSW were distinguished from direct FSW, generally working in entertainment establishments as beer promotion girls, waitresses, hostesses, or karaoke girls for example, and engaged in occasional transactional sex for supplementary income.²¹⁻²³ In 1997, an estimated 5,300 women worked in the entertainment/service sector and 6,000 were brothel-based FSW. [The number of](#)

1 women involved in entertainment-based sex work has grown dramatically in recent
2 years in Cambodia. Until 2008, the estimated number of women engaged in sex and
3 entertainment work was stable (12,762 women were enumerated in 2008), however by
4 2012, this had increased dramatically to an estimated 41,622 women, a more than
5 threefold increase from the 2008 estimate (NCHADS, personal communication). The
6 reasons for this growth have not been explored in detail, but may be associated with
7 changing economic factors during this time in Cambodia. Following the passage and
8 implementation of the "Law on Suppression of Human Trafficking and Sexual
9 Exploitation" in February, 2008, brothel-based sex work was banned, and the most
10 direct effect was on direct sex trade, which went "underground", or women moved into
11 indirect work.¹⁰ Along with the overt enforcement against FSW, the 2008 anti-
12 trafficking legislation had other consequences. For instance, official terminology used by
13 governmental and non-governmental organizations (NGO) to describe FSW labeled all
14 women engaged in sex and entertainment work as "entertainment workers", or EW*.
15 Historically, brothel-based FSW were easily accessed and monitored for HIV prevention
16 efforts, including HIV and behavioral surveillance. NGOs working in HIV prevention
17 reported that as transactional sex was displaced to a wider range of settings, women at
18 highest risk became harder to reach for both prevention and service delivery.^{16 24 25}
19 These factors pose significant challenges to HIV prevention and threaten to undermine
20 progress achieved to date.

21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

* The term 'female sex worker' is no longer used in Cambodia. Terminology was changed in 2008 to designate high risk women working in service and entertainment venues as "entertainment workers" or EW. No new HIV surveillance data has been published on FSW, and Behavioral Surveillance Survey (BSS) methods have been changed to recognize only indirect sex workers- 'EW', and determining whether or not they are selling sex by the average number of reported sex partners per week (10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012..

1 HIV prevalence is extremely high among Cambodian FSW with prevalence among
2 younger women is particularly troubling as their infection is likely to be more recent and
3 indicative of incidence.^{5 8 9 21} A cornerstone of HIV prevention in Cambodia was the
4 100% Condom Use campaign^{26 27}, primarily directed at brothel-based FSW. With
5 changes in sex work venues, this prevention approach is likely less effective, failing to
6 reach the large number of women now engaged in transactional sex in entertainment
7 establishments. Indeed, measures of self-reported condom use have declined according
8 to monitoring data reported by UNAIDS.¹⁰ New risk factors have also emerged,
9 especially amphetamine-type stimulant (ATS) use, in the form of “yama”, (pills) and
10 “ice” (a crystalline form).²⁸⁻³⁸ ATS use is associated with increased sexual risk behavior
11 and STI incidence among these young women^{5 39}, similar to that seen in other
12 populations and locales.⁴⁰⁻⁴⁴

13 We conducted two prospective studies of high-risk young women engaged in
14 transactional sex in Phnom Penh, [the principal research questions focused on estimating
15 HIV and STI prevalence and incidence and associated risk factors](#). The first, Young
16 Women’s Health Study (YWHS-1), was conducted in 2007-2008 and the second, YWHS-
17 2, in 2009-2010.^{5 16 39 45 46} In this paper, we explore the changing HIV risk landscape by
18 comparing and contrasting the two cohorts of FSW sampled prior to, and following,
19 legislative changes designed to combat human trafficking and sexual exploitation in
20 Cambodia. [We theorize that the demographic characteristics and HIV risk of FSW has
21 shifted as a result of socio-legal changes induced by the implementation of the new
22 legislation.](#)

23 **Methods**

24 ***Study setting***

1 The YWHS-1 and YWHS-2 were both prospective studies of young women engaged in
2 sex work in Phnom Penh, Cambodia. Methods have been described in detail previously.⁵
3
4
5
6 ³⁹ Both studies were led by a multidisciplinary collaborative prevention research group
7
8 from NCHADS, the Cambodian Women's Development Association (CWDA), the
9
10 University of California in San Francisco (UCSF) in the United States, and the Kirby
11
12 Institute at the University of New South Wales (UNSW) in Australia.
13
14

15 16 17 **Study population and recruitment**

18
19 The target population in both studies was young women engaged in transactional sex in
20 Phnom Penh. Inclusion criteria were: aged 15-29 years, Khmer language
21
22 comprehension, ≥ 2 different sexual partners in the last month *or* engaged in
23
24 transactional sex (sex in exchange for money, goods, services, or drugs) within the last
25
26 three months, no plans to move in the next 12 months, biologically female, and able to
27
28 provide voluntary informed consent. YWHS-1 aimed to sample 160 women to provide
29
30 80% power to estimate a point prevalence of HIV at 15% with a 95% confidence
31
32 interval (CI) of 9.7% to 23.0%. Based on results of YWHS-1, YWHS-2 aimed to sample
33
34 220 women to detect an estimated HIV prevalence of 23% (95% CI, 17.3%, 30.5%).
35
36
37
38
39
40
41
42

43 Recruitment and enrollment procedures were the same in both studies.⁵ CWDA field
44
45 assistants provided study information and conducted eligibility screening via information
46
47 meetings in neighborhoods where sex work was prevalent. Eligible women were invited
48
49 to a community location used by various sex-worker organizations where study
50
51 information was described in more detail and [written](#) informed consent was obtained.
52
53 Enrolled participants were given appointment cards to present to the YWHS clinic field-
54
55 site and free transportation was offered. [In both studies, women were remunerated](#)
56
57 [US\\$5 at each study visit for their participation time.](#)
58
59
60

Data collection

All data collection occurred at the YWHS clinic, which was staffed by a physician, nurses, counselors and a laboratory technician. A structured questionnaire was administered in Khmer by trained interviewers. Survey items were similar in both studies, and covered socio-demographic characteristics, occupational and sexual risk history, alcohol and drug use. HIV testing was conducted at each visit. In YWHS-1, urine specimens were tested for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea* (GC). In YWHS-2, women were tested for HPV infection. STI treatment was provided at no cost, and women with HIV and HPV infection were referred to a local provider for free medical evaluation and treatment.

Laboratory testing

HIV serology was performed using two rapid tests; Uni-Gold Recombigen[™] HIV rapid HIV test (Trinity Biotech USA, Jamestown, NY) and the Clairview HIV 1/2 STAT-PAK (Inverness Medical Diagnostics, Waltham, MA). HIV positive and discordant samples were confirmed by HIV-1 immunoblot. CT and GC were assessed from urine samples using BDProbeTec[™] strand displacement amplification assay (Becton Dickinson, Sparks, MD) at the NCHADS STD laboratory.⁵ Cervical specimens for HPV testing were collected using a standard cytobrush.⁴⁷ Client-centered risk reduction counseling was provided in association with all testing.

Ethical review

The study protocols were reviewed and approved by Institutional Review Board of the Committee on Human Research at UCSF, the Cambodian National Ethics Committee, and the University of New South Wales Human Research Ethics Committee in

1 accordance with ethical standards (institutional and national) and with the Helsinki
2
3 Declaration of 1975, as revised in 2000.
4
5
6
7

8 **Measures**

9
10 Both studies aimed to estimate HIV infection, ATS use, and sexual risk behavior and
11 included questions on sociodemographic factors, work history, income, and duration of
12 sex work, and whether they currently had an employer (manager, boss or supervisor).
13
14 Women were asked if they had ever and/or were currently working: as a beer promoter,
15 in a beer garden, as a waitress or hostess in a karaoke bar, nightclub or snooker bar, in
16 a massage parlor, brothel, as a freelance sex worker using space at a brothel, as a
17 freelance sex worker in the park or on the street, or to specify 'other' location. They
18 were asked about age at first sex, number of partners (last month) and condom use
19 with last partners (paying and non-paying). Paying partners were defined as male
20 clients with whom respondents traded sex for money, goods or drugs. Condom use was
21 classified as "consistent" if the participant reported always using a condom. Participants
22 were asked about the number of days in which alcohol was drunk and the number of
23 days in which they were "affected" by alcohol or were "drunk" in the past month. ATS
24 use (ever and last 3 months) was assessed with questions regarding use of *yama* and
25 crystal (ice).
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

47 **Analyses**

48
49 Prevalence estimates were calculated using exact binomial confidence intervals (CI).
50
51 Chi-square and Fisher's Exact Tests were used to examine differences in baseline socio-
52 demographic, occupational, sexual, and alcohol/drug use exposures and prevalent HIV
53 and STI between the two cohorts. The only longitudinal data compared was HIV
54 incidence. The HIV incidence rate calculated using the number of seroconversions per
55
56
57
58
59
60

1 100 person-years of observation (PYO) assuming a Poisson distribution. Analyses were
2 performed using STATA 9.0 (STATA, College Station, TX).
3
4
5
6
7

8 **Results**

9
10 In YWHS-1, 285 women attended community information sessions, 161 (56%) eligible
11 women were recruited to the group information/consent meeting, and 160 (99%)
12 consented to participate. In YWHS-2, 220 (64%) women consented out of 345 who
13 attended information sessions. Sixty-seven women from YWHS-1 also enrolled in
14 YWHS-2; they were not included in the YWHS-2 comparison group, leaving 153 in the
15 analysis. Table 1 shows baseline socio-demographic and occupational factors, as well as
16 sexual and substance use risk exposures, in the two cohorts. The cohorts were similar
17 with respect to age (median 25 years), and age of sexual debut (median 17 and 18
18 years, respectively), but differed significantly in years of education and marital status.
19 Compared to women in YWHS-1, women in YWHS-2 had more education (median of 5
20 years (IQR 2,7) vs. 2 years (IQR 0,4)), and were more likely to be married or
21 cohabitating with a partner (31.4% vs. 15%, respectively).
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

38 Women in YWHS-2 had been involved in sex work for significantly less time (median of
39 3 years (IQR 1.7, 5)) than YWHS-1 women (median of 4.3 years (IQR 2.5, 6.3)). More
40 YWHS-2 women were currently (last 30 days) working in entertainment venues and
41 fewer in brothels, or as freelance FSW (including in parks, guest houses, or on the
42 street). These differences were also reflected in the significantly higher proportion of
43 YWHS-2 women who reported having a manager or boss (81.6%) compared to YWHS-1
44 (46%). Figure 1 shows the distribution and range of work venues women reported 'ever'
45 working in. Women in YWHS-2 also reported significantly fewer sexual partners in the
46 past 30 days: a median of 5 compared to 30 in YWHS-1 (Table 1). Despite these
47 differences, women in the two samples reported similar income distributions. Self-
48
49
50
51
52
53
54
55
56
57
58
59
60

1 reported consistent condom use, with both paying and non-paying partners, did not
2
3 differ between cohorts. Alcohol and ATS use differed significantly: women in YWHS-2
4
5 reported more alcohol use, but fewer days drunk in the past month than in YWHS-1;
6
7 and fewer women in YWHS-2 reported ever using ATS, although recent use was similar
8
9 in both groups (Table 1). Both alcohol and ATS use varied by cohort and work venue:
10
11 entertainment-based women in YWHS-2 reported less of both, whereas brothel and
12
13 freelance-based women in YWHS-2 reported significantly more ATS use (Figure 2).
14
15
16
17
18
19

20
21 HIV prevalence was significantly ($p < 0.01$) lower in women sampled in YWHS-2
22
23 compared to YWHS-1: 9.2% (95% CI 4.5%, 13.8%; $p < 0.01$) vs. 23% (95% CI 16.5%,
24
25 29.7%) (Table 2). [When the 67 women who had participated in both samples were](#)
26
27 [included in YWHS-2, HIV prevalence was 15.5% \(95% CI 10.6, 20.3\).](#) HIV incidence
28
29 was also lower in YWHS-2: 0.8/100 pyo (95% CI 0.1, 6.0) vs. 3.6/100 pyo (95% CI
30
31 1.2, 11.1), but not significantly ($p = 0.26$). In YWHS-1, prevalence of Chlamydia infection
32
33 was 11.5% (95% CI 6.0%, 17.1%) and Gonorrhoea infection was 7.8% (95% CI 3.5%,
34
35 12.3%). Women in YWHS-2 were not tested for these STI, but 41.1% were HPV. HIV
36
37 prevalence differed significantly by work venue and by cohort, but over 30% of
38
39 freelance-based women tested positive in both cohorts (Table 2).
40
41
42
43

44 In both cohorts, 20% reported being tested for HIV in the past 3 months but more
45
46 YWHS-2 women had a history of testing (Table 3). More women in YWHS-1 reported not
47
48 knowing their HIV test results: 11 of the 84 women (13.1%) who reported being
49
50 negative tested positive and 4 of 12 women (33.3%) who reported they did not know
51
52 their previous HIV results tested positive. In YWHS-2, 5 of 114 (4.4%) who reported
53
54 testing negative, and 2 of 4 (50%) who did not know their previous results, tested
55
56
57
58
59
60

1 positive. Among women who reported no history of HIV testing, 31% (18/58) and
2
3
4 12.9% (4/31) tested HIV positive in YWHS-1 and -2, respectively.
5
6
7
8

9 **Discussion**

10
11
12 In these two samples of young FSW, recruited using the same eligibility criteria and
13
14 outreach methods, we observed important differences in socio-demographics, risk
15
16 exposures and HIV infection outcomes. Most notably, women sampled more recently
17
18 were more educated, had fewer sex partners, less time working in sex work and had
19
20 significantly lower prevalence of HIV. Where women worked was also very different in
21
22 the two cohorts: a much higher proportion of women sampled in 2009-10 compared to
23
24 2007-8 worked in entertainment-based establishments and fewer were brothel-based or
25
26 freelance FSW. These differences point to the notable changes in sex work typology and
27
28 environment that occurred following the enactment and enforcement in 2008 of anti-
29
30 trafficking legislation in Cambodia¹⁶. Brothel closures and increases in policing have
31
32 been acknowledged as a cause of significant social and occupational upheaval among
33
34 FSW, driving many women, especially former brothel-based FSW, "underground".¹⁰ Both
35
36 government agencies and NGOs in Phnom Penh have reported negative impacts of the
37
38 legislation on FSW including: displacement and harassment and reduced access to
39
40 condoms and health care.^{10 20 24} In our qualitative research, women confirmed these
41
42 impacts, describing how they moved to new venues or locales for sex work transactions
43
44 including apartments or houses rented by brothel owners following brothel closures¹⁶,
45
46 raising concerns about increased risks of HIV transmission as a result of the increasingly
47
48 clandestine nature of direct sex work. [The significant increases in the number of women
49
50 involved in sex work also warrant attention.](#)
51
52
53
54
55
56
57
58
59
60

1 The differences in HIV prevalence, risk profiles, and sex work environments reported by
2 these two samples are consistent with both quantitative and qualitative research
3 demonstrating how socio-political and environmental factors can increase vulnerability
4 to HIV among FSW.⁴⁸⁻⁵¹ The time period in which these two cohorts were sampled,
5 corresponded with increased criminalization of sex work which impacted the number
6 and settings of transactional sex. These shifts can have mixed effects. First, women
7 engaged in entertainment-based work have lower risk profiles than women engaged in
8 freelance sex work.⁵ The shorter duration of sex work reported by entertainment-based
9 FSW likely contributes to the lower HIV prevalence in this group. Protective effects of
10 entertainment-based work may include having a boss or manager; odds of HIV among
11 women who say they have a boss or manager are lower compared to women who do
12 not (OR: 0.40; 95% CI 0.19, 0.90).⁵ We also explored these factors in qualitative
13 interviews with FSW.¹⁶ Brothel and entertainment-based sex workers reported that the
14 'boss/manager' mitigated risk of violence from clients and problems with police. Also,
15 women working in entertainment establishments report earning up to three times more
16 (US \$50-\$60 or in \$200,000-\$240,000 Cambodian Riel) per client than women who
17 worked in brothels or streets and parks.¹⁶ This is substantiated by the two cohorts'
18 report of similar income levels despite differences in the number of sex partners. It is
19 also possible that entertainment-based FW have lower risk partners than brothel-based
20 and freelance FSW. **Despite the lower prevalence of HIV and the lower number of male
21 sex partners reported by this growing group of FSW, there is significant potential for
22 amplified transmission of HIV at a population level, given the extraordinary growth in
23 the size of the population, especially if male partners bridge to women who are not
24 involved in transactional sex.**

1 The two cohorts also showed differences in drug and alcohol use exposures. Our group
2 has identified ATS use as a significant independent risk factor for HIV related risk
3 behaviour including number of sex partners (Adjusted Risk Ratio (ARR): 1.49; 95% CI
4 1.0, 2.21) and incident STI (AOR: 5.41; 95% CI 1.15, 25.48)³⁹. Alcohol use is also
5 emerging as a potential HIV-related risk factor¹⁶, although not well quantified among
6 FSW, especially those working in entertainment establishments (or their male partners).
7 Entertainment venues largely revolve around alcohol, and women working at these are
8 generally employed as hostesses, waitresses, or as “promoters” such as “beer
9 promotion girls” in a variety of venues.^{16 21} Women who were working in the
10 entertainment sector were more likely to both report more days of drinking, and more
11 days intoxicated, than brothel or street-based FSW. Alcohol use can be a barrier to
12 effective condom use and condom negotiation in the transactional context.^{16 52} **Although**
13 **women in the two samples did not report differences in inconsistent condom use, we**
14 **have previously found** that women who report heavy alcohol use are also significantly
15 more likely to report inconsistent condom use.³⁹ Given how entwined drug and alcohol
16 use are with sex work, especially in the growing entertainment-based sector, there is a
17 significant need to better elucidate ways to mitigate HIV-associated risks among women
18 whose livelihood depends on working in these establishments. Designing and
19 implementing prevention in these contexts will require input, not only from working
20 women, but also from the wider business sector, as well as male clients.^{48 53-56}

21 The differences in HIV and risk profiles between the women in our two samples, as well
22 as outreach efforts by HIV prevention organizations, may be a result of reaching “low
23 hanging fruit” resulting from both substantive increases in the number of women
24 working in entertainment establishments, and the increased challenges of engaging
25 women with higher risk and who are HIV infected for the reasons described above. FSW

1 in Phnom Penh have historically been easily accessed for prevention and surveillance
2 efforts. However, recent changes in the sex work landscape suggest that alternative
3 sampling methods, such as respondent driven sampling, may result in better access to
4 higher risk women who are more hidden and therefore hard to reach in this new legal
5 climate.⁵⁷

6
7
8
9
10
11
12
13
14
15 HIV prevention remains an important and essential priority for all women engaged in
16 transactional sex. A recent systematic review confirms that FSW in Asia have the
17 highest odds of infection compared to women of reproductive age in the general
18 population.⁵⁸ In addition to new structural interventions aimed at reducing risk in the
19 work-based environment, the very high prevalence and risk of HIV among FSW in
20 Cambodia suggests a need for combination HIV prevention interventions including
21 biomedical (pre-exposure prophylaxis, microbicides, and treatment as prevention),
22 behavioural and development approaches (such as microfinance or income generating
23 opportunities).⁵⁹⁻⁶⁴

24
25
26
27
28
29
30
31
32
33
34
35
36
37
38 Several limitations of these analyses should be noted. First results presented here are
39 cross-sectional and thus associations do not reflect causality. The comparison of the
40 serial samples is ecological in nature and does not prove temporal effects. The sample
41 sizes are small and thus subject to limitations with respect to generalizability. Many
42 exposures are self-reported and thus may reflect social desirability bias, especially
43 condom use which we have found has been over-reported based on biomarker data.⁶⁵
44
45
46
47
48
49
50
51
52 On the other hand, we have found that self-reported ATS use is accurate compared to
53 urine toxicology screening, suggesting that measures of drug and alcohol use in this
54 group are accurate.⁶⁶

1 Results from this analysis provide important insights into recent shifts in the context of
2 sex work and risk in young FSW in Phnom Penh, highlight challenges to HIV prevention
3 in this environment, and also point to the need for more research. Conflicting trends,
4 including the criminalization and suppression of direct sex work while the indirect
5 entertainment-based sex work industry is flourishing, has potentially set a new stage.
6 Unless there is acknowledgment and access to women who are more directly engaged in
7 sex work, these women will be poorly represented in any national HIV or behavioural
8 surveillance. They will remain hidden and stigmatized, subject to repression, violence
9 and potentially with less access to prevention or care. While the 100% condom use
10 program had its criticisms, that policy at least acknowledged the existence and need for
11 HIV prevention at a multisectoral level for FSW. The current socio-political climate has
12 potentially reversed these benefits, by denying the existence of FSW. Further in-depth
13 research among both FSW, their male clients and among entertainment venue
14 management would help to elucidate the impacts, both positive and negative of these
15 new laws. The exponential growth of entertainment-based sex work has the potential to
16 result in an expanding HIV epidemic among young women in Cambodia. From a
17 programmatic perspective entertainment-based FSW are much easier to reach but likely
18 require different HIV prevention interventions than the 100% condom use program.
19 Implementation of research and programmatic efforts that integrate health, social
20 empowerment, and safe work environments for HIV prevention remain a high priority
21 for women engaged in sex work in Cambodia.⁶⁷

References

1. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Annual Report 2009: National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/report.php>; Accessed July 8, 2011, 2011.
2. Saphonn V, Sopheab H, Sun LP, Vun MC, Wantha SS, Gorbach PM, et al. Current HIV/AIDS/STI epidemic: intervention programs in Cambodia, 1993-2003. *AIDS Educ Prev* 2004;16(3 Suppl A):64-77.
3. NCHADS. Behavioral Sentinel Surveillance 2010. *Cambodia National Center for HIV, AIDS, Dermatology and STD Dissemination Conference, December 30, 2010* 2011.
4. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Estimation of the HIV prevalence among the general population in Cambodia. : National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/index.php?id=20&event=146> Accessed July 8, 2011, 2011.
5. Couture MC, Sansothy N, Saphonn V, Phal S, Sichan K, Stein E, et al. Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine-type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis* 2011;38(1):33-9.
6. Sopheab H, Saphonn V, Chhea C, Fylkesnes K. Distribution of HIV in Cambodia: findings from the first national population survey. *AIDS* 2009;23(11):1389-95.
7. Sopheab H, Morineau G, Neal JJ, Saphonn V, Fylkesnes K. Sustained high prevalence of sexually transmitted infections among female sex workers in Cambodia: high turnover seriously challenges the 100% Condom Use Programme. *BMC Infect Dis* 2008;8:167.
8. Sopheab H, Gorbach PM, Gloyd S, Leng HB. Rural sex work in Cambodia: work characteristics, risk behaviours, HIV, and syphilis. *Sex Transm Infect* 2003;79(4):e2.
9. Saphonn V, Parekh BS, Dobbs T, Mean C, Bun LH, Ly SP, et al. Trends of HIV-1 Seroincidence Among HIV-1 Sentinel Surveillance Groups in Cambodia, 1999-2002. *J Acquir Immune Defic Syndr* 2005;39(5):587-92.
10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012.
11. UNAIDS. HIV in Asia and the Pacific: Getting to Zero. http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/20110826_APGettingToZero_en.pdf 2011;Accessed December 20, 2011.
12. Samnang P, Leng HB, Kim A, Canchola A, Moss A, Mandel JS, et al. HIV prevalence and risk factors among fishermen in Sihanouk Ville, Cambodia. *Int J STD AIDS* 2004;15(7):479-83.
13. Nishigaya K. Female garment factory workers in Cambodia: migration, sex work and HIV/AIDS. *Women Health* 2002;35(4):27-42.
14. Patterson D. Southeast Asia: national policy audits on HIV and migration. *HIV AIDS Policy Law Rev* 2005;10(3):31, 33.
15. Hor LB, Detels R, Heng S, Mun P. The role of sex worker clients in transmission of HIV in Cambodia. *Int J STD AIDS* 2005;16(2):170-4.

16. Maher L, Mooney-Somers J, Phlong P, Couture MC, Stein E, Evans J, et al. Selling sex in unsafe spaces: Sex work risk environments in Phnom Penh, Cambodia. *Harm Reduct J* 2011;8(1):30.
17. Plummer R. The sex industry in Cambodia: the traffic police. . *The Economist* June 11, 2009.
18. UNIAP. United Nations Inter-Agency Project on Human Trafficking (Phase III). Cambodia: Exodus to the sex trade? Effects of the global financial crisis on women's working conditions and opportunities. Report http://www.no-trafficking.org/reports_docs/siren/siren_cb-04.pdf; Accessed August 31, 2009.
19. UNAIDS pr. More women in Cambodia turning to sex trade amid financial crisis – UN report. <http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking&Cr1=> 2009.
20. KHANA. Mapping the pattern of sex workers, entertainment establishments, and men who have sex with men in Cambodia. Accessed July 9, 2011. Report by Hor Bun Leng, M.D, and Tuot Sovaranny, March. 2008.
21. Kim AA, Sun LP, Chhorvann C, Lindan C, Van Griensven F, Kilmarx PH, et al. High prevalence of HIV and sexually transmitted infections among indirect sex workers in Cambodia. *Sex Transm Dis* 2005;32(12):745-51.
22. Gorbach PM, Sopheab H, Chhorvann C, Weiss RE, Vun MC. Changing behaviors and patterns among Cambodian sex workers: 1997-2003. *Journal of Acquired Immune Deficiency Syndromes* 2006;42(2):242-7.
23. Ghys PD, Jenkins C, Pisani E. HIV surveillance among female sex workers. *Aids* 2001;15 Suppl 3:S33-40.
24. Francis C. HIV prevention and anti-trafficking in conflict? The public health consequences of Cambodia's fight against trafficking. FHI (in collaboration with PSI, Care, UNAIDS); December 2008.
25. FHI. SMARTgirl Program to Reduce Risk and Inspire Behavior Change. . http://www.fhi.org/en/CountryProfiles/Cambodia/res_SMARTgirl.htm Accessed July 15th, 2011.
26. Burke KP, Munshaw S, Osburn WO, Levine J, Liu L, Sidney J, et al. Immunogenicity and cross-reactivity of a representative ancestral sequence in hepatitis C virus infection. *J Immunol* 2012;188(10):5177-88.
27. Lamptey PR. Reducing heterosexual transmission of HIV in poor countries. *Bmj Clinical Research Ed.* 2002;324(7331):207-11.
28. UNODC. Patterns and Trends of Amphetamine Type Stimulants and other drugs; Asia and the Pacific. *The Global SMART Programme (Synthetics Monitoring: Analyses, Reporting, Trends)* <http://www.unodc.org/unodc/en/scientists/smart.html> (Accessed January 5, 2012) 2011.
29. Ahmad K. Increased use of amphetamine-type stimulants threatens east Asian countries. *Lancet* 2002;359(9321):1927.
30. Ahmad K. Asia grapples with spreading amphetamine abuse. *Lancet* 2003;361(9372):1878-9.
31. Kulsudjarit K. Drug problem in southeast and southwest Asia. *Ann N Y Acad Sci* 2004;1025:446-57.
32. Farrell M, Marsden J, Ali R, Ling W. Methamphetamine: drug use and psychoses becomes a major public health issue in the Asia Pacific region. *Addiction* 2002;97(7):771-2.

- 1 33. Mongkolsirichaikul D, Mokkhavesa C, Ratanabanangkoon K. The incidence of
2 amphetamine use among truck drivers from various regions of Thailand. *J Med*
3 *Assoc Thai* 1988;71(9):471-4.
- 4 34. Vongsheree S, Sri-Ngam P, Ruchusatsawat N, Thaisri H, Puangtabtim W,
5 Phutiprawan T, et al. High HIV-1 prevalence among metamphetamine users in
6 central Thailand, 1999-2000. *J Med Assoc Thai* 2001;84(9):1263-7.
- 7 35. Dayrit FM, Dumlao MC. Impurity profiling of methamphetamine hydrochloride drugs
8 seized in the Philippines. *Forensic Sci Int* 2004;144(1):29-36.
- 9 36. Lin SK, Ball D, Hsiao CC, Chiang YL, Ree SC, Chen CK. Psychiatric comorbidity and
10 gender differences of persons incarcerated for methamphetamine abuse in
11 Taiwan. *Psychiatry Clin Neurosci* 2004;58(2):206-12.
- 12 37. Lua AC, Lin HR, Tseng YT, Hu AR, Yeh PC. Profiles of urine samples from
13 participants at rave party in Taiwan: prevalence of ketamine and MDMA abuse.
14 *Forensic Sci Int* 2003;136(1-3):47-51.
- 15 38. Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, Beyrer C, et al. HIV
16 prevalence and risks among injection and noninjection drug users in northern
17 Thailand: need for comprehensive HIV prevention programs. *J Acquir Immune*
18 *Defic Syndr* 2003;33(2):259-66.
- 19 39. Couture MC, Evans JL, Sothy NS, Stein ES, Sichan K, Maher L, et al. Correlates of
20 amphetamine-type stimulant use and associations with HIV-related risks among
21 young women engaged in sex work in Phnom Penh, Cambodia. *Drug Alcohol*
22 *Depend* 2012;120(1-3):119-26.
- 23 40. Melbye K, Khamboonruang C, Kunawararak P, Celentano DD, Prapamontol T, Nelson
24 KE, et al. Lifetime correlates associated with amphetamine use among northern
25 Thai men attending STD and HIV anonymous test sites. *Drug Alcohol Depend*
26 2002;68(3):245-53.
- 27 41. Sattah MV, Supawitkul S, Dondero TJ, Kilmarx PH, Young NL, Mastro TD, et al.
28 Prevalence of and risk factors for methamphetamine use in northern Thai youth:
29 results of an audio-computer-assisted self-interviewing survey with urine testing.
30 *Addiction* 2002;97(7):801-8.
- 31 42. Buavirat A, Page-Shafer K, van Griensven GJ, Mandel JS, Evans J, Chuaratanaphong
32 J, et al. Risk of prevalent HIV infection associated with incarceration among
33 injecting drug users in Bangkok, Thailand: case-control study. *BMJ*
34 2003;326(7384):308.
- 35 43. Beyrer C, Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, et al.
36 Methamphetamine users in northern Thailand: changing demographics and risks
37 for HIV and STD among treatment-seeking substance abusers. *Int J STD AIDS*
38 2004;15(10):697-704.
- 39 44. Vanichseni S, Tappero JW, Pitisuttithum P, Kitayaporn D, Mastro TD, Vimutisunthorn
40 E, et al. Recruitment, screening and characteristics of injection drug users
41 participating in the AIDS-VAX B/E HIV vaccine trial, Bangkok, Thailand. *Aids*
42 2004;18(2):311-6.
- 43 45. Maher L, Phlong P, Mooney-Somers J, Keo S, Stein E, Couture MC, et al.
44 Amphetamine-type stimulant use and HIV/STI risk behaviour among young
45 female sex workers in Phnom Penh, Cambodia. *Int J Drug Policy* 2011;22(3):203-
46 9.
- 47 46. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for
48 amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS
49 use among young female sex workers in Cambodia. *Masters Thesis for University*
50 *of California Berkeley, School of Public Health, MPH in Epidemiology and*
51 *Biostatistics. Completed May 15, 2011.*
- 52
53
54
55
56
57
58
59
60

- 1 47. Chattergoon MA, Levine JS, Latanich R, Osburn WO, Thomas DL, Cox AL. High
2 plasma interleukin-18 levels mark the acute phase of hepatitis C virus infection. *J*
3 *Infect Dis* 2011;204(11):1730-40.
- 4 48. Yang C, Latkin C, Luan R, Nelson K. Condom use with female sex workers among
5 male clients in Sichuan Province, China: the role of interpersonal and venue-level
6 factors. *J Urban Health* 2010;87(2):292-303.
- 7 49. Erausquin JT, Reed E, Blankenship KM. Police-related experiences and HIV risk
8 among female sex workers in Andhra Pradesh, India. *J Infect Dis* 2011;204 Suppl
9 5:S1223-8.
- 10 50. Shannon K, Kerr T, Allinott S, Chettiar J, Shoveller J, Tyndall MW. Social and
11 structural violence and power relations in mitigating HIV risk of drug-using
12 women in survival sex work. *Soc Sci Med* 2008;66(4):911-21.
- 13 51. Shannon K, Kerr T, Strathdee SA, Shoveller J, Montaner JS, Tyndall MW. Prevalence
14 and structural correlates of gender based violence among a prospective cohort of
15 female sex workers. *BMJ* 2009;339:b2939.
- 16 52. Kalichman SC, Simbayi LC, Kaufman M, Cain D, Jooste S. Alcohol use and sexual
17 risks for HIV/AIDS in sub-Saharan Africa: systematic review of empirical findings.
18 *Prev Sci* 2007;8(2):141-51.
- 19 53. Morisky DE, Chiao C, Ksobiech K, Malow RM. Reducing alcohol use, sex risk
20 behaviors, and sexually transmitted infections among Filipina female bar workers:
21 effects of an ecological intervention. *J Prev Interv Community* 2010;38(2):104-
22 17.
- 23 54. Surratt HL, Inciardi JA. An effective HIV risk-reduction protocol for drug-using
24 female sex workers. *J Prev Interv Community* 2010;38(2):118-31.
- 25 55. Argento E, Reza-Paul S, Lorway R, Jain J, Bhagya M, Fathima M, et al. Confronting
26 structural violence in sex work: lessons from a community-led HIV prevention
27 project in Mysore, India. *Aids Care* 2011;23(1):69-74.
- 28 56. Reza-Paul S, Beattie T, Syed HU, Venukumar KT, Venugopal MS, Fathima MP, et al.
29 Declines in risk behaviour and sexually transmitted infection prevalence following
30 a community-led HIV preventive intervention among female sex workers in
31 Mysore, India. *Aids* 2008;22 Suppl 5:S91-100.
- 32 57. Johnston LG, Sabin K, Mai TH, Pham TH. Assessment of respondent driven sampling
33 for recruiting female sex workers in two Vietnamese cities: reaching the unseen
34 sex worker. *J Urban Health* 2006;83(6 Suppl):i16-28.
- 35 58. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV
36 among female sex workers in low-income and middle-income countries: a
37 systematic review and meta-analysis. *Lancet Infect Dis* 2012;12(7):538-49.
- 38 59. Merson M, Padian N, Coates TJ, Gupta GR, Bertozzi SM, Piot P, et al. Combination
39 HIV prevention. *Lancet* 2008;372(9652):1805-6.
- 40 60. Abdool Karim Q, Abdool Karim SS, Frohlich JA, Grobler AC, Baxter C, Mansoor LE, et
41 al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the
42 prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.
- 43 61. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure
44 chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J*
45 *Med* 2010;363(27):2587-99.
- 46 62. Dworkin SL, Blankenship K. Microfinance and HIV/AIDS prevention: assessing its
47 promise and limitations. *AIDS Behav* 2009;13(3):462-9.
- 48 63. Pronyk PM, Kim JC, Abramsky T, Phetla G, Hargreaves JR, Morison LA, et al. A
49 combined microfinance and training intervention can reduce HIV risk behaviour in
50 young female participants. *AIDS* 2008;22(13):1659-65.
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
64. Rosenberg MS, Seavey BK, Jules R, Kershaw TS. The Role of a Microfinance Program on HIV Risk Behavior Among Haitian Women. *AIDS Behav* 2011;15(5):911-8.
65. Evans J, Couture M-C, Stein ES, Sansothy N, Maher L, Page K, et al. Biomarker validation of recent unprotected sexual intercourse in a prospective study of young women engaged in sex work in Phnom Penh, Cambodia. *STD* in press.
66. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS use among young female sex workers in Cambodia. . *Addiction Science & Clinical Practice* 2012;7:11-25.
67. Tucker JD, Tuminez AS. Reframing the interpretation of sex worker health: a behavioral-structural approach. *J Infect Dis* 2011;204 Suppl 5:S1206-10.

Table 1: Selected socio-demographic characteristics, occupational, and risk exposures in two cohorts of high risk young women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2 N=153*		p-value
	Prevalence of characteristic		Prevalence of characteristic		
	N	%	N	%	
Age (years, median (IQR))	25 (21 – 27)		25 (22 – 28)		0.56
16-18	13	8.1	11	7.2	0.86
19-24	64	40.0	58	37.9	
25-29	83	51.8	84	54.9	
Marital status					
Never married	57	35.6	38	24.8	<0.01
Married-living together	24	15.0	48	31.4	
Widowed/Divorced/Separated	79	49.4	67	43.8	
Education (years)					
None	64	40.0	23	15.0	<0.01
Primary (1-6 years)	82	51.3	91	59.5	
Secondary (7+ years)	14	8.8	39	25.5	
Age at first sex (median (IQR))	17 (16 – 18)		18 (16 – 19)		0.03
≤ 15	32	20.1	22	14.5	0.19
> 15	127	79.9	130	85.5	
Length of employment as FSW (years, median (IQR))	4.3 (2.5 – 6.3)		3 (1.7 – 5)		<0.01
Current employment venue (last 30 days)					
Entertainment	51	31.9	113	74.3	<0.01†
Brothel	23	9.2	3	2.0	
Freelance	59	39.3	29	19.1	
Other/Multiple	27	16.9	7	4.6	
Have a manager, boss or supervisor					
No	82	53.6	28	14.4	<0.01
Yes	71	46.4	124	81.6	
Income in past month (US \$)					
Less than \$100	68	42.5	50	32.9	0.18
100-150\$	35	21.9	43	29.3	

Over 150\$	57	35.6	59	38.8	
Number of sex partners in last month (median (IQR))	30 (10 – 90)		5 (3 – 13)		<0.01
≤10	45	28.1	112	73.2	<0.01
11 – 50	53	33.1	41	26.8	
> 50	62	38.8	0	0	
Condom use with last paying partner					
Consistent (always)	108	85.7	86	87.8	0.66
Inconsistent	18	14.3	12	12.2	
Condom use with last non paying partner					
Consistent (always)	7	20.6	10	18.2	0.78
Inconsistent	27	79.4	45	81.8	
Number of days drink alcohol (last month)	15 (2 – 30)		18 (5 – 28)		0.76
0 – 4	65	40.6	36	23.5	<0.01
5 – 19	25	15.6	42	27.5	
≥ 20	70	43.7	75	49.0	
Number of days drunk (last month)	5 (1 – 20)		3 (1 – 10)		0.07
0 – 4	89	55.6	86	56.2	<0.01
5 – 19	33	20.6	50	32.7	
≥ 20	38	23.7	17	11.1	
ATS use (ever)					
No	92	57.5	107	69.9	0.02
Yes	68	42.5	46	30.1	
ATS use (last 3 months)					
No	116	73.4	117	76.5	0.54
Yes	42	26.6	36	23.5	
Ever used any drug prior to/during sex					
No	109	68.1	117	76.5	0.10
Yes	51	31.9	36	23.5	

* Excludes women who participated in YWHS-1

†Fisher Exact p-value

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 2: HIV prevalence overall and by current work venue in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	% (95% CI)	N	%	
HIV positive	37	23.1 (16.5 – 29.7)	14	9.2 (4.5 – 13.8)	<0.01
HIV positive by employment venue (n/N)					
Entertainment	5/51	9.8 (1.5 – 18.1)	5/113	4.4 (0.6 – 8.2)	<0.01
Brothel	4/23	17.4 (1.5 – 33.3)	0/3	0	
Freelance	22/59	37.3 (25.0 – 48.0)	9/29	31.0 (13.8 – 48.2)	
Other/Multiple	6/27	22.2 (6.2 – 38.3)	0/7	0	

* Excludes women who participated in YWHS-1

Table 3: HIV testing history and behaviors in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	%	N	%	
Ever tested for HIV					
No	58	36.5	31	20.3	<0.01
Yes	101	63.5	122	79.7	
HIV test in last 3 months					
No	126	79.3	119	77.8	0.75
Yes	33	20.7	34	22.2	
What was result of last HIV test?#					
Negative	84	84.0	114	93.4	0.04
Positive	4	4.0	4	3.3	
Don't know	12	12.0	4	3.3	
Where received last HIV test#					
Public hospital	35	34.7	55	34.0	0.10
Voluntary testing and counseling center	1	1.0	0	0	
NGO clinic	59	58.4	54	44.3	
Private hospital, clinic, or laboratory	6	5.9	13	10.7	

* Excludes women who participated in YWHS-1

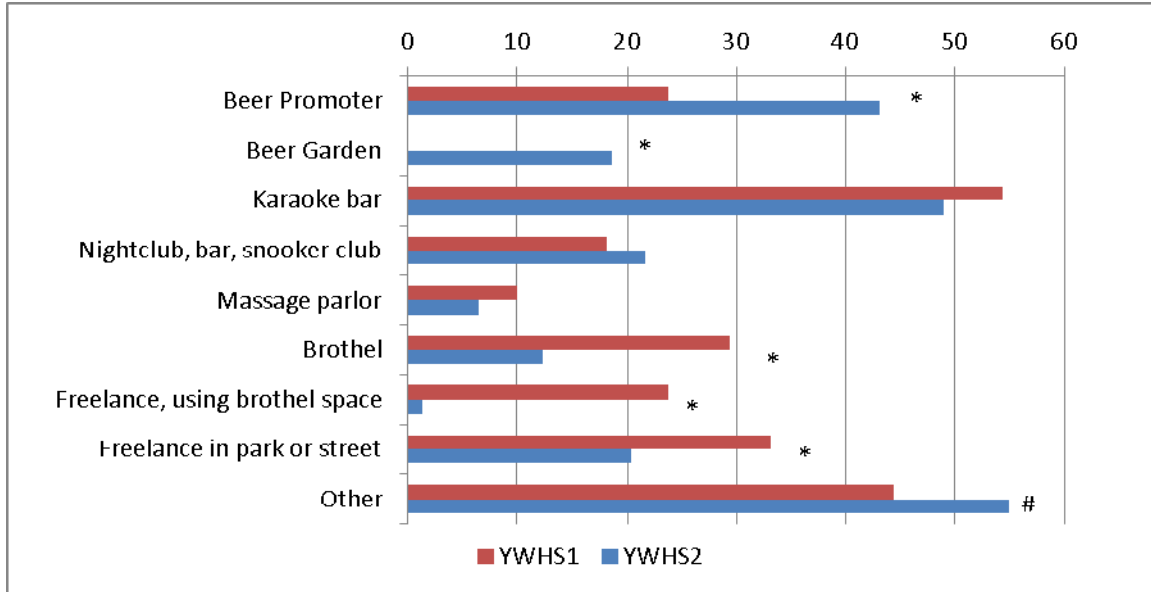
Among those who reported being previously tested for HIV

Figure Legend

Figure 1: Venues where women in YWHS-2 and YWHS-2 reported ever working

Figure 2. Alcohol use in the past month and ATS use in the past 3 months reported by women in YWHS-1 and YWHS-2 by work venue: (A) Entertainment-based; (B) Brothel-based; (C) Freelance

For peer review only



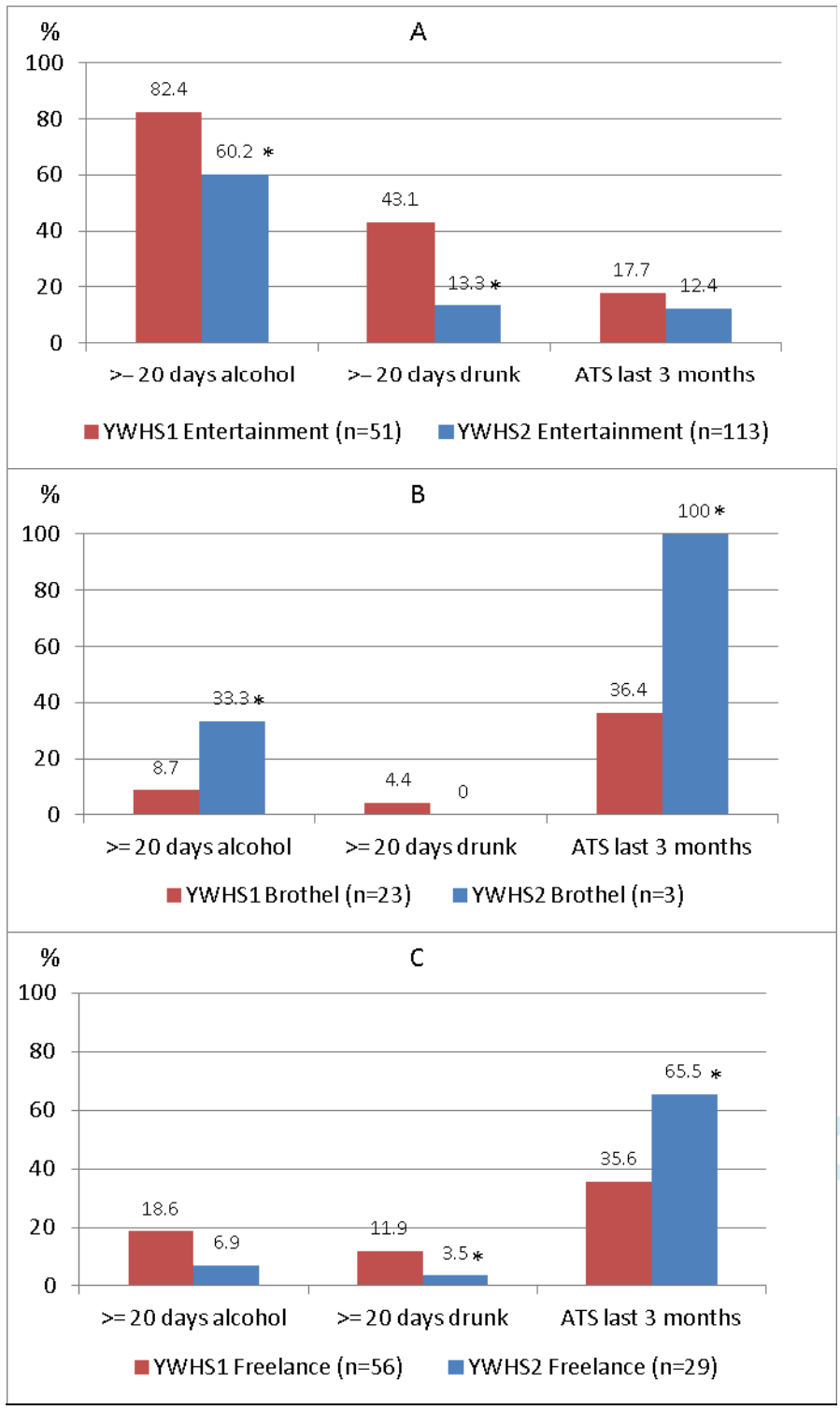
* p≤0.05; # p=0.06

Peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only



*p<0.05

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

Page et al., Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high risk young women in Phnom Penh, Cambodia

	Item No	Item, Section and PAGE NUMBER
Title and abstract	1	(a) Study's design with a commonly used terms – PAGE 1 (b) Provide in the abstract an informative and balanced summary of what was done and what was found – PAGE 3
Introduction		
Background/rationale	2	Scientific background and rationale for the investigation being reported – PAGE 7-9
Objectives	3	State specific objectives, including any prespecified hypotheses- PAGE 9
Methods		
Study design	4	Present key elements of study design early in the paper- PAGE 9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection- PAGE 9, 11
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up- PAGE 10 (b) For matched studies, give matching criteria and number of exposed and unexposed
Variables	7	Clearly define all outcomes, exposures, predictors, - PAGE 10-12
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group – PAGE 10-12
Bias	9	Describe any efforts to address potential sources of bias – NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Study size	10	Explain how the study size was arrived at – PAGE 10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why- PAGE 12
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding- PAGE 12 (b) Describe any methods used to examine subgroups and interactions- PAGE 12 (c) Explain how missing data were addressed- NA (BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (d) If applicable, explain how loss to follow-up was addressed NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (e) Describe any sensitivity analyses NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed- PAGE 12, 13 (b) Give reasons for non-participation at each stage NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (c) Consider use of a flow diagram NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders- PAGE 12, 13, and TABLE 1

		(b) Indicate number of participants with missing data for each variable of interest NA
		(c) Summarise follow-up time (eg, average and total amount) NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Outcome data	15*	Report numbers of outcome events or summary measures over time – TABLE 1 AND 2
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included. TABLES 1 AND 2 (b) Report category boundaries when continuous variables were categorized NA (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses –PAGE 13
Discussion		
Key results	18	Summarise key results with reference to study objectives – PAGE 14, 15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias – PAGE 18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence PAGE 14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results PAGE 18
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based PAGE 5

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.



Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high risk young women in Phnom Penh, Cambodia

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-003095.R2
Article Type:	Research
Date Submitted by the Author:	08-Aug-2013
Complete List of Authors:	Page, Kimberly; University of California San Francisco, Epidemiology and Biostatistics Stein, Ellen; UCSF, Epidemiology & Biostatistics Sansothy, Neth; NCHADS, Evans, Jennifer; UCSF, Epidemiology & Biostatistics Couture, Marie-Claude; UCSF, Epidemiology & Biostatistics Sichan, Keo; Cambodia Women's Development Assoc., Cockroft, Melissa; Cambodia Women's Development Assoc., Mooney-Somers, Julie; University of Sydney, Center for Values, Ethics and the Law in Medicine Phlong, Pisith; Royal University of Fine Arts, Kaldor, John; University of New South Wales, The Kirby Institute Maher, Lisa; The Kirby Institute,
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Epidemiology, Global health, HIV/AIDS, Public health
Keywords:	EPIDEMIOLOGY, HIV & AIDS < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES

SCHOLARONE™
Manuscripts

1 Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high
2 risk young women in Phnom Penh, Cambodia
3
4
5
6
7
8
9

10 Kimberly Page, Ph.D.¹, Ellen Stein, MPH¹, Neth Sansothy, M.D.², Jennifer Evans, M.S.¹,
11 Marie-Claude Couture, Ph.D.¹, Keo Sichan³, Melissa Cockroft, BA^{3*}, Julie Mooney-
12 Somers, Ph.D.^{4, 5}, Pisith Phlong, M.A.⁶, John Kaldor, Ph.D.⁴, Lisa Maher Ph.D.⁴,
13
14
15
16
17
18
19
20
21

22 Collaborators: (on behalf of the Young Women's Health Study Collaborative: John
23 Kaldor, Ph.D.⁴, Serey Phal Kien³, Kimberly Page, Ph.D.¹, Joel M. Palefsky M.D.⁷,
24 Vonthanak Saphonn, M.D.², Mean Chhi Vun, M.D.²).
25
26
27
28
29
30
31
32

- 33 1. University of California San Francisco, Department of Epidemiology and Biostatistics;
34 San Francisco, and Global Health Sciences, 50 Beale St., 12th Floor, San Francisco, CA,
35 94105; USA
- 36 2. National Center for HIV/AIDS, Dermatology and STDs (NCHADS), #245H, Street 6A,
37 Phum Kean Khlang, Sangkat Prekleap Russey Keo, Phnom Penh, Cambodia
- 38 3. Cambodian Women's Development Association (CWDA); No. 19, Street 242, Boeung
39 Prolit, Khan 7 Makara, Phnom Penh, Cambodia
- 40 4. The Kirby Institute (formerly the National Centre in HIV Epidemiology and Clinical
41 Research); University of New South Wales, CFI building, corner of West and Boundary
42 Streets, Darlinghurst, NSW 2010, Australia
- 43 5. The Centre for Values, Ethics and the Law in Medicine, The University of Sydney
44 Level 1 of the Medical Foundation Building, 92-94 Parramatta Road, Camperdown, NSW,
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1 Australia

2
3 6. Royal University of Fine Arts, 72 Street 19, Phnom Penh, Cambodia.

4
5
6 7. University of California San Francisco, Department of Medicine; 513 Parnassus Ave,
7
8 Med Sci S-420; UCSF, San Francisco, San Francisco, CA. 94143 - 0654
9

10
11
12 *Melissa Cockroft is currently at Marie Stopes International in Phnom Pehn, Cambodia
13

14
15
16
17 Address correspondence to:

18
19 Kimberly Page, Ph.D., MPH, Dept. of Epidemiology and Biostatistics, Global Health
20
21 Sciences, University of California San Francisco, CA 94105; 50 Beale St., 12th Floor, San
22
23 Francisco, CA USA, 94105. kpage@psg.ucsf.edu
24
25

26
27
28
29 Word count: Abstract: 296; Text 3444; 3 Tables, 2 Figures.
30

31
32
33 Key words: Cambodia, female sex workers, HIV, STI, risk, amphetamine-type
34
35 stimulant, alcohol, policy effects
36
37

38
39
40 Short title: HIV infection and risk in two samples of FSW in Phnom Penh, Cambodia
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Abstract

Objectives: HIV prevalence among Cambodian female sex workers (FSW) is among the highest in Southeast Asia. We describe HIV prevalence and associated risk exposures in FSW sampled serially in Phnom Penh, Cambodia (Young Women's Health Study (YWHS), before and after the implementation of a new law designed to combat human trafficking and sexual exploitation.

Design: Cross-sectional analysis of baseline data from two prospective cohorts.

Setting: Community-based study in Phnom Penh, Cambodia.

Participants: Women aged 15-29 years, reporting ≥ 2 sexual partners in the last month and/or engaged in transactional sex in the last 3 months, were enrolled in the studies in 2007 (N=161; YWHS-1), and 2009 (N=220; YWHS-2) following information sessions where 285 and 345 women attended.

Primary outcomes: HIV prevalence, sexual risk behaviour, amphetamine-type stimulant (ATS) and alcohol use, and work-related factors were compared the two groups, enrolled before and after implementation of the new law.

Results: Participants and in the two cohorts were similar in age (median 25 years), but YWHS-2 women reported fewer sex partners, more alcohol use, and less ATS use. A higher proportion of YWHS-2 compared to YWHS-1 women worked in entertainment-based venues (68% vs. 31%, respectively). HIV prevalence was significantly lower in the more recently sampled women: 9.2% (95% CI 4.5, 13.8) vs. 23% (95% CI 16.5, 29.7).

Conclusions: Sex work context and risk has shifted among young FSW in Phnom Penh, following implementation of anti-prostitution and anti-trafficking laws. While both cohorts were recruited using the same eligibility criteria, more recently sampled women had lower prevalence of sexual risk and HIV infection. Women engaged more directly in transactional sex have become harder to sample and access. Future prevention

1 research and programs need to consider how new policies and demographic changes in
2
3
4 FSW impact HIV transmission.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Article summary

Article Focus

- HIV prevalence and incidence in two serial samples of young female sex workers in Phnom Penh, Cambodia (2007-2008, and 2009-2010);
- Comparison of baseline risk and HIV outcomes, including sexual behavior, drug and alcohol use in the two cohorts sampled before and after implementation of anti-trafficking and sexual exploitation laws in 2008;
- Impact of anti-trafficking and sexual exploitation legislation on female sex workers and HIV risk.

Key Messages

- Women sampled using the same eligibility criteria and outreach methods in differed with respect to risk exposures and HIV outcomes;
- Changes in sex work typology and environment are evident after enactment of the anti-trafficking laws, including very few brothel-based FSW and significantly more FSW based in the entertainment sector;
- Shifts in the context of sex work and risk highlight the ongoing need and challenges for HIV and drug prevention for young women engaged in sex work.

Strengths and Limitations

- Two comparably sampled groups of young FSW suggest changing trends in HIV risk;
- Comparison of cross-sectional samples is ecological and does not prove temporal effects;
- Criminalization and suppression of sex work and a flourishing entertainment-based sex work industry set new and conflicting stage for HIV prevention.

1 Author Contributions: All authors contributed to the design and implementation of the
2
3 YWHS-1 and -2 studies. Authors KP, ES, JE, and LM compiled the first draft of the
4
5 manuscript, which was reviewed by NS, M-CC, KS, MC, JM_S, PP, JK. The primary
6
7 statistical analysis was conducted by JE and M-CC; KS and MC provided supplemental
8
9 data review, and KP reviewed all data analyses. All authors contributed to and have
10
11 approved the final manuscript. The YWHS Collaborative is a steering committee who
12
13 reviewed and approved the study protocols, and provided expertise into some or all of
14
15 the studies' methods and implementation.
16
17
18
19
20
21

22 Data Sharing: no additional data available.
23
24
25
26

27 Funding sources and conflicts of interest: The Young Women's Health Study-1 and
28
29 YWHS-2 were supported by Awards 1R21DA025441 from the National Institute on Drug
30
31 Abuse, and R01NR010995 from the National Institute of Nursing Research. M-C Couture
32
33 was also supported by the Canadian Institutes of Health Research (postdoctoral
34
35 fellowship award). Professors Lisa Maher and John Kaldor are supported by Australian
36
37 National Health and Medical Research Council (NHMRC) Research Fellowship. The Kirby
38
39 Institute is affiliated with the Faculty of Medicine, University of New South Wales and is
40
41 funded by the Australian Government Department of Health and Ageing. The content is
42
43 solely the responsibility of the authors and does not necessarily represent the official
44
45 views of the National Institutes of Health, nor the Australian Government. The authors
46
47 have no conflicts to disclose.
48
49
50
51
52
53

54 Acknowledgments: The authors would like to acknowledge the coordinated efforts and
55
56 dedication of the research teams at the National Center for HIV/AIDS, Dermatology,
57
58 and STDs and the Cambodian Women's Development Agency. We are indebted to all the
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Cambodian women who agreed to participate in this study and grateful for the privilege to work with them.

For peer review only

Introduction

There have been significant declines in HIV prevalence in Cambodia since the epidemic peaked in around 2000, a success widely attributed to measurable increases in condom use, declines in the number and frequency of commercial sex transactions reported by men, access to HIV voluntary counseling & testing (VCT) and uptake of antiretroviral therapy.¹⁻³ In 2010, the National Center for HIV/AIDS, Dermatology and STDs (NCHADS) revised the national estimate of HIV prevalence to 0.8% (in 15-49 year olds), reflecting a significant decline after the peak estimate of 2.4% in 1998.⁴ However, HIV prevalence in Cambodian women, especially young women, is among the highest in Southeast Asia and heterosexual sex remains the main route of transmission.⁵⁻⁹ Since 2006, women have accounted for over half (52%) of all HIV infections in Cambodia¹⁰, higher than in Asia and the Pacific in general (35%).¹¹ Limited income generating activities, a highly mobile workforce, trafficking in women and girls and widespread transactional sex, poverty, and sexually transmitted infections (STI) have been identified as key drivers of the epidemic among female sex workers (FSW).^{1 5 6 10 12-15} As in many countries, FSW in Cambodia can be hard to reach and difficult to provide prevention services to. In recent years significant economic and policy changes have affected the sex work landscape, with notable shifts in sex work venues, typologies, and more women engaged in transactional sex than ever before.¹⁶⁻²⁰

Until 2008, FSW in Cambodia were categorized as "direct" and were mostly brothel-based, or "indirect". Indirect FSW were distinguished from direct FSW, generally working in entertainment establishments as beer promotion girls, waitresses, hostesses, or karaoke girls for example, and engaged in occasional transactional sex for supplementary income.²¹⁻²³ In 1997, an estimated 5,300 women worked in the entertainment/service sector and 6,000 were brothel-based FSW. The number of

1 women involved in entertainment-based sex work has grown dramatically in recent
2 years in Cambodia. Until 2008, the estimated number of women engaged in sex and
3 entertainment work was stable (12,762 women were enumerated in 2008), however by
4 2012, this had increased dramatically to an estimated 41,622 women, a more than
5 threefold increase from the 2008 estimate (NCHADS, personal communication). The
6 reasons for this growth have not been explored in detail, but may be associated with
7 changing economic factors during this time in Cambodia. Following the passage and
8 implementation of the "Law on Suppression of Human Trafficking and Sexual
9 Exploitation" in February, 2008, brothel-based sex work was banned, and the most
10 direct effect was on direct sex trade, which went "underground", or women moved into
11 indirect work.¹⁰ Along with the overt enforcement against FSW, the 2008 anti-
12 trafficking legislation had other consequences. For instance, official terminology used by
13 governmental and non-governmental organizations (NGO) to describe FSW labeled all
14 women engaged in sex and entertainment work as "entertainment workers", or EW*.
15 Historically, brothel-based FSW were easily accessed and monitored for HIV prevention
16 efforts, including HIV and behavioral surveillance. NGOs working in HIV prevention
17 reported that as transactional sex was displaced to a wider range of settings, women at
18 highest risk became harder to reach for both prevention and service delivery.^{16 24 25}
19 These factors pose significant challenges to HIV prevention and threaten to undermine
20 progress achieved to date.

21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

* The term 'female sex worker' is no longer used in Cambodia. Terminology was changed in 2008 to designate high risk women working in service and entertainment venues as "entertainment workers" or EW. No new HIV surveillance data has been published on FSW, and Behavioral Surveillance Survey (BSS) methods have been changed to recognize only indirect sex workers- 'EW', and determining whether or not they are selling sex by the average number of reported sex partners per week (10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012..

1 HIV prevalence is extremely high among Cambodian FSW with prevalence among
2 younger women is particularly troubling as their infection is likely to be more recent and
3 indicative of incidence.^{5 8 9 21} A cornerstone of HIV prevention in Cambodia was the
4 100% Condom Use campaign^{26 27}, primarily directed at brothel-based FSW. With
5 changes in sex work venues, this prevention approach is likely less effective, failing to
6 reach the large number of women now engaged in transactional sex in entertainment
7 establishments. Indeed, measures of self-reported condom use have declined according
8 to monitoring data reported by UNAIDS.¹⁰ New risk factors have also emerged,
9 especially amphetamine-type stimulant (ATS) use, in the form of “yama”, (pills) and
10 “ice” (a crystalline form).²⁸⁻³⁸ ATS use is associated with increased sexual risk behavior
11 and STI incidence among these young women^{5 39}, similar to that seen in other
12 populations and locales.⁴⁰⁻⁴⁴

13 We conducted two prospective studies of high-risk young women engaged in
14 transactional sex in Phnom Penh, the principal research questions focused on estimating
15 HIV and STI prevalence and incidence and associated risk factors. The first, Young
16 Women’s Health Study (YWHS-1), was conducted in 2007-2008 and the second, YWHS-
17 2, in 2009-2010.^{5 16 39 45 46} In this paper, we explore the changing HIV risk landscape by
18 comparing and contrasting the two cohorts of FSW sampled prior to, and following,
19 legislative changes designed to combat human trafficking and sexual exploitation in
20 Cambodia. We theorize that the demographic characteristics and HIV risk of FSW has
21 shifted as a result of socio-legal changes induced by the implementation of the new
22 legislation.

23 **Methods**

24 ***Study setting***

1 The YWHS-1 and YWHS-2 were both prospective studies of young women engaged in
2 sex work in Phnom Penh, Cambodia. Methods have been described in detail previously.⁵
3
4
5
6 ³⁹ Both studies were led by a multidisciplinary collaborative prevention research group
7
8 from NCHADS, the Cambodian Women's Development Association (CWDA), the
9
10 University of California in San Francisco (UCSF) in the United States, and the Kirby
11
12 Institute at the University of New South Wales (UNSW) in Australia.
13
14

15 16 17 **Study population and recruitment**

18
19 The target population in both studies was young women engaged in transactional sex in
20 Phnom Penh. Inclusion criteria were: aged 15-29 years, Khmer language
21
22 comprehension, ≥ 2 different sexual partners in the last month *or* engaged in
23
24 transactional sex (sex in exchange for money, goods, services, or drugs) within the last
25
26 three months, no plans to move in the next 12 months, biologically female, and able to
27
28 provide voluntary informed consent. YWHS-1 aimed to sample 160 women to provide
29
30 80% power to estimate a point prevalence of HIV at 15% with a 95% confidence
31
32 interval (CI) of 9.7% to 23.0%. Based on results of YWHS-1, YWHS-2 aimed to sample
33
34 220 women to detect an estimated HIV prevalence of 23% (95% CI, 17.3%, 30.5%).
35
36
37
38
39
40
41
42

43 Recruitment and enrollment procedures were the same in both studies.⁵ CWDA field
44
45 assistants provided study information and conducted eligibility screening via information
46
47 meetings in neighborhoods where sex work was prevalent. Eligible women were invited
48
49 to a community location used by various sex-worker organizations where study
50
51 information was described in more detail and written informed consent was obtained.
52
53 Enrolled participants were given appointment cards to present to the YWHS clinic field-
54
55 site and free transportation was offered. In both studies, women were remunerated
56
57 US\$5 at each study visit for their participation time.
58
59
60

Data collection

All data collection occurred at the YWHS clinic, which was staffed by a physician, nurses, counselors and a laboratory technician. A structured questionnaire was administered in Khmer by trained interviewers. Survey items were similar in both studies, and covered socio-demographic characteristics, occupational and sexual risk history, alcohol and drug use. HIV testing was conducted at each visit. In YWHS-1, urine specimens were tested for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea* (GC). In YWHS-2, women were tested for HPV infection. STI treatment was provided at no cost, and women with HIV and HPV infection were referred to a local provider for free medical evaluation and treatment.

Laboratory testing

HIV serology was performed using two rapid tests; Uni-Gold Recombigen[™] HIV rapid HIV test (Trinity Biotech USA, Jamestown, NY) and the Clairview HIV 1/2 STAT-PAK (Inverness Medical Diagnostics, Waltham, MA). HIV positive and discordant samples were confirmed by HIV-1 immunoblot. CT and GC were assessed from urine samples using BDProbeTec[™] strand displacement amplification assay (Becton Dickinson, Sparks, MD) at the NCHADS STD laboratory.⁵ Cervical specimens for HPV testing were collected using a standard cytobrush.⁴⁷ Client-centered risk reduction counseling was provided in association with all testing.

Ethical review

The study protocols were reviewed and approved by Institutional Review Board of the Committee on Human Research at UCSF, the Cambodian National Ethics Committee, and the University of New South Wales Human Research Ethics Committee in

1 accordance with ethical standards (institutional and national) and with the Helsinki
2 Declaration of 1975, as revised in 2000.
3
4
5
6
7

8 **Measures**

9
10 Both studies aimed to estimate HIV infection, ATS use, and sexual risk behavior and
11 included questions on sociodemographic factors, work history, income, and duration of
12 sex work, and whether they currently had an employer (manager, boss or supervisor).
13 Women were asked if they had ever and/or were currently working: as a beer promoter,
14 in a beer garden, as a waitress or hostess in a karaoke bar, nightclub or snooker bar, in
15 a massage parlor, brothel, as a freelance sex worker using space at a brothel, as a
16 freelance sex worker in the park or on the street, or to specify 'other' location. They
17 were asked about age at first sex, number of partners (last month) and condom use
18 with last partners (paying and non-paying). Paying partners were defined as male
19 clients with whom respondents traded sex for money, goods or drugs. Condom use was
20 classified as "consistent" if the participant reported always using a condom. Participants
21 were asked about the number of days in which alcohol was drunk and the number of
22 days in which they were "affected" by alcohol or were "drunk" in the past month. ATS
23 use (ever and last 3 months) was assessed with questions regarding use of *yama* and
24 crystal (ice).
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

47 **Analyses**

48
49 Prevalence estimates were calculated using exact binomial confidence intervals (CI).
50 Chi-square and Fisher's Exact Tests were used to examine differences in baseline socio-
51 demographic, occupational, sexual, and alcohol/drug use exposures and prevalent HIV
52 and STI between the two cohorts. The only longitudinal data compared was HIV
53 incidence. The HIV incidence rate calculated using the number of seroconversions per
54
55
56
57
58
59
60

1 100 person-years of observation (PYO) assuming a Poisson distribution. Analyses were
2 performed using STATA 9.0 (STATA, College Station, TX).
3
4
5
6
7

8 **Results**

9
10 In YWHS-1, 285 women attended community information sessions, 161 (56%) eligible
11 women were recruited to the group information/consent meeting, and 160 (99%)
12 consented to participate. In YWHS-2, 220 (64%) women consented out of 345 who
13 attended information sessions. Sixty-seven women from YWHS-1 also enrolled in
14 YWHS-2; they were not included in the YWHS-2 comparison group, leaving 153 in the
15 analysis. Table 1 shows baseline socio-demographic and occupational factors, as well as
16 sexual and substance use risk exposures, in the two cohorts. The cohorts were similar
17 with respect to age (median 25 years), and age of sexual debut (median 17 and 18
18 years, respectively), but differed significantly in years of education and marital status.
19 Compared to women in YWHS-1, women in YWHS-2 had more education (median of 5
20 years (IQR 2,7) vs. 2 years (IQR 0,4)), and were more likely to be married or
21 cohabitating with a partner (31.4% vs. 15%, respectively).
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

38 Women in YWHS-2 had been involved in sex work for significantly less time (median of
39 3 years (IQR 1.7, 5)) than YWHS-1 women (median of 4.3 years (IQR 2.5, 6.3)). More
40 YWHS-2 women were currently (last 30 days) working in entertainment venues and
41 fewer in brothels, or as freelance FSW (including in parks, guest houses, or on the
42 street). These differences were also reflected in the significantly higher proportion of
43 YWHS-2 women who reported having a manager or boss (81.6%) compared to YWHS-1
44 (46%). Figure 1 shows the distribution and range of work venues women reported 'ever'
45 working in. Women in YWHS-2 also reported significantly fewer sexual partners in the
46 past 30 days: a median of 5 compared to 30 in YWHS-1 (Table 1). Despite these
47 differences, women in the two samples reported similar income distributions. Self-
48
49
50
51
52
53
54
55
56
57
58
59
60

1 reported consistent condom use, with both paying and non-paying partners, did not
2
3 differ between cohorts. Alcohol and ATS use differed significantly: women in YWHS-2
4
5 reported more alcohol use, but fewer days drunk in the past month than in YWHS-1;
6
7 and fewer women in YWHS-2 reported ever using ATS, although recent use was similar
8
9 in both groups (Table 1). Both alcohol and ATS use varied by cohort and work venue:
10
11 entertainment-based women in YWHS-2 reported less of both, whereas brothel and
12
13 freelance-based women in YWHS-2 reported significantly more ATS use (Figure 2).
14
15
16
17
18
19

20
21 HIV prevalence was significantly ($p < 0.01$) lower in women sampled in YWHS-2
22
23 compared to YWHS-1: 9.2% (95% CI 4.5%, 13.8%; $p < 0.01$) vs. 23% (95% CI 16.5%,
24
25 29.7%) (Table 2). When the 67 women who had participated in both samples were
26
27 included in YWHS-2, HIV prevalence was 15.5% (95% CI 10.6, 20.3). HIV incidence
28
29 was also lower in YWHS-2: 0.8/100 pyo (95% CI 0.1, 6.0) vs. 3.6/100 pyo (95% CI
30
31 1.2, 11.1), but not significantly ($p = 0.26$). In YWHS-1, prevalence of Chlamydia infection
32
33 was 11.5% (95% CI 6.0%, 17.1%) and Gonorrhoea infection was 7.8% (95% CI 3.5%,
34
35 12.3%). Women in YWHS-2 were not tested for these STI, but 41.1% were HPV. HIV
36
37 prevalence differed significantly by work venue and by cohort, but over 30% of
38
39 freelance-based women tested positive in both cohorts (Table 2).
40
41
42
43

44 In both cohorts, 20% reported being tested for HIV in the past 3 months but more
45
46 YWHS-2 women had a history of testing (Table 3). More women in YWHS-1 reported not
47
48 knowing their HIV test results: 11 of the 84 women (13.1%) who reported being
49
50 negative tested positive and 4 of 12 women (33.3%) who reported they did not know
51
52 their previous HIV results tested positive. In YWHS-2, 5 of 114 (4.4%) who reported
53
54 testing negative, and 2 of 4 (50%) who did not know their previous results, tested
55
56
57
58
59
60

1 positive. Among women who reported no history of HIV testing, 31% (18/58) and
2
3
4 12.9% (4/31) tested HIV positive in YWHS-1 and -2, respectively.
5
6
7

8 9 **Discussion**

10
11
12 In these two samples of young FSW, recruited using the same eligibility criteria and
13
14 outreach methods, we observed important differences in socio-demographics, risk
15
16 exposures and HIV infection outcomes. Most notably, women sampled more recently
17
18 were more educated, had fewer sex partners, less time working in sex work and had
19
20 significantly lower prevalence of HIV. Where women worked was also very different in
21
22 the two cohorts: a much higher proportion of women sampled in 2009-10 compared to
23
24 2007-8 worked in entertainment-based establishments and fewer were brothel-based or
25
26 freelance FSW. These differences point to the notable changes in sex work typology and
27
28 environment that occurred following the enactment and enforcement in 2008 of anti-
29
30 trafficking legislation in Cambodia¹⁶. Brothel closures and increases in policing have
31
32 been acknowledged as a cause of significant social and occupational upheaval among
33
34 FSW, driving many women, especially former brothel-based FSW, "underground".¹⁰ Both
35
36 government agencies and NGOs in Phnom Penh have reported negative impacts of the
37
38 legislation on FSW including: displacement and harassment and reduced access to
39
40 condoms and health care.^{10 20 24} In our qualitative research, women confirmed these
41
42 impacts, describing how they moved to new venues or locales for sex work transactions
43
44 including apartments or houses rented by brothel owners following brothel closures¹⁶,
45
46 raising concerns about increased risks of HIV transmission as a result of the increasingly
47
48 clandestine nature of direct sex work. The significant increases in the number of women
49
50 involved in sex work also warrants attention.
51
52
53
54
55
56
57
58
59
60

1 The differences in HIV prevalence, risk profiles, and sex work environments reported by
2 these two samples are consistent with both quantitative and qualitative research
3 demonstrating how socio-political and environmental factors can increase vulnerability
4 to HIV among FSW.⁴⁸⁻⁵¹ The time period in which these two cohorts were sampled,
5 corresponded with increased criminalization of sex work which impacted the number
6 and settings of transactional sex. These shifts can have mixed effects. First, women
7 engaged in entertainment-based work have lower risk profiles than women engaged in
8 freelance sex work.⁵ The shorter duration of sex work reported by entertainment-based
9 FSW likely contributes to the lower HIV prevalence in this group. Protective effects of
10 entertainment-based work may include having a boss or manager; odds of HIV among
11 women who say they have a boss or manager are lower compared to women who do
12 not (OR: 0.40; 95% CI 0.19, 0.90).⁵ We also explored these factors in qualitative
13 interviews with FSW.¹⁶ Brothel and entertainment-based sex workers reported that the
14 'boss/manager' mitigated risk of violence from clients and problems with police. Also,
15 women working in entertainment establishments report earning up to three times more
16 (US \$50-\$60 or in \$200,000-\$240,000 Cambodian Riel) per client than women who
17 worked in brothels or streets and parks.¹⁶ This is substantiated by the two cohorts'
18 report of similar income levels despite differences in the number of sex partners. It is
19 also possible that entertainment-based FW have lower risk partners than brothel-based
20 and freelance FSW. We believe that despite the lower prevalence of HIV and the lower
21 number of male sex partners reported by this growing group of FSW, there is significant
22 potential for amplified transmission of HIV at a population level, due principally to the
23 extraordinary growth in the size of the population engaged in sex work. The numbers
24 enumerated by the government, are likely to include a high proportion of entertainment-
25 based FSW who have significantly lower risk overall. But it is unclear if how well the
26 population of high risk women, those previously working in brothels, who were not
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

apparent or represented in our latter sample, are apparent in the census. These women now displaced, may or may not be counted, but are highly likely to be engaged in clandestine transactional sex, as suggested by our qualitative research. Women sampled in the YWHS-2 reflect the majority of the growing population of low risk entertainment workers: they report fewer exposures and have lower HIV prevalence, however our qualitative data also suggests that unprotected sex, length of sexual transactions, sex in risky environments may have increased^{16 45}. While we cannot establish that the criminalization of sex work causes increases in population HIV risk from this limited data, results from these studies correspond to marked shifts in the demographic and risk population that should be investigated more thoroughly.

The two cohorts also showed differences in drug and alcohol use exposures. Our group has identified ATS use as a significant independent risk factor for HIV related risk behaviour including number of sex partners (Adjusted Risk Ratio (ARR): 1.49; 95% CI 1.0, 2.21) and incident STI (AOR: 5.41; 95% CI 1.15, 25.48)³⁹. Alcohol use is also emerging as a potential HIV-related risk factor¹⁶, although not well quantified among FSW, especially those working in entertainment establishments (or their male partners). Entertainment venues largely revolve around alcohol, and women working at these are generally employed as hostesses, waitresses, or as "promoters" such as "beer promotion girls" in a variety of venues.^{16 21} Women who were working in the entertainment sector were more likely to both report more days of drinking, and more days intoxicated, than brothel or street-based FSW. Alcohol use can be a barrier to effective condom use and condom negotiation in the transactional context.^{16 52} Although women in the two samples did not report differences in inconsistent condom use, we have previously found that women who report heavy alcohol use are also significantly more likely to report inconsistent condom use.³⁹ Given how entwined drug and alcohol

1 use are with sex work, especially in the growing entertainment-based sector, there is a
2
3 significant need to better elucidate ways to mitigate HIV-associated risks among women
4
5 whose livelihood depends on working in these establishments. Designing and
6
7 implementing prevention in these contexts will require input, not only from working
8
9 women, but also from the wider business sector, as well as male clients.^{48 53-56}
10
11
12
13
14

15 The differences in HIV and risk profiles between the women in our two samples, as well
16
17 as outreach efforts by HIV prevention organizations, may be a result of reaching “low
18
19 hanging fruit” resulting from both substantive increases in the number of women
20
21 working in entertainment establishments, and the increased challenges of engaging
22
23 women with higher risk and who are HIV infected for the reasons described above. FSW
24
25 in Phnom Penh have historically been easily accessed for prevention and surveillance
26
27 efforts. However, recent changes in the sex work landscape suggest that alternative
28
29 sampling methods, such as respondent driven sampling, may result in better access to
30
31 higher risk women who are more hidden and therefore hard to reach in this new legal
32
33 climate.⁵⁷
34
35
36
37
38
39

40 HIV prevention remains an important and essential priority for all women engaged in
41
42 transactional sex. A recent systematic review confirms that FSW in Asia have the
43
44 highest odds of infection compared to women of reproductive age in the general
45
46 population.⁵⁸ In addition to new structural interventions aimed at reducing risk in the
47
48 work-based environment, the very high prevalence and risk of HIV among FSW in
49
50 Cambodia suggests a need for combination HIV prevention interventions including
51
52 biomedical (pre-exposure prophylaxis, microbicides, and treatment as prevention),
53
54 behavioural and development approaches (such as microfinance or income generating
55
56 opportunities).⁵⁹⁻⁶⁴
57
58
59
60

1
2
3
4 Several limitations of these analyses should be noted. First results presented here are
5
6 cross-sectional and thus associations do not reflect causality. The comparison of the
7
8 serial samples is ecological in nature and does not prove temporal effects. The sample
9
10 sizes are small and thus subject to limitations with respect to generalizability. Many
11
12 exposures are self-reported and thus may reflect social desirability bias, especially
13
14 condom use which we have found has been over-reported based on biomarker data.⁶⁵
15
16 On the other hand, we have found that self-reported ATS use is accurate compared to
17
18 urine toxicology screening, suggesting that measures of drug and alcohol use in this
19
20 group are accurate.⁶⁶
21
22
23
24
25
26

27 Results from this analysis provide important insights into recent shifts in the context of
28
29 sex work and risk in young FSW in Phnom Penh, highlight challenges to HIV prevention
30
31 in this environment, and also point to the need for more research. Conflicting trends,
32
33 including the criminalization and suppression of direct sex work while the indirect
34
35 entertainment-based sex work industry is flourishing, has potentially set a new stage.
36
37 Unless there is acknowledgment and access to women who are more directly engaged in
38
39 sex work, these women will be poorly represented in any national HIV or behavioural
40
41 surveillance. They will remain hidden and stigmatized, subject to repression, violence
42
43 and potentially with less access to prevention or care. While the 100% condom use
44
45 program had its criticisms, that policy at least acknowledged the existence and need for
46
47 HIV prevention at a multisectoral level for FSW. The current socio-political climate has
48
49 potentially reversed these benefits, by denying the existence of FSW. Further in-depth
50
51 research among both FSW, their male clients and among entertainment venue
52
53 management would help to elucidate the impacts, both positive and negative of these
54
55 new laws. The exponential growth of entertainment-based sex work has the potential to
56
57
58
59
60

1 result in an expanding HIV epidemic among young women in Cambodia. From a
2
3 programmatic perspective entertainment-based FSW are much easier to reach but likely
4
5 require different HIV prevention interventions than the 100% condom use program.
6
7 Implementation of research and programmatic efforts that integrate health, social
8
9 empowerment, and safe work environments for HIV prevention remain a high priority
10
11 for women engaged in sex work in Cambodia.⁶⁷
12
13
14
15
16

17 **Funding**

18 U.S. National Institutes of Health
19

20 **Competing Interests**

21 None
22

23 **Contributorship**

24 All authors contributed to the design and implementation of the YWHS-1 and -2 studies. Authors KP,
25
26 ES, JE, and LM compiled the first draft of the manuscript, which was reviewed by NS, M-CC, KS,
27
28 MC, JM_S, PP, JK. The primary statistical analysis was conducted by JE and M-CC; KS and MC
29
30 provided supplemental data review, and KP reviewed all data analyses. All authors contributed to and
31
32 have approved the final manuscript. The YWHS Collaborative is a steering committee who reviewed
33
34 and approved the study protocols, and provided expertise into some or all of the studies' methods and
35
36 implementation.
37
38
39
40
41
42
43
44

45 **Data sharing**

46 No additional data are available.
47
48
49
50
51
52
53
54
55
56
57
58
59
60

References

1. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Annual Report 2009: National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/report.php>; Accessed July 8, 2011, 2011.
2. Saphonn V, Sopheab H, Sun LP, et al. Current HIV/AIDS/STI epidemic: intervention programs in Cambodia, 1993-2003. *AIDS Educ Prev* 2004;16(3 Suppl A):64-77.
3. NCHADS. Behavioral Sentinel Surveillance 2010. *Cambodia National Center for HIV, AIDS, Dermatology and STD Dissemination Conference, December 30, 2010* 2011.
4. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Estimation of the HIV prevalence among the general population in Cambodia. : National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/index.php?id=20&event=146> Accessed July 8, 2011, 2011.
5. Couture MC, Sansothy N, Saphonn V, et al. Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine-type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis* 2011;38(1):33-9.
6. Sopheab H, Saphonn V, Chhea C, et al. Distribution of HIV in Cambodia: findings from the first national population survey. *AIDS* 2009;23(11):1389-95.
7. Sopheab H, Morineau G, Neal JJ, et al. Sustained high prevalence of sexually transmitted infections among female sex workers in Cambodia: high turnover seriously challenges the 100% Condom Use Programme. *BMC Infect Dis* 2008;8:167.
8. Sopheab H, Gorbach PM, Gloyd S, et al. Rural sex work in Cambodia: work characteristics, risk behaviours, HIV, and syphilis. *Sex Transm Infect* 2003;79(4):e2.
9. Saphonn V, Parekh BS, Dobbs T, et al. Trends of HIV-1 Seroincidence Among HIV-1 Sentinel Surveillance Groups in Cambodia, 1999-2002. *J Acquir Immune Defic Syndr* 2005;39(5):587-592.
10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012.
11. UNAIDS. HIV in Asia and the Pacific: Getting to Zero. http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/20110826_APGettingToZero_en.pdf 2011;Accessed December 20, 2011.
12. Samnang P, Leng HB, Kim A, et al. HIV prevalence and risk factors among fishermen in Sihanouk Ville, Cambodia. *Int J STD AIDS* 2004;15(7):479-83.
13. Nishigaya K. Female garment factory workers in Cambodia: migration, sex work and HIV/AIDS. *Women Health* 2002;35(4):27-42.
14. Patterson D. Southeast Asia: national policy audits on HIV and migration. *HIV AIDS Policy Law Rev* 2005;10(3):31, 33.
15. Hor LB, Detels R, Heng S, Mun P. The role of sex worker clients in transmission of HIV in Cambodia. *Int J STD AIDS* 2005;16(2):170-4.
16. Maher L, Mooney-Somers J, Phlong P, et al. Selling sex in unsafe spaces: Sex work risk environments in Phnom Penh, Cambodia. *Harm Reduct J* 2011;8(1):30.

- 1 17. Plummer R. The sex industry in Cambodia: the traffic police. . *The Economist* June
2 11, 2009.
- 3 18. UNIAP. United Nations Inter-Agency Project on Human Trafficking (Phase III).
4 Cambodia: Exodus to the sex trade? Effects of the global financial crisis on
5 women's working conditions and opportunities. *Report* [http://www.no-
7 trafficking.org/reports_docs/siren/siren_cb-04.pdf](http://www.no-
6 trafficking.org/reports_docs/siren/siren_cb-04.pdf); Accessed August 31, 2009.
- 8 19. UNAIDS pr. More women in Cambodia turning to sex trade amid financial crisis – UN
9 report.
10 [http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking
12 &Cr1=](http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking
11 &Cr1=) 2009.
- 13 20. KHANA. Mapping the pattern of sex workers, entertainment establishments, and
14 men who have sex with men in Cambodia. Accessed July 9, 2011. Report by Hor
15 Bun Leng, M.D, and Tuot Sovaranny, March. 2008.
- 16 21. Kim AA, Sun LP, Chhorvann C, et al. High prevalence of HIV and sexually
17 transmitted infections among indirect sex workers in Cambodia. *Sex Transm Dis*
18 2005;32(12):745-51.
- 19 22. Gorbach PM, Sopheab H, Chhorvann C, et al. Changing behaviors and patterns
20 among Cambodian sex workers: 1997-2003. *Journal of Acquired Immune*
21 *Deficiency Syndromes* 2006;42(2):242-7.
- 22 23. Ghys PD, Jenkins C, Pisani E. HIV surveillance among female sex workers. *Aids*
23 2001;15 Suppl 3:S33-40.
- 24 24. Francis C. HIV prevention and anti-trafficking in conflict? The public health
25 consequences of Cambodia's fight against trafficking. FHI (in collaboration with
26 PSI, Care, UNAIDS); December 2008.
- 27 25. FHI. SMARTgirl Program to Reduce Risk and Inspire Behavior Change. .
28 http://www.fhi.org/en/CountryProfiles/Cambodia/res_SMARTgirl.htm# Accessed
29 July 15th, 2011.
- 30 26. Burke KP, Munshaw S, Osburn WO, et al. Immunogenicity and cross-reactivity of a
31 representative ancestral sequence in hepatitis C virus infection. *J Immunol*
32 2012;188(10):5177-88.
- 33 27. Lamptey PR. Reducing heterosexual transmission of HIV in poor countries. *Bmj*
34 *Clinical Research Ed.* 2002;324(7331):207-11.
- 35 28. UNODC. Patterns and Trends of Amphetamine Type Stimulants and other drugs;
36 Asia and the Pacific. *The Global SMART Programme (Synthetics Monitoring:
37 Analyses, Reporting, Trends)*
38 <http://www.unodc.org/unodc/en/scientists/smart.html> (Accessed January 5,
39 2012) 2011.
- 40 29. Ahmad K. Increased use of amphetamine-type stimulants threatens east Asian
41 countries. *Lancet* 2002;359(9321):1927.
- 42 30. Ahmad K. Asia grapples with spreading amphetamine abuse. *Lancet*
43 2003;361(9372):1878-9.
- 44 31. Kulsudjarit K. Drug problem in southeast and southwest Asia. *Ann N Y Acad Sci*
45 2004;1025:446-57.
- 46 32. Farrell M, Marsden J, Ali R, et al. Methamphetamine: drug use and psychoses
47 becomes a major public health issue in the Asia Pacific region. *Addiction*
48 2002;97(7):771-2.
- 49 33. Mongkolsirichaikul D, Mokkhaveva C, Ratanabanangkoon K. The incidence of
50 amphetamine use among truck drivers from various regions of Thailand. *J Med*
51 *Assoc Thai* 1988;71(9):471-4.
- 52
53
54
55
56
57
58
59
60

- 1 34. Vongsheree S, Sri-Ngam P, Ruchusatsawat N, et al. High HIV-1 prevalence among
2 metamphetamine users in central Thailand, 1999-2000. *J Med Assoc Thai*
3 2001;84(9):1263-7.
- 4 35. Dayrit FM, Dumlao MC. Impurity profiling of methamphetamine hydrochloride drugs
5 seized in the Philippines. *Forensic Sci Int* 2004;144(1):29-36.
- 6 36. Lin SK, Ball D, Hsiao CC, et al. Psychiatric comorbidity and gender differences of
7 persons incarcerated for methamphetamine abuse in Taiwan. *Psychiatry Clin*
8 *Neurosci* 2004;58(2):206-12.
- 9 37. Lua AC, Lin HR, Tseng YT, et al. Profiles of urine samples from participants at rave
10 party in Taiwan: prevalence of ketamine and MDMA abuse. *Forensic Sci Int*
11 2003;136(1-3):47-51.
- 12 38. Razak MH, Jittiwutikarn J, Suriyanon V, et al. HIV prevalence and risks among
13 injection and noninjection drug users in northern Thailand: need for
14 comprehensive HIV prevention programs. *J Acquir Immune Defic Syndr*
15 2003;33(2):259-66.
- 16 39. Couture MC, Evans JL, Sothy NS, et al. Correlates of amphetamine-type stimulant
17 use and associations with HIV-related risks among young women engaged in sex
18 work in Phnom Penh, Cambodia. *Drug Alcohol Depend* 2012;120(1-3):119-26.
- 19 40. Melbye K, Khamboonruang C, Kunawararak P, et al. Lifetime correlates associated
20 with amphetamine use among northern Thai men attending STD and HIV
21 anonymous test sites. *Drug Alcohol Depend* 2002;68(3):245-53.
- 22 41. Sattah MV, Supawitkul S, Dondero TJ, et al. Prevalence of and risk factors for
23 methamphetamine use in northern Thai youth: results of an audio-computer-
24 assisted self-interviewing survey with urine testing. *Addiction* 2002;97(7):801-8.
- 25 42. Buavirat A, Page-Shafer K, van Griensven GJ, et al. Risk of prevalent HIV infection
26 associated with incarceration among injecting drug users in Bangkok, Thailand:
27 case-control study. *BMJ* 2003;326(7384):308.
- 28 43. Beyrer C, Razak MH, Jittiwutikarn J, et al. Methamphetamine users in northern
29 Thailand: changing demographics and risks for HIV and STD among treatment-
30 seeking substance abusers. *Int J STD AIDS* 2004;15(10):697-704.
- 31 44. Vanichseni S, Tappero JW, Pitisuttithum P, et al. Recruitment, screening and
32 characteristics of injection drug users participating in the AIDS VAX B/E HIV
33 vaccine trial, Bangkok, Thailand. *Aids* 2004;18(2):311-6.
- 34 45. Maher L, Phlong P, Mooney-Somers J, et al. Amphetamine-type stimulant use and
35 HIV/STI risk behaviour among young female sex workers in Phnom Penh,
36 Cambodia. *Int J Drug Policy* 2011;22(3):203-9.
- 37 46. Kab V, Evans J, Sansothy N, et al. Testing for amphetamine-type stimulant (ATS)
38 use to ascertain validity of self-reported ATS use among young female sex
39 workers in Cambodia. *Masters Thesis for University of California Berkeley, School*
40 *of Public Health, MPH in Epidemiology and Biostatistics. Completed May 15, 2011.*
- 41 47. Chattergoon MA, Levine JS, Latanich R, et al. High plasma interleukin-18 levels
42 mark the acute phase of hepatitis C virus infection. *J Infect Dis*
43 2011;204(11):1730-40.
- 44 48. Yang C, Latkin C, Luan R, et al. Condom use with female sex workers among male
45 clients in Sichuan Province, China: the role of interpersonal and venue-level
46 factors. *J Urban Health* 2010;87(2):292-303.
- 47 49. Erausquin JT, Reed E, Blankenship KM. Police-related experiences and HIV risk
48 among female sex workers in Andhra Pradesh, India. *J Infect Dis* 2011;204 Suppl
49 5: S1223-8.
- 50
51
52
53
54
55
56
57
58
59
60

- 1 50. Shannon K, Kerr T, Allinott S, et al. Social and structural violence and power
2 relations in mitigating HIV risk of drug-using women in survival sex work. *Soc Sci*
3 *Med* 2008;66(4):911-21.
- 4 51. Shannon K, Kerr T, Strathdee SA, et al. Prevalence and structural correlates of
5 gender based violence among a prospective cohort of female sex workers. *BMJ*
6 2009;339:b2939.
- 7 52. Kalichman SC, Simbayi LC, Kaufman M, et al. Alcohol use and sexual risks for
8 HIV/AIDS in sub-Saharan Africa: systematic review of empirical findings. *Prev Sci*
9 2007;8(2):141-51.
- 10 53. Morisky DE, Chiao C, Ksobiech K, et al. Reducing alcohol use, sex risk behaviors,
11 and sexually transmitted infections among Filipina female bar workers: effects of
12 an ecological intervention. *J Prev Interv Community* 2010;38(2):104-17.
- 13 54. Surratt HL, Inciardi JA. An effective HIV risk-reduction protocol for drug-using
14 female sex workers. *J Prev Interv Community* 2010;38(2):118-31.
- 15 55. Argento E, Reza-Paul S, Lorway R, et al. Confronting structural violence in sex
16 work: lessons from a community-led HIV prevention project in Mysore, India.
17 *Aids Care* 2011;23(1):69-74.
- 18 56. Reza-Paul S, Beattie T, Syed HU, et al. Declines in risk behaviour and sexually
19 transmitted infection prevalence following a community-led HIV preventive
20 intervention among female sex workers in Mysore, India. *Aids* 2008;22 Suppl
21 5:S91-100.
- 22 57. Johnston LG, Sabin K, Mai TH, et al. Assessment of respondent driven sampling for
23 recruiting female sex workers in two Vietnamese cities: reaching the unseen sex
24 worker. *J Urban Health* 2006;83(6 Suppl):i16-28.
- 25 58. Baral S, Beyrer C, Muessig K, et al. Burden of HIV among female sex workers in
26 low-income and middle-income countries: a systematic review and meta-analysis.
27 *Lancet Infect Dis* 2012;12(7):538-49.
- 28 59. Merson M, Padian N, Coates TJ, et al. Combination HIV prevention. *Lancet*
29 2008;372(9652):1805-6.
- 30 60. Abdool Karim Q, Abdool Karim SS, Frohlich JA, et al. Effectiveness and safety of
31 tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in
32 women. *Science* 2010;329(5996):1168-74.
- 33 61. Grant RM, Lama JR, Anderson PL, et al. Preexposure chemoprophylaxis for HIV
34 prevention in men who have sex with men. *N Engl J Med* 2010;363(27):2587-99.
- 35 62. Dworkin SL, Blankenship K. Microfinance and HIV/AIDS prevention: assessing its
36 promise and limitations. *AIDS Behav* 2009;13(3):462-9.
- 37 63. Pronyk PM, Kim JC, Abramsky T, et al. A combined microfinance and training
38 intervention can reduce HIV risk behaviour in young female participants. *AIDS*
39 2008;22(13):1659-65.
- 40 64. Rosenberg MS, Seavey BK, Jules R, et al. The Role of a Microfinance Program on
41 HIV Risk Behavior Among Haitian Women. *AIDS Behav* 2011;15(5):911-8.
- 42 65. Evans J, Couture M-C, Stein ES, et al. Biomarker validation of recent unprotected
43 sexual intercourse in a prospective study of young women engaged in sex work in
44 Phnom Penh, Cambodia. . *STD* in press.
- 45 66. Kab V, Evans J, Sansothy N, et al. Testing for amphetamine-type stimulant (ATS)
46 use to ascertain validity of self-reported ATS use among young female sex
47 workers in Cambodia. . *Addiction Science & Clinical Practice* 2012;7:11-25.
- 48 67. Tucker JD, Tuminez AS. Reframing the interpretation of sex worker health: a
49 behavioral-structural approach. *J Infect Dis* 2011;204 Suppl 5:S1206-10.
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

Table 1: Selected socio-demographic characteristics, occupational, and risk exposures in two cohorts of high risk young women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2 N=153*		p-value
	Prevalence of characteristic		Prevalence of characteristic		
	N	%	N	%	
Age (years, median (IQR))	25 (21 – 27)		25 (22 – 28)		0.56
16-18	13	8.1	11	7.2	0.86
19-24	64	40.0	58	37.9	
25-29	83	51.8	84	54.9	
Marital status					
Never married	57	35.6	38	24.8	<0.01
Married-living together	24	15.0	48	31.4	
Widowed/Divorced/Separated	79	49.4	67	43.8	
Education (years)					
None	64	40.0	23	15.0	<0.01
Primary (1-6 years)	82	51.3	91	59.5	
Secondary (7+ years)	14	8.8	39	25.5	
Age at first sex (median (IQR))	17 (16 – 18)		18 (16 – 19)		0.03
≤ 15	32	20.1	22	14.5	0.19
> 15	127	79.9	130	85.5	
Length of employment as FSW (years, median (IQR))	4.3 (2.5 – 6.3)		3 (1.7 – 5)		<0.01
Current employment venue (last 30 days)					
Entertainment	51	31.9	113	74.3	<0.01†
Brothel	23	9.2	3	2.0	
Freelance	59	39.3	29	19.1	
Other/Multiple	27	16.9	7	4.6	
Have a manager, boss or supervisor					
No	82	53.6	28	14.4	<0.01
Yes	71	46.4	124	81.6	
Income in past month (US \$)					
Less than \$100	68	42.5	50	32.9	0.18
100-150\$	35	21.9	43	29.3	

Over 150\$	57	35.6	59	38.8	
Number of sex partners in last month (median (IQR))	30 (10 – 90)		5 (3 – 13)		<0.01
≤10	45	28.1	112	73.2	<0.01
11 – 50	53	33.1	41	26.8	
> 50	62	38.8	0	0	
Condom use with last paying partner					
Consistent (always)	108	85.7	86	87.8	0.66
Inconsistent	18	14.3	12	12.2	
Condom use with last non paying partner					
Consistent (always)	7	20.6	10	18.2	0.78
Inconsistent	27	79.4	45	81.8	
Number of days drink alcohol (last month)	15 (2 – 30)		18 (5 – 28)		0.76
0 – 4	65	40.6	36	23.5	<0.01
5 – 19	25	15.6	42	27.5	
≥ 20	70	43.7	75	49.0	
Number of days drunk (last month)	5 (1 – 20)		3 (1 – 10)		0.07
0 – 4	89	55.6	86	56.2	<0.01
5 – 19	33	20.6	50	32.7	
≥ 20	38	23.7	17	11.1	
ATS use (ever)					
No	92	57.5	107	69.9	0.02
Yes	68	42.5	46	30.1	
ATS use (last 3 months)					
No	116	73.4	117	76.5	0.54
Yes	42	26.6	36	23.5	
Ever used any drug prior to/during sex					
No	109	68.1	117	76.5	0.10
Yes	51	31.9	36	23.5	

* Excludes women who participated in YWHS-1

†Fisher Exact p-value

Table 2: HIV prevalence overall and by current work venue in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	% (95% CI)	N	%	
HIV positive	37	23.1 (16.5 – 29.7)	14	9.2 (4.5 – 13.8)	<0.01
HIV positive by employment venue (n/N)					
Entertainment	5/51	9.8 (1.5 – 18.1)	5/113	4.4 (0.6 – 8.2)	<0.01
Brothel	4/23	17.4 (1.5 – 33.3)	0/3	0	
Freelance	22/59	37.3 (25.0 – 48.0)	9/29	31.0 (13.8 – 48.2)	
Other/Multiple	6/27	22.2 (6.2 – 38.3)	0/7	0	

* Excludes women who participated in YWHS-1

Table 3: HIV testing history and behaviors in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	%	N	%	
Ever tested for HIV					
No	58	36.5	31	20.3	<0.01
Yes	101	63.5	122	79.7	
HIV test in last 3 months					
No	126	79.3	119	77.8	0.75
Yes	33	20.7	34	22.2	
What was result of last HIV test?#					
Negative	84	84.0	114	93.4	0.04
Positive	4	4.0	4	3.3	
Don't know	12	12.0	4	3.3	
Where received last HIV test#					
Public hospital	35	34.7	55	34.0	0.10
Voluntary testing and counseling center	1	1.0	0	0	
NGO clinic	59	58.4	54	44.3	
Private hospital, clinic, or laboratory	6	5.9	13	10.7	

* Excludes women who participated in YWHS-1

Among those who reported being previously tested for HIV

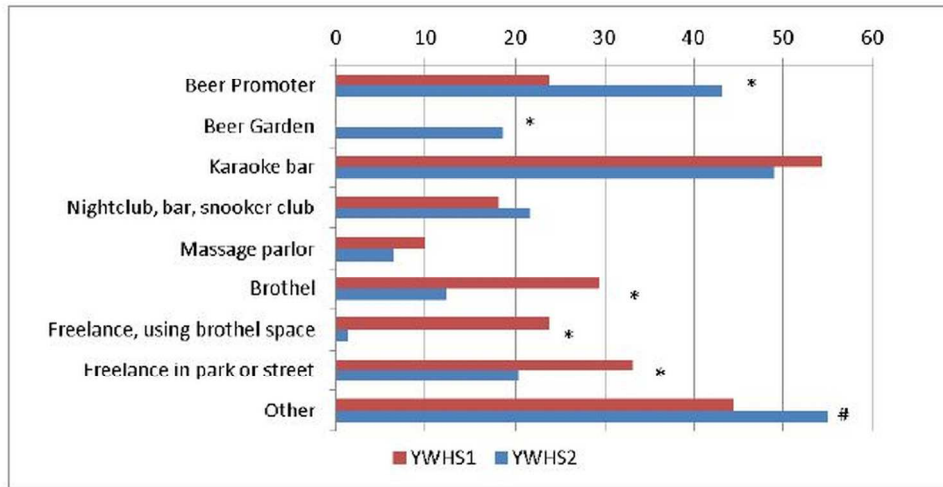
Figure Legend

Figure 1: Venues where women in YWHS-2 and YWHS-2 reported ever working

Figure 2. Alcohol use in the past month and ATS use in the past 3 months reported by women in YWHS-1 and YWHS-2 by work venue: (A) Entertainment-based; (B) Brothel-based; (C) Freelance

For peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

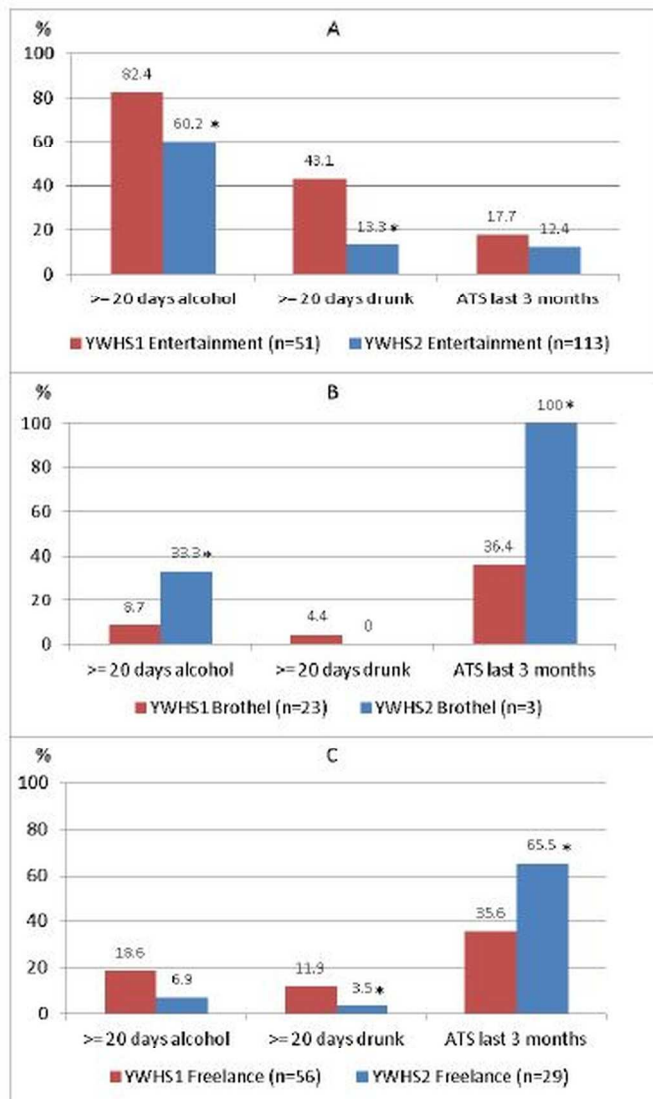


* p≤0.05; # p=0.06

Venues where women in YWHS-1 and YWHS-2 reported ever working
151x90mm (300 x 300 DPI)

review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



*p<0.05

Alcohol use in the past month and ATS use in the past 3 months reported by women in YWHS-1 and YWHS-2 by work venue: (A) Entertainment-based; (B) Brothel-based; (C) Freelance
106x183mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

Page et al., Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high risk young women in Phnom Penh, Cambodia

	Item No	Item, Section and PAGE NUMBER
Title and abstract	1	(a) Study's design with a commonly used terms – PAGE 1 (b) Provide in the abstract an informative and balanced summary of what was done and what was found – PAGE 3
Introduction		
Background/rationale	2	Scientific background and rationale for the investigation being reported – PAGE 7-9
Objectives	3	State specific objectives, including any prespecified hypotheses- PAGE 9
Methods		
Study design	4	Present key elements of study design early in the paper- PAGE 9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection- PAGE 9, 11
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up- PAGE 10 (b) For matched studies, give matching criteria and number of exposed and unexposed
Variables	7	Clearly define all outcomes, exposures, predictors, - PAGE 10-12
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group – PAGE 10-12
Bias	9	Describe any efforts to address potential sources of bias – NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Study size	10	Explain how the study size was arrived at – PAGE 10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why- PAGE 12
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding- PAGE 12 (b) Describe any methods used to examine subgroups and interactions- PAGE 12 (c) Explain how missing data were addressed- NA (BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (d) If applicable, explain how loss to follow-up was addressed NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (e) Describe any sensitivity analyses NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed- PAGE 12, 13 (b) Give reasons for non-participation at each stage NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS) (c) Consider use of a flow diagram NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders- PAGE 12, 13, and TABLE 1

		(b) Indicate number of participants with missing data for each variable of interest NA
		(c) Summarise follow-up time (eg, average and total amount) NA (CROSS-SECTIONAL BASELINE DATA ONLY ARE INCLUDED IN THIS ANALYSIS)
Outcome data	15*	Report numbers of outcome events or summary measures over time – TABLE 1 AND 2
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included. TABLES 1 AND 2 (b) Report category boundaries when continuous variables were categorized NA (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses –PAGE 13
Discussion		
Key results	18	Summarise key results with reference to study objectives – PAGE 14, 15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias – PAGE 18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence PAGE 14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results PAGE 18
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based PAGE 5

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

1 Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high
2 risk young women in Phnom Penh, Cambodia
3
4
5
6
7
8
9

10 Kimberly Page, Ph.D.¹, Ellen Stein, MPH¹, Neth Sansothy, M.D.², Jennifer Evans, M.S.¹,
11 Marie-Claude Couture, Ph.D.¹, Keo Sichan³, Melissa Cockroft, BA^{3*}, Julie Mooney-
12 Somers, Ph.D.^{4, 5}, Pisith Phlong, M.A.⁶, John Kaldor, Ph.D.⁴, Lisa Maher Ph.D.⁴, (on
13 behalf of the Young Women's Health Study Collaborative: John Kaldor, Ph.D.⁴, Serey
14 Phal Kien³, Kimberly Page, Ph.D.¹, Joel M. Palefsky M.D.⁷, Vonthanak Saphonn, M.D.²,
15 Mean Chhi Vun, M.D.²).
16
17
18
19
20
21
22
23
24
25
26
27
28

- 29 1. University of California San Francisco, Department of Epidemiology and Biostatistics;
30 San Francisco, and Global Health Sciences, 50 Beale St., 12th Floor, San Francisco, CA,
31 94105; USA
32
33
- 34 2. National Center for HIV/AIDS, Dermatology and STDs (NCHADS), #245H, Street 6A,
35 Phum Kean Khlang, Sangkat Prekleap Russey Keo, Phnom Penh, Cambodia
36
37
- 38 3. Cambodian Women's Development Association (CWDA); No. 19, Street 242, Boeung
39 Prolit, Khan 7 Makara, Phnom Penh, Cambodia
40
41
- 42 4. The Kirby Institute (formerly the National Centre in HIV Epidemiology and Clinical
43 Research); University of New South Wales, CFI building, corner of West and Boundary
44 Streets, Darlinghurst, NSW 2010, Australia
45
46
- 47 5. The Centre for Values, Ethics and the Law in Medicine, The University of Sydney
48 Level 1 of the Medical Foundation Building, 92-94 Parramatta Road, Camperdown, NSW,
49 Australia
50
51
- 52 6. Royal University of Fine Arts, 72 Street 19, Phnom Penh, Cambodia.
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

7. University of California San Francisco, Department of Medicine; 513 Parnassus Ave,
Med Sci S-420; UCSF, San Francisco, San Francisco, CA. 94143 - 0654

*Melissa Cockroft is currently at Marie Stopes International in Phnom Pehn, Cambodia

Address correspondence to:

Kimberly Page, Ph.D., MPH, Dept. of Epidemiology and Biostatistics, Global Health
Sciences, University of California San Francisco, CA 94105; 50 Beale St., 12th Floor, San
Francisco, CA USA, 94105. kpage@psg.ucsf.edu

Word count: Abstract: 296; Text 3444; 3 Tables, 2 Figures.

Key words: Cambodia, female sex workers, HIV, STI, risk, amphetamine-type
stimulant, alcohol, policy effects

Short title: HIV infection and risk in two samples of FSW in Phnom Penh, Cambodia

Abstract

Objectives: HIV prevalence among Cambodian female sex workers (FSW) is among the highest in Southeast Asia. We describe HIV prevalence and associated risk exposures in FSW sampled serially in Phnom Penh, Cambodia (Young Women's Health Study (YWHS), before and after the implementation of a new law designed to combat human trafficking and sexual exploitation.

Design: Cross-sectional analysis of baseline data from two prospective cohorts.

Setting: Community-based study in Phnom Penh, Cambodia.

Participants: Women aged 15-29 years, reporting ≥ 2 sexual partners in the last month and/or engaged in transactional sex in the last 3 months, were enrolled in the studies in 2007 (N=161; YWHS-1), and 2009 (N=220; YWHS-2) following information sessions where 285 and 345 women attended.

Primary outcomes: HIV prevalence, sexual risk behaviour, amphetamine-type stimulant (ATS) and alcohol use, and work-related factors were compared the two groups, enrolled before and after implementation of the new law.

Results: Participants and in the two cohorts were similar in age (median 25 years), but YWHS-2 women reported fewer sex partners, more alcohol use, and less ATS use. A higher proportion of YWHS-2 compared to YWHS-1 women worked in entertainment-based venues (68% vs. 31%, respectively). HIV prevalence was significantly lower in the more recently sampled women: 9.2% (95% CI 4.5, 13.8) vs. 23% (95% CI 16.5, 29.7).

Conclusions: Sex work context and risk has shifted among young FSW in Phnom Penh, following implementation of anti-prostitution and anti-trafficking laws. While both cohorts were recruited using the same eligibility criteria, more recently sampled women had lower prevalence of sexual risk and HIV infection. Women engaged more directly in transactional sex have become harder to sample and access. Future prevention

1 research and programs need to consider how new policies and demographic changes in
2
3
4 FSW impact HIV transmission.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Article summary

Article Focus

- HIV prevalence and incidence in two serial samples of young female sex workers in Phnom Penh, Cambodia (2007-2008, and 2009-2010);
- Comparison of baseline risk and HIV outcomes, including sexual behavior, drug and alcohol use in the two cohorts sampled before and after implementation of anti-trafficking and sexual exploitation laws in 2008;
- Impact of anti-trafficking and sexual exploitation legislation on female sex workers and HIV risk.

Key Messages

- Women sampled using the same eligibility criteria and outreach methods in differed with respect to risk exposures and HIV outcomes;
- Changes in sex work typology and environment are evident after enactment of the anti-trafficking laws, including very few brothel-based FSW and significantly more FSW based in the entertainment sector;
- Shifts in the context of sex work and risk highlight the ongoing need and challenges for HIV and drug prevention for young women engaged in sex work.

Strengths and Limitations

- Two comparably sampled groups of young FSW suggest changing trends in HIV risk;
- Comparison of cross-sectional samples is ecological and does not prove temporal effects;
- Criminalization and suppression of sex work and a flourishing entertainment-based sex work industry set new and conflicting stage for HIV prevention.

1 Author Contributions: All authors contributed to the design and implementation of the
2
3 YWHS-1 and -2 studies. Authors KP, ES, JE, and LM compiled the first draft of the
4
5 manuscript, which was reviewed by NS, M-CC, KS, MC, JM_S, PP, JK. The primary
6
7 statistical analysis was conducted by JE and M-CC; KS and MC provided supplemental
8
9 data review, and KP reviewed all data analyses. All authors contributed to and have
10
11 approved the final manuscript. The YWHS Collaborative is a steering committee who
12
13 reviewed and approved the study protocols, and provided expertise into some or all of
14
15 the studies' methods and implementation.
16
17
18
19
20
21

22 Data Sharing: no additional data available.
23
24
25

26 Funding sources and conflicts of interest: The Young Women's Health Study-1 and
27
28 YWHS-2 were supported by Awards 1R21DA025441 from the National Institute on Drug
29
30 Abuse, and R01NR010995 from the National Institute of Nursing Research. M-C Couture
31
32 was also supported by the Canadian Institutes of Health Research (postdoctoral
33
34 fellowship award). Professors Lisa Maher and John Kaldor are supported by Australian
35
36 National Health and Medical Research Council (NHMRC) Research Fellowship. The Kirby
37
38 Institute is affiliated with the Faculty of Medicine, University of New South Wales and is
39
40 funded by the Australian Government Department of Health and Ageing. The content is
41
42 solely the responsibility of the authors and does not necessarily represent the official
43
44 views of the National Institutes of Health, nor the Australian Government. The authors
45
46 have no conflicts to disclose.
47
48
49
50
51
52

53 Acknowledgments: The authors would like to acknowledge the coordinated efforts and
54
55 dedication of the research teams at the National Center for HIV/AIDS, Dermatology,
56
57 and STDs and the Cambodian Women's Development Agency. We are indebted to all the
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Cambodian women who agreed to participate in this study and grateful for the privilege to work with them.

For peer review only

Introduction

There have been significant declines in HIV prevalence in Cambodia since the epidemic peaked in around 2000, a success widely attributed to measurable increases in condom use, declines in the number and frequency of commercial sex transactions reported by men, access to HIV voluntary counseling & testing (VCT) and uptake of antiretroviral therapy.¹⁻³ In 2010, the National Center for HIV/AIDS, Dermatology and STDs (NCHADS) revised the national estimate of HIV prevalence to 0.8% (in 15-49 year olds), reflecting a significant decline after the peak estimate of 2.4% in 1998.⁴ However, HIV prevalence in Cambodian women, especially young women, is among the highest in Southeast Asia and heterosexual sex remains the main route of transmission.⁵⁻⁹ Since 2006, women have accounted for over half (52%) of all HIV infections in Cambodia¹⁰, higher than in Asia and the Pacific in general (35%).¹¹ Limited income generating activities, a highly mobile workforce, trafficking in women and girls and widespread transactional sex, poverty, and sexually transmitted infections (STI) have been identified as key drivers of the epidemic among female sex workers (FSW).^{1 5 6 10 12-15} As in many countries, FSW in Cambodia can be hard to reach and difficult to provide prevention services to. In recent years significant economic and policy changes have affected the sex work landscape, with notable shifts in sex work venues, typologies, and more women engaged in transactional sex than ever before.¹⁶⁻²⁰

Until 2008, FSW in Cambodia were categorized as "direct" and were mostly brothel-based, or "indirect". Indirect FSW were distinguished from direct FSW, generally working in entertainment establishments as beer promotion girls, waitresses, hostesses, or karaoke girls for example, and engaged in occasional transactional sex for supplementary income.²¹⁻²³ In 1997, an estimated 5,300 women worked in the entertainment/service sector and 6,000 were brothel-based FSW. The number of

1 women involved in entertainment-based sex work has grown dramatically in recent
2 years in Cambodia. Until 2008, the estimated number of women engaged in sex and
3 entertainment work was stable (12,762 women were enumerated in 2008), however by
4 2012, this had increased dramatically to an estimated 41,622 women, a more than
5 threefold increase from the 2008 estimate (NCHADS, personal communication). The
6 reasons for this growth have not been explored in detail, but may be associated with
7 changing economic factors during this time in Cambodia. Following the passage and
8 implementation of the "Law on Suppression of Human Trafficking and Sexual
9 Exploitation" in February, 2008, brothel-based sex work was banned, and the most
10 direct effect was on direct sex trade, which went "underground", or women moved into
11 indirect work.¹⁰ Along with the overt enforcement against FSW, the 2008 anti-
12 trafficking legislation had other consequences. For instance, official terminology used by
13 governmental and non-governmental organizations (NGO) to describe FSW labeled all
14 women engaged in sex and entertainment work as "entertainment workers", or EW*.
15 Historically, brothel-based FSW were easily accessed and monitored for HIV prevention
16 efforts, including HIV and behavioral surveillance. NGOs working in HIV prevention
17 reported that as transactional sex was displaced to a wider range of settings, women at
18 highest risk became harder to reach for both prevention and service delivery.^{16 24 25}
19 These factors pose significant challenges to HIV prevention and threaten to undermine
20 progress achieved to date.

21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

* The term 'female sex worker' is no longer used in Cambodia. Terminology was changed in 2008 to designate high risk women working in service and entertainment venues as "entertainment workers" or EW. No new HIV surveillance data has been published on FSW, and Behavioral Surveillance Survey (BSS) methods have been changed to recognize only indirect sex workers- 'EW', and determining whether or not they are selling sex by the average number of reported sex partners per week (10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012..

1 HIV prevalence is extremely high among Cambodian FSW with prevalence among
2 younger women is particularly troubling as their infection is likely to be more recent and
3 indicative of incidence.^{5 8 9 21} A cornerstone of HIV prevention in Cambodia was the
4 100% Condom Use campaign^{26 27}, primarily directed at brothel-based FSW. With
5 changes in sex work venues, this prevention approach is likely less effective, failing to
6 reach the large number of women now engaged in transactional sex in entertainment
7 establishments. Indeed, measures of self-reported condom use have declined according
8 to monitoring data reported by UNAIDS.¹⁰ New risk factors have also emerged,
9 especially amphetamine-type stimulant (ATS) use, in the form of “yama”, (pills) and
10 “ice” (a crystalline form).²⁸⁻³⁸ ATS use is associated with increased sexual risk behavior
11 and STI incidence among these young women^{5 39}, similar to that seen in other
12 populations and locales.⁴⁰⁻⁴⁴

13 We conducted two prospective studies of high-risk young women engaged in
14 transactional sex in Phnom Penh, the principal research questions focused on estimating
15 HIV and STI prevalence and incidence and associated risk factors. The first, Young
16 Women’s Health Study (YWHS-1), was conducted in 2007-2008 and the second, YWHS-
17 2, in 2009-2010.^{5 16 39 45 46} In this paper, we explore the changing HIV risk landscape by
18 comparing and contrasting the two cohorts of FSW sampled prior to, and following,
19 legislative changes designed to combat human trafficking and sexual exploitation in
20 Cambodia. We theorize that the demographic characteristics and HIV risk of FSW has
21 shifted as a result of socio-legal changes induced by the implementation of the new
22 legislation.

23 **Methods**

24 ***Study setting***

1 The YWHS-1 and YWHS-2 were both prospective studies of young women engaged in
2 sex work in Phnom Penh, Cambodia. Methods have been described in detail previously.⁵
3
4
5
6 ³⁹ Both studies were led by a multidisciplinary collaborative prevention research group
7
8 from NCHADS, the Cambodian Women's Development Association (CWDA), the
9
10 University of California in San Francisco (UCSF) in the United States, and the Kirby
11
12 Institute at the University of New South Wales (UNSW) in Australia.
13
14

15 16 17 **Study population and recruitment**

18
19 The target population in both studies was young women engaged in transactional sex in
20 Phnom Penh. Inclusion criteria were: aged 15-29 years, Khmer language
21
22 comprehension, ≥ 2 different sexual partners in the last month *or* engaged in
23
24 transactional sex (sex in exchange for money, goods, services, or drugs) within the last
25
26 three months, no plans to move in the next 12 months, biologically female, and able to
27
28 provide voluntary informed consent. YWHS-1 aimed to sample 160 women to provide
29
30 80% power to estimate a point prevalence of HIV at 15% with a 95% confidence
31
32 interval (CI) of 9.7% to 23.0%. Based on results of YWHS-1, YWHS-2 aimed to sample
33
34 220 women to detect an estimated HIV prevalence of 23% (95% CI, 17.3%, 30.5%).
35
36
37
38
39
40
41
42

43 Recruitment and enrollment procedures were the same in both studies.⁵ CWDA field
44
45 assistants provided study information and conducted eligibility screening via information
46
47 meetings in neighborhoods where sex work was prevalent. Eligible women were invited
48
49 to a community location used by various sex-worker organizations where study
50
51 information was described in more detail and written informed consent was obtained.
52
53 Enrolled participants were given appointment cards to present to the YWHS clinic field-
54
55 site and free transportation was offered. In both studies, women were remunerated
56
57 US\$5 at each study visit for their participation time.
58
59
60

Data collection

All data collection occurred at the YWHS clinic, which was staffed by a physician, nurses, counselors and a laboratory technician. A structured questionnaire was administered in Khmer by trained interviewers. Survey items were similar in both studies, and covered socio-demographic characteristics, occupational and sexual risk history, alcohol and drug use. HIV testing was conducted at each visit. In YWHS-1, urine specimens were tested for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea* (GC). In YWHS-2, women were tested for HPV infection. STI treatment was provided at no cost, and women with HIV and HPV infection were referred to a local provider for free medical evaluation and treatment.

Laboratory testing

HIV serology was performed using two rapid tests; Uni-Gold Recombigen[™] HIV rapid HIV test (Trinity Biotech USA, Jamestown, NY) and the Clairview HIV 1/2 STAT-PAK (Inverness Medical Diagnostics, Waltham, MA). HIV positive and discordant samples were confirmed by HIV-1 immunoblot. CT and GC were assessed from urine samples using BDProbeTec[™] strand displacement amplification assay (Becton Dickinson, Sparks, MD) at the NCHADS STD laboratory.⁵ Cervical specimens for HPV testing were collected using a standard cytobrush.⁴⁷ Client-centered risk reduction counseling was provided in association with all testing.

Ethical review

The study protocols were reviewed and approved by Institutional Review Board of the Committee on Human Research at UCSF, the Cambodian National Ethics Committee, and the University of New South Wales Human Research Ethics Committee in

1 accordance with ethical standards (institutional and national) and with the Helsinki
2 Declaration of 1975, as revised in 2000.
3
4
5
6
7

8 **Measures**

9
10 Both studies aimed to estimate HIV infection, ATS use, and sexual risk behavior and
11 included questions on sociodemographic factors, work history, income, and duration of
12 sex work, and whether they currently had an employer (manager, boss or supervisor).
13 Women were asked if they had ever and/or were currently working: as a beer promoter,
14 in a beer garden, as a waitress or hostess in a karaoke bar, nightclub or snooker bar, in
15 a massage parlor, brothel, as a freelance sex worker using space at a brothel, as a
16 freelance sex worker in the park or on the street, or to specify 'other' location. They
17 were asked about age at first sex, number of partners (last month) and condom use
18 with last partners (paying and non-paying). Paying partners were defined as male
19 clients with whom respondents traded sex for money, goods or drugs. Condom use was
20 classified as "consistent" if the participant reported always using a condom. Participants
21 were asked about the number of days in which alcohol was drunk and the number of
22 days in which they were "affected" by alcohol or were "drunk" in the past month. ATS
23 use (ever and last 3 months) was assessed with questions regarding use of *yama* and
24 crystal (ice).
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

47 **Analyses**

48
49 Prevalence estimates were calculated using exact binomial confidence intervals (CI).
50 Chi-square and Fisher's Exact Tests were used to examine differences in baseline socio-
51 demographic, occupational, sexual, and alcohol/drug use exposures and prevalent HIV
52 and STI between the two cohorts. The only longitudinal data compared was HIV
53 incidence. The HIV incidence rate calculated using the number of seroconversions per
54
55
56
57
58
59
60

1 100 person-years of observation (PYO) assuming a Poisson distribution. Analyses were
2 performed using STATA 9.0 (STATA, College Station, TX).
3
4
5
6
7

8 **Results**

9
10 In YWHS-1, 285 women attended community information sessions, 161 (56%) eligible
11 women were recruited to the group information/consent meeting, and 160 (99%)
12 consented to participate. In YWHS-2, 220 (64%) women consented out of 345 who
13 attended information sessions. Sixty-seven women from YWHS-1 also enrolled in
14 YWHS-2; they were not included in the YWHS-2 comparison group, leaving 153 in the
15 analysis. Table 1 shows baseline socio-demographic and occupational factors, as well as
16 sexual and substance use risk exposures, in the two cohorts. The cohorts were similar
17 with respect to age (median 25 years), and age of sexual debut (median 17 and 18
18 years, respectively), but differed significantly in years of education and marital status.
19 Compared to women in YWHS-1, women in YWHS-2 had more education (median of 5
20 years (IQR 2,7) vs. 2 years (IQR 0,4)), and were more likely to be married or
21 cohabitating with a partner (31.4% vs. 15%, respectively).
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

38 Women in YWHS-2 had been involved in sex work for significantly less time (median of
39 3 years (IQR 1.7, 5)) than YWHS-1 women (median of 4.3 years (IQR 2.5, 6.3)). More
40 YWHS-2 women were currently (last 30 days) working in entertainment venues and
41 fewer in brothels, or as freelance FSW (including in parks, guest houses, or on the
42 street). These differences were also reflected in the significantly higher proportion of
43 YWHS-2 women who reported having a manager or boss (81.6%) compared to YWHS-1
44 (46%). Figure 1 shows the distribution and range of work venues women reported 'ever'
45 working in. Women in YWHS-2 also reported significantly fewer sexual partners in the
46 past 30 days: a median of 5 compared to 30 in YWHS-1 (Table 1). Despite these
47 differences, women in the two samples reported similar income distributions. Self-
48
49
50
51
52
53
54
55
56
57
58
59
60

1 reported consistent condom use, with both paying and non-paying partners, did not
2
3 differ between cohorts. Alcohol and ATS use differed significantly: women in YWHS-2
4
5 reported more alcohol use, but fewer days drunk in the past month than in YWHS-1;
6
7 and fewer women in YWHS-2 reported ever using ATS, although recent use was similar
8
9 in both groups (Table 1). Both alcohol and ATS use varied by cohort and work venue:
10
11 entertainment-based women in YWHS-2 reported less of both, whereas brothel and
12
13 freelance-based women in YWHS-2 reported significantly more ATS use (Figure 2).
14
15
16
17
18
19

20
21 HIV prevalence was significantly ($p < 0.01$) lower in women sampled in YWHS-2
22
23 compared to YWHS-1: 9.2% (95% CI 4.5%, 13.8%; $p < 0.01$) vs. 23% (95% CI 16.5%,
24
25 29.7%) (Table 2). When the 67 women who had participated in both samples were
26
27 included in YWHS-2, HIV prevalence was 15.5% (95% CI 10.6, 20.3). HIV incidence
28
29 was also lower in YWHS-2: 0.8/100 pyo (95% CI 0.1, 6.0) vs. 3.6/100 pyo (95% CI
30
31 1.2, 11.1), but not significantly ($p = 0.26$). In YWHS-1, prevalence of Chlamydia infection
32
33 was 11.5% (95% CI 6.0%, 17.1%) and Gonorrhoea infection was 7.8% (95% CI 3.5%,
34
35 12.3%). Women in YWHS-2 were not tested for these STI, but 41.1% were HPV. HIV
36
37 prevalence differed significantly by work venue and by cohort, but over 30% of
38
39 freelance-based women tested positive in both cohorts (Table 2).
40
41
42
43

44 In both cohorts, 20% reported being tested for HIV in the past 3 months but more
45
46 YWHS-2 women had a history of testing (Table 3). More women in YWHS-1 reported not
47
48 knowing their HIV test results: 11 of the 84 women (13.1%) who reported being
49
50 negative tested positive and 4 of 12 women (33.3%) who reported they did not know
51
52 their previous HIV results tested positive. In YWHS-2, 5 of 114 (4.4%) who reported
53
54 testing negative, and 2 of 4 (50%) who did not know their previous results, tested
55
56
57
58
59
60

1 positive. Among women who reported no history of HIV testing, 31% (18/58) and
2
3
4 12.9% (4/31) tested HIV positive in YWHS-1 and -2, respectively.
5
6
7

8 9 **Discussion**

10
11
12 In these two samples of young FSW, recruited using the same eligibility criteria and
13
14 outreach methods, we observed important differences in socio-demographics, risk
15
16 exposures and HIV infection outcomes. Most notably, women sampled more recently
17
18 were more educated, had fewer sex partners, less time working in sex work and had
19
20 significantly lower prevalence of HIV. Where women worked was also very different in
21
22 the two cohorts: a much higher proportion of women sampled in 2009-10 compared to
23
24 2007-8 worked in entertainment-based establishments and fewer were brothel-based or
25
26 freelance FSW. These differences point to the notable changes in sex work typology and
27
28 environment that occurred following the enactment and enforcement in 2008 of anti-
29
30 trafficking legislation in Cambodia¹⁶. Brothel closures and increases in policing have
31
32 been acknowledged as a cause of significant social and occupational upheaval among
33
34 FSW, driving many women, especially former brothel-based FSW, "underground".¹⁰ Both
35
36 government agencies and NGOs in Phnom Penh have reported negative impacts of the
37
38 legislation on FSW including: displacement and harassment and reduced access to
39
40 condoms and health care.^{10 20 24} In our qualitative research, women confirmed these
41
42 impacts, describing how they moved to new venues or locales for sex work transactions
43
44 including apartments or houses rented by brothel owners following brothel closures¹⁶,
45
46 raising concerns about increased risks of HIV transmission as a result of the increasingly
47
48 clandestine nature of direct sex work. The significant increases in the number of women
49
50 involved in sex work also warrants attention.
51
52
53
54
55
56
57
58
59
60

1 The differences in HIV prevalence, risk profiles, and sex work environments reported by
2 these two samples are consistent with both quantitative and qualitative research
3 demonstrating how socio-political and environmental factors can increase vulnerability
4 to HIV among FSW.⁴⁸⁻⁵¹ The time period in which these two cohorts were sampled,
5 corresponded with increased criminalization of sex work which impacted the number
6 and settings of transactional sex. These shifts can have mixed effects. First, women
7 engaged in entertainment-based work have lower risk profiles than women engaged in
8 freelance sex work.⁵ The shorter duration of sex work reported by entertainment-based
9 FSW likely contributes to the lower HIV prevalence in this group. Protective effects of
10 entertainment-based work may include having a boss or manager; odds of HIV among
11 women who say they have a boss or manager are lower compared to women who do
12 not (OR: 0.40; 95% CI 0.19, 0.90).⁵ We also explored these factors in qualitative
13 interviews with FSW.¹⁶ Brothel and entertainment-based sex workers reported that the
14 'boss/manager' mitigated risk of violence from clients and problems with police. Also,
15 women working in entertainment establishments report earning up to three times more
16 (US \$50-\$60 or in \$200,000-\$240,000 Cambodian Riel) per client than women who
17 worked in brothels or streets and parks.¹⁶ This is substantiated by the two cohorts'
18 report of similar income levels despite differences in the number of sex partners. It is
19 also possible that entertainment-based FW have lower risk partners than brothel-based
20 and freelance FSW. We believe that despite the lower prevalence of HIV and the lower
21 number of male sex partners reported by this growing group of FSW, there is significant
22 potential for amplified transmission of HIV at a population level, due principally to the
23 extraordinary growth in the size of the population engaged in sex work. The numbers
24 enumerated by the government, are likely to include a high proportion of entertainment-
25 based FSW who have significantly lower risk overall. But it is unclear if how well the
26 population of high risk women, those previously working in brothels, who were not
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

apparent or represented in our latter sample, are apparent in the census. These women now displaced, may or may not be counted, but are highly likely to be engaged in clandestine transactional sex, as suggested by our qualitative research. Women sampled in the YWHS-2 reflect the majority of the growing population of low risk entertainment workers: they report fewer exposures and have lower HIV prevalence, however our qualitative data also suggests that unprotected sex, length of sexual transactions, sex in risky environments may have increased^{16 45}. While we cannot establish that the criminalization of sex work causes increases in population HIV risk from this limited data, results from these studies correspond to marked shifts in the demographic and risk population that should be investigated more thoroughly.

The two cohorts also showed differences in drug and alcohol use exposures. Our group has identified ATS use as a significant independent risk factor for HIV related risk behaviour including number of sex partners (Adjusted Risk Ratio (ARR): 1.49; 95% CI 1.0, 2.21) and incident STI (AOR: 5.41; 95% CI 1.15, 25.48)³⁹. Alcohol use is also emerging as a potential HIV-related risk factor¹⁶, although not well quantified among FSW, especially those working in entertainment establishments (or their male partners). Entertainment venues largely revolve around alcohol, and women working at these are generally employed as hostesses, waitresses, or as “promoters” such as “beer promotion girls” in a variety of venues.^{16 21} Women who were working in the entertainment sector were more likely to both report more days of drinking, and more days intoxicated, than brothel or street-based FSW. Alcohol use can be a barrier to effective condom use and condom negotiation in the transactional context.^{16 52} Although women in the two samples did not report differences in inconsistent condom use, we have previously found that women who report heavy alcohol use are also significantly more likely to report inconsistent condom use.³⁹ Given how entwined drug and alcohol

1 use are with sex work, especially in the growing entertainment-based sector, there is a
2 significant need to better elucidate ways to mitigate HIV-associated risks among women
3 whose livelihood depends on working in these establishments. Designing and
4 implementing prevention in these contexts will require input, not only from working
5 women, but also from the wider business sector, as well as male clients.^{48 53-56}
6
7
8
9
10
11
12
13
14

15 The differences in HIV and risk profiles between the women in our two samples, as well
16 as outreach efforts by HIV prevention organizations, may be a result of reaching “low
17 hanging fruit” resulting from both substantive increases in the number of women
18 working in entertainment establishments, and the increased challenges of engaging
19 women with higher risk and who are HIV infected for the reasons described above. FSW
20 in Phnom Penh have historically been easily accessed for prevention and surveillance
21 efforts. However, recent changes in the sex work landscape suggest that alternative
22 sampling methods, such as respondent driven sampling, may result in better access to
23 higher risk women who are more hidden and therefore hard to reach in this new legal
24 climate.⁵⁷
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

40 HIV prevention remains an important and essential priority for all women engaged in
41 transactional sex. A recent systematic review confirms that FSW in Asia have the
42 highest odds of infection compared to women of reproductive age in the general
43 population.⁵⁸ In addition to new structural interventions aimed at reducing risk in the
44 work-based environment, the very high prevalence and risk of HIV among FSW in
45 Cambodia suggests a need for combination HIV prevention interventions including
46 biomedical (pre-exposure prophylaxis, microbicides, and treatment as prevention),
47 behavioural and development approaches (such as microfinance or income generating
48 opportunities).⁵⁹⁻⁶⁴
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Several limitations of these analyses should be noted. First results presented here are
5
6 cross-sectional and thus associations do not reflect causality. The comparison of the
7
8 serial samples is ecological in nature and does not prove temporal effects. The sample
9
10 sizes are small and thus subject to limitations with respect to generalizability. Many
11
12 exposures are self-reported and thus may reflect social desirability bias, especially
13
14 condom use which we have found has been over-reported based on biomarker data.⁶⁵
15
16 On the other hand, we have found that self-reported ATS use is accurate compared to
17
18 urine toxicology screening, suggesting that measures of drug and alcohol use in this
19
20 group are accurate.⁶⁶
21
22
23
24
25
26

27 Results from this analysis provide important insights into recent shifts in the context of
28
29 sex work and risk in young FSW in Phnom Penh, highlight challenges to HIV prevention
30
31 in this environment, and also point to the need for more research. Conflicting trends,
32
33 including the criminalization and suppression of direct sex work while the indirect
34
35 entertainment-based sex work industry is flourishing, has potentially set a new stage.
36
37 Unless there is acknowledgment and access to women who are more directly engaged in
38
39 sex work, these women will be poorly represented in any national HIV or behavioural
40
41 surveillance. They will remain hidden and stigmatized, subject to repression, violence
42
43 and potentially with less access to prevention or care. While the 100% condom use
44
45 program had its criticisms, that policy at least acknowledged the existence and need for
46
47 HIV prevention at a multisectoral level for FSW. The current socio-political climate has
48
49 potentially reversed these benefits, by denying the existence of FSW. Further in-depth
50
51 research among both FSW, their male clients and among entertainment venue
52
53 management would help to elucidate the impacts, both positive and negative of these
54
55 new laws. The exponential growth of entertainment-based sex work has the potential to
56
57
58
59
60

1 result in an expanding HIV epidemic among young women in Cambodia. From a
2
3 programmatic perspective entertainment-based FSW are much easier to reach but likely
4
5 require different HIV prevention interventions than the 100% condom use program.
6
7
8 Implementation of research and programmatic efforts that integrate health, social
9
10 empowerment, and safe work environments for HIV prevention remain a high priority
11
12 for women engaged in sex work in Cambodia.⁶⁷
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

References

1. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Annual Report 2009: National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/report.php>; Accessed July 8, 2011, 2011.
2. Saphonn V, Sopheab H, Sun LP, Vun MC, Wantha SS, Gorbach PM, et al. Current HIV/AIDS/STI epidemic: intervention programs in Cambodia, 1993-2003. *AIDS Educ Prev* 2004;16(3 Suppl A):64-77.
3. NCHADS. Behavioral Sentinel Surveillance 2010. *Cambodia National Center for HIV, AIDS, Dermatology and STD Dissemination Conference, December 30, 2010* 2011.
4. NCHADS. Ministry of Health National Center for HIV, AIDS, Dermatology and STDs. Estimation of the HIV prevalence among the general population in Cambodia. : National Centre for HIV/AIDS, Dermatology and STDs, Cambodia; <http://www.nchads.org/index.php?id=20&event=146> Accessed July 8, 2011, 2011.
5. Couture MC, Sansothy N, Saphonn V, Phal S, Sichan K, Stein E, et al. Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine-type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis* 2011;38(1):33-9.
6. Sopheab H, Saphonn V, Chhea C, Fylkesnes K. Distribution of HIV in Cambodia: findings from the first national population survey. *AIDS* 2009;23(11):1389-95.
7. Sopheab H, Morineau G, Neal JJ, Saphonn V, Fylkesnes K. Sustained high prevalence of sexually transmitted infections among female sex workers in Cambodia: high turnover seriously challenges the 100% Condom Use Programme. *BMC Infect Dis* 2008;8:167.
8. Sopheab H, Gorbach PM, Gloyd S, Leng HB. Rural sex work in Cambodia: work characteristics, risk behaviours, HIV, and syphilis. *Sex Transm Infect* 2003;79(4):e2.
9. Saphonn V, Parekh BS, Dobbs T, Mean C, Bun LH, Ly SP, et al. Trends of HIV-1 Seroincidence Among HIV-1 Sentinel Surveillance Groups in Cambodia, 1999-2002. *J Acquir Immune Defic Syndr* 2005;39(5):587-592.
10. UNAIDS. Cambodia Country Progress Report: Monitoring the Progress towards the Implementation of the Declaration of Commitment on HIV and AIDS. Reporting period: January 2010-December 2011. Prepared by National AIDS Authority for United Nations General Assembly Special Session (UNGASS). . <http://www.unaids.org/en/regionscountries/countries/cambodia/> Accessed December 28, 2012.
11. UNAIDS. HIV in Asia and the Pacific: Getting to Zero. http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/20110826_APGettingToZero_en.pdf 2011;Accessed December 20, 2011.
12. Samnang P, Leng HB, Kim A, Canchola A, Moss A, Mandel JS, et al. HIV prevalence and risk factors among fishermen in Sihanouk Ville, Cambodia. *Int J STD AIDS* 2004;15(7):479-83.
13. Nishigaya K. Female garment factory workers in Cambodia: migration, sex work and HIV/AIDS. *Women Health* 2002;35(4):27-42.
14. Patterson D. Southeast Asia: national policy audits on HIV and migration. *HIV AIDS Policy Law Rev* 2005;10(3):31, 33.
15. Hor LB, Detels R, Heng S, Mun P. The role of sex worker clients in transmission of HIV in Cambodia. *Int J STD AIDS* 2005;16(2):170-4.

- 1 16. Maher L, Mooney-Somers J, Phlong P, Couture MC, Stein E, Evans J, et al. Selling
2 sex in unsafe spaces: Sex work risk environments in Phnom Penh, Cambodia.
3 *Harm Reduct J* 2011;8(1):30.
- 4 17. Plummer R. The sex industry in Cambodia: the traffic police. . *The Economist* June
5 11, 2009.
- 6 18. UNIAP. United Nations Inter-Agency Project on Human Trafficking (Phase III).
7 Cambodia: Exodus to the sex trade? Effects of the global financial crisis on
8 women's working conditions and opportunities. Report [http://www.no-
10 trafficking.org/reports_docs/siren/siren_cb-04.pdf](http://www.no-
9 trafficking.org/reports_docs/siren/siren_cb-04.pdf); Accessed August 31, 2009.
- 11 19. UNAIDS pr. More women in Cambodia turning to sex trade amid financial crisis – UN
12 report.
13 [http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking
15 &Cr1=](http://www.un.org/apps/news/story.asp?NewsID=31541&Cr=human+trafficking
14 &Cr1=) 2009.
- 16 20. KHANA. Mapping the pattern of sex workers, entertainment establishments, and
17 men who have sex with men in Cambodia. Accessed July 9, 2011. Report by Hor
18 Bun Leng, M.D, and Tuot Sovaranny, March. 2008.
- 19 21. Kim AA, Sun LP, Chhorvann C, Lindan C, Van Griensven F, Kilmarx PH, et al. High
20 prevalence of HIV and sexually transmitted infections among indirect sex workers
21 in Cambodia. *Sex Transm Dis* 2005;32(12):745-51.
- 22 22. Gorbach PM, Sopheab H, Chhorvann C, Weiss RE, Vun MC. Changing behaviors and
23 patterns among Cambodian sex workers: 1997-2003. *Journal of Acquired
24 Immune Deficiency Syndromes* 2006;42(2):242-7.
- 25 23. Ghys PD, Jenkins C, Pisani E. HIV surveillance among female sex workers. *Aids*
26 2001;15 Suppl 3:S33-40.
- 27 24. Francis C. HIV prevention and anti-trafficking in conflict? The public health
28 consequences of Cambodia's fight against trafficking. FHI (in collaboration with
29 PSI, Care, UNAIDS); December 2008.
- 30 25. FHI. SMARTgirl Program to Reduce Risk and Inspire Behavior Change. .
31 http://www.fhi.org/en/CountryProfiles/Cambodia/res_SMARTgirl.htm# Accessed
32 July 15th, 2011.
- 33 26. Burke KP, Munshaw S, Osburn WO, Levine J, Liu L, Sidney J, et al. Immunogenicity
34 and cross-reactivity of a representative ancestral sequence in hepatitis C virus
35 infection. *J Immunol* 2012;188(10):5177-88.
- 36 27. Lamptey PR. Reducing heterosexual transmission of HIV in poor countries. *Bmj
37 Clinical Research Ed.* 2002;324(7331):207-11.
- 38 28. UNODC. Patterns and Trends of Amphetamine Type Stimulants and other drugs;
39 Asia and the Pacific. *The Global SMART Programme (Synthetics Monitoring:
40 Analyses, Reporting, Trends)*
41 <http://www.unodc.org/unodc/en/scientists/smart.html> (Accessed January 5,
42 2012) 2011.
- 43 29. Ahmad K. Increased use of amphetamine-type stimulants threatens east Asian
44 countries. *Lancet* 2002;359(9321):1927.
- 45 30. Ahmad K. Asia grapples with spreading amphetamine abuse. *Lancet*
46 2003;361(9372):1878-9.
- 47 31. Kulsudjarit K. Drug problem in southeast and southwest Asia. *Ann N Y Acad Sci*
48 2004;1025:446-57.
- 49 32. Farrell M, Marsden J, Ali R, Ling W. Methamphetamine: drug use and psychoses
50 becomes a major public health issue in the Asia Pacific region. *Addiction*
51 2002;97(7):771-2.
- 52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
33. Mongkolsirichaikul D, Mokkhavesa C, Ratanabanangkoon K. The incidence of amphetamine use among truck drivers from various regions of Thailand. *J Med Assoc Thai* 1988;71(9):471-4.
 34. Vongsheree S, Sri-Ngam P, Ruchusatsawat N, Thaisri H, Puangtabtim W, Phutiprawan T, et al. High HIV-1 prevalence among metamphetamine users in central Thailand, 1999-2000. *J Med Assoc Thai* 2001;84(9):1263-7.
 35. Dayrit FM, Dumlao MC. Impurity profiling of methamphetamine hydrochloride drugs seized in the Philippines. *Forensic Sci Int* 2004;144(1):29-36.
 36. Lin SK, Ball D, Hsiao CC, Chiang YL, Ree SC, Chen CK. Psychiatric comorbidity and gender differences of persons incarcerated for methamphetamine abuse in Taiwan. *Psychiatry Clin Neurosci* 2004;58(2):206-12.
 37. Lua AC, Lin HR, Tseng YT, Hu AR, Yeh PC. Profiles of urine samples from participants at rave party in Taiwan: prevalence of ketamine and MDMA abuse. *Forensic Sci Int* 2003;136(1-3):47-51.
 38. Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, Beyrer C, et al. HIV prevalence and risks among injection and noninjection drug users in northern Thailand: need for comprehensive HIV prevention programs. *J Acquir Immune Defic Syndr* 2003;33(2):259-66.
 39. Couture MC, Evans JL, Sothy NS, Stein ES, Sichan K, Maher L, et al. Correlates of amphetamine-type stimulant use and associations with HIV-related risks among young women engaged in sex work in Phnom Penh, Cambodia. *Drug Alcohol Depend* 2012;120(1-3):119-26.
 40. Melbye K, Khamboonruang C, Kunawararak P, Celentano DD, Prapamontol T, Nelson KE, et al. Lifetime correlates associated with amphetamine use among northern Thai men attending STD and HIV anonymous test sites. *Drug Alcohol Depend* 2002;68(3):245-53.
 41. Sattah MV, Supawitkul S, Dondero TJ, Kilmarx PH, Young NL, Mastro TD, et al. Prevalence of and risk factors for methamphetamine use in northern Thai youth: results of an audio-computer-assisted self-interviewing survey with urine testing. *Addiction* 2002;97(7):801-8.
 42. Buavirat A, Page-Shafer K, van Griensven GJ, Mandel JS, Evans J, Chuaratanaphong J, et al. Risk of prevalent HIV infection associated with incarceration among injecting drug users in Bangkok, Thailand: case-control study. *BMJ* 2003;326(7384):308.
 43. Beyrer C, Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, et al. Methamphetamine users in northern Thailand: changing demographics and risks for HIV and STD among treatment-seeking substance abusers. *Int J STD AIDS* 2004;15(10):697-704.
 44. Vanichseni S, Tappero JW, Pitisuttithum P, Kitayaporn D, Mastro TD, Vimutisunthorn E, et al. Recruitment, screening and characteristics of injection drug users participating in the AIDS-VAX B/E HIV vaccine trial, Bangkok, Thailand. *Aids* 2004;18(2):311-6.
 45. Maher L, Phlong P, Mooney-Somers J, Keo S, Stein E, Couture MC, et al. Amphetamine-type stimulant use and HIV/STI risk behaviour among young female sex workers in Phnom Penh, Cambodia. *Int J Drug Policy* 2011;22(3):203-9.
 46. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS use among young female sex workers in Cambodia. *Masters Thesis for University of California Berkeley, School of Public Health, MPH in Epidemiology and Biostatistics. Completed May 15, 2011.*

- 1 47. Chattergoon MA, Levine JS, Latanich R, Osburn WO, Thomas DL, Cox AL. High
2 plasma interleukin-18 levels mark the acute phase of hepatitis C virus infection. *J*
3 *Infect Dis* 2011;204(11):1730-40.
- 4 48. Yang C, Latkin C, Luan R, Nelson K. Condom use with female sex workers among
5 male clients in Sichuan Province, China: the role of interpersonal and venue-level
6 factors. *J Urban Health* 2010;87(2):292-303.
- 7 49. Erasquin JT, Reed E, Blankenship KM. Police-related experiences and HIV risk
8 among female sex workers in Andhra Pradesh, India. *J Infect Dis* 2011;204 Suppl
9 5:S1223-8.
- 10 50. Shannon K, Kerr T, Allinott S, Chettiar J, Shoveller J, Tyndall MW. Social and
11 structural violence and power relations in mitigating HIV risk of drug-using
12 women in survival sex work. *Soc Sci Med* 2008;66(4):911-21.
- 13 51. Shannon K, Kerr T, Strathdee SA, Shoveller J, Montaner JS, Tyndall MW. Prevalence
14 and structural correlates of gender based violence among a prospective cohort of
15 female sex workers. *BMJ* 2009;339:b2939.
- 16 52. Kalichman SC, Simbayi LC, Kaufman M, Cain D, Jooste S. Alcohol use and sexual
17 risks for HIV/AIDS in sub-Saharan Africa: systematic review of empirical findings.
18 *Prev Sci* 2007;8(2):141-51.
- 19 53. Morisky DE, Chiao C, Ksobiech K, Malow RM. Reducing alcohol use, sex risk
20 behaviors, and sexually transmitted infections among Filipina female bar workers:
21 effects of an ecological intervention. *J Prev Interv Community* 2010;38(2):104-
22 17.
- 23 54. Surratt HL, Inciardi JA. An effective HIV risk-reduction protocol for drug-using
24 female sex workers. *J Prev Interv Community* 2010;38(2):118-31.
- 25 55. Argento E, Reza-Paul S, Lorway R, Jain J, Bhagya M, Fathima M, et al. Confronting
26 structural violence in sex work: lessons from a community-led HIV prevention
27 project in Mysore, India. *Aids Care* 2011;23(1):69-74.
- 28 56. Reza-Paul S, Beattie T, Syed HU, Venukumar KT, Venugopal MS, Fathima MP, et al.
29 Declines in risk behaviour and sexually transmitted infection prevalence following
30 a community-led HIV preventive intervention among female sex workers in
31 Mysore, India. *Aids* 2008;22 Suppl 5:S91-100.
- 32 57. Johnston LG, Sabin K, Mai TH, Pham TH. Assessment of respondent driven sampling
33 for recruiting female sex workers in two Vietnamese cities: reaching the unseen
34 sex worker. *J Urban Health* 2006;83(6 Suppl):i16-28.
- 35 58. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV
36 among female sex workers in low-income and middle-income countries: a
37 systematic review and meta-analysis. *Lancet Infect Dis* 2012;12(7):538-49.
- 38 59. Merson M, Padian N, Coates TJ, Gupta GR, Bertozzi SM, Piot P, et al. Combination
39 HIV prevention. *Lancet* 2008;372(9652):1805-6.
- 40 60. Abdool Karim Q, Abdool Karim SS, Frohlich JA, Grobler AC, Baxter C, Mansoor LE, et
41 al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the
42 prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.
- 43 61. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure
44 chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J*
45 *Med* 2010;363(27):2587-99.
- 46 62. Dworkin SL, Blankenship K. Microfinance and HIV/AIDS prevention: assessing its
47 promise and limitations. *AIDS Behav* 2009;13(3):462-9.
- 48 63. Pronyk PM, Kim JC, Abramsky T, Phetla G, Hargreaves JR, Morison LA, et al. A
49 combined microfinance and training intervention can reduce HIV risk behaviour in
50 young female participants. *AIDS* 2008;22(13):1659-65.
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
64. Rosenberg MS, Seavey BK, Jules R, Kershaw TS. The Role of a Microfinance Program on HIV Risk Behavior Among Haitian Women. *AIDS Behav* 2011;15(5):911-8.
65. Evans J, Couture M-C, Stein ES, Sansothy N, Maher L, Page K, et al. Biomarker validation of recent unprotected sexual intercourse in a prospective study of young women engaged in sex work in Phnom Penh, Cambodia. . *STD* in press.
66. Kab V, Evans J, Sansothy N, Stein E, Couture M-C, Maher L, et al. Testing for amphetamine-type stimulant (ATS) use to ascertain validity of self-reported ATS use among young female sex workers in Cambodia. . *Addiction Science & Clinical Practice* 2012;7:11-25.
67. Tucker JD, Tuminez AS. Reframing the interpretation of sex worker health: a behavioral-structural approach. *J Infect Dis* 2011;204 Suppl 5:S1206-10.

Table 1: Selected socio-demographic characteristics, occupational, and risk exposures in two cohorts of high risk young women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2 N=153*		p-value
	Prevalence of characteristic		Prevalence of characteristic		
	N	%	N	%	
Age (years, median (IQR))	25 (21 – 27)		25 (22 – 28)		0.56
16-18	13	8.1	11	7.2	0.86
19-24	64	40.0	58	37.9	
25-29	83	51.8	84	54.9	
Marital status					
Never married	57	35.6	38	24.8	<0.01
Married-living together	24	15.0	48	31.4	
Widowed/Divorced/Separated	79	49.4	67	43.8	
Education (years)					
None	64	40.0	23	15.0	<0.01
Primary (1-6 years)	82	51.3	91	59.5	
Secondary (7+ years)	14	8.8	39	25.5	
Age at first sex (median (IQR))	17 (16 – 18)		18 (16 – 19)		0.03
≤ 15	32	20.1	22	14.5	0.19
> 15	127	79.9	130	85.5	
Length of employment as FSW (years, median (IQR))	4.3 (2.5 – 6.3)		3 (1.7 – 5)		<0.01
Current employment venue (last 30 days)					
Entertainment	51	31.9	113	74.3	<0.01†
Brothel	23	9.2	3	2.0	
Freelance	59	39.3	29	19.1	
Other/Multiple	27	16.9	7	4.6	
Have a manager, boss or supervisor					
No	82	53.6	28	14.4	<0.01
Yes	71	46.4	124	81.6	
Income in past month (US \$)					
Less than \$100	68	42.5	50	32.9	0.18
100-150\$	35	21.9	43	29.3	

Over 150\$	57	35.6	59	38.8	
Number of sex partners in last month (median (IQR))	30 (10 – 90)		5 (3 – 13)		<0.01
≤10	45	28.1	112	73.2	<0.01
11 – 50	53	33.1	41	26.8	
> 50	62	38.8	0	0	
Condom use with last paying partner					
Consistent (always)	108	85.7	86	87.8	0.66
Inconsistent	18	14.3	12	12.2	
Condom use with last non paying partner					
Consistent (always)	7	20.6	10	18.2	0.78
Inconsistent	27	79.4	45	81.8	
Number of days drink alcohol (last month)	15 (2 – 30)		18 (5 – 28)		0.76
0 – 4	65	40.6	36	23.5	<0.01
5 – 19	25	15.6	42	27.5	
≥ 20	70	43.7	75	49.0	
Number of days drunk (last month)	5 (1 – 20)		3 (1 – 10)		0.07
0 – 4	89	55.6	86	56.2	<0.01
5 – 19	33	20.6	50	32.7	
≥ 20	38	23.7	17	11.1	
ATS use (ever)					
No	92	57.5	107	69.9	0.02
Yes	68	42.5	46	30.1	
ATS use (last 3 months)					
No	116	73.4	117	76.5	0.54
Yes	42	26.6	36	23.5	
Ever used any drug prior to/during sex					
No	109	68.1	117	76.5	0.10
Yes	51	31.9	36	23.5	

* Excludes women who participated in YWHS-1

†Fisher Exact p-value

Table 2: HIV prevalence overall and by current work venue in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	% (95% CI)	N	%	
HIV positive	37	23.1 (16.5 – 29.7)	14	9.2 (4.5 – 13.8)	<0.01
HIV positive by employment venue (n/N)					
Entertainment	5/51	9.8 (1.5 – 18.1)	5/113	4.4 (0.6 – 8.2)	<0.01
Brothel	4/23	17.4 (1.5 – 33.3)	0/3	0	
Freelance	22/59	37.3 (25.0 – 48.0)	9/29	31.0 (13.8 – 48.2)	
Other/Multiple	6/27	22.2 (6.2 – 38.3)	0/7	0	

* Excludes women who participated in YWHS-1

Table 3: HIV testing history and behaviors in two cohorts of young high risk women in Phnom Penh, Cambodia: YWHS-1 (2006-2007) and YWHS-2 (2009-2010)

Characteristic	YWHS-1 N=160		YWHS-2* N=153*		p-value
	N	%	N	%	
Ever tested for HIV					
No	58	36.5	31	20.3	<0.01
Yes	101	63.5	122	79.7	
HIV test in last 3 months					
No	126	79.3	119	77.8	0.75
Yes	33	20.7	34	22.2	
What was result of last HIV test?#					
Negative	84	84.0	114	93.4	0.04
Positive	4	4.0	4	3.3	
Don't know	12	12.0	4	3.3	
Where received last HIV test#					
Public hospital	35	34.7	55	34.0	0.10
Voluntary testing and counseling center	1	1.0	0	0	
NGO clinic	59	58.4	54	44.3	
Private hospital, clinic, or laboratory	6	5.9	13	10.7	

* Excludes women who participated in YWHS-1

Among those who reported being previously tested for HIV

Figure Legend

Figure 1: Venues where women in YWHS-2 and YWHS-2 reported ever working

Figure 2. Alcohol use in the past month and ATS use in the past 3 months reported by women in YWHS-1 and YWHS-2 by work venue: (A) Entertainment-based; (B) Brothel-based; (C) Freelance

For peer review only