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PROGRAMME SCIENCE

Demographic changes and trends in risk behaviours, HIV and other sexually transmitted infections among female sex workers in Bangalore, India involved in a focused HIV preventive intervention

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ABSTRACT

The primary objectives of this study were to assess the changing demographic characteristics of female sex workers (FSWs) in the urban Bangalore district, India, and trends in programme coverage, HIV/sexually transmitted infection prevalence rates and condom use. Cross-sectional, integrated behavioural and biological assessments of FSWs were conducted in 2006, 2009 and 2011. Univariate and multivariate analyses were used to describe trends over time. The results indicate the mean age of initiation into sex work has increased (26.9 years in 2006 vs 27.6 years in 2011, $p<0.01$), a higher proportion of FSWs reported being in 'stable' relationships in 2011 (70.2% vs 43.2% in 2006, $p<0.01$) and having conducted sex work outside the district in the past 6 months (10.0% in 2011 vs 16.0% in 2006 $p=0.01$). There was an increase in the proportion of FSWs using cellphones to solicit clients (4.4% in 2006 vs 57.5% in 2011, $p<0.01$) and their homes for sex work (61.4% in 2006 vs 77.8% in 2011, $p<0.01$). Reactive syphilis prevalence declined (12.6% in 2006 to 4% in 2011, $p=0.02$), as did high-titre syphilis prevalence (9.5% in 2006 to 2.5% in 2011, $p=0.01$). HIV prevalence declined but not significantly (12.7% in 2006 and 9.3% in 2011, $p=0.39$). Condom use remained above 90% increasing significantly among repeat (paying) clients (66.6% in 2006 to 93.6% in 2011, $p<0.01$). However, condom use remained low with non-paying partners when compared with occasional paying partners (17.6% vs 97.2% in 2011, $p<0.01$). Given the changing dynamics in the FSW population at multiple levels, there is a need to develop and customise strategies to meet local needs.

INTRODUCTION

The state of Karnataka in southern India has a population of approximately 60 million and is divided into 30 administrative districts, including the urban Bangalore district comprising the state capital. Since 1988, when the first individuals with HIV in Karnataka were identified, substantial evidence has been collected to suggest that the state has a fairly advanced HIV epidemic. In 2003, when HIV intervention programmes were initiated, HIV prevalence among antenatal clinic attenders in Karnataka was 1.5%, ranking Karnataka among the

top four states in India with regard to epidemic severity.^{1,2} The prevalence of HIV among sexually transmitted infection (STI) clinic attenders exceeded 10%.² Heterosexual contact has typically been the main route of transmission, with commercial sex believed to be a major driver. The female sex worker (FSW) population in Karnataka has been estimated to be over 100 000 with studies suggesting that HIV prevalence in this group ranges from 10% to 34%³; most sex work is either initiated in public places or is home-based.⁴

In 2003, the University of Manitoba, in partnership with the government of Karnataka, established the Karnataka Health Promotion Trust, to intensify and expand HIV preventive interventions for most-at-risk populations, including FSWs. Supported by *Avahan*, the India AIDS Initiative of the Bill & Melinda Gates Foundation,⁵ targeted interventions were implemented throughout the state, with the objective of protecting and promoting the health of FSWs, and interrupting transmission to and from this subpopulation as a means of controlling HIV and other STIs. The *Pragati* programme⁶ was launched in 2005 in the urban Bangalore district, India's third most populous metropolitan area, as a partnership between *Swati Mahila Sangha* (SMS), a community-based organisation of FSWs, and *Swasti*, a health resource centre. *Pragati* reaches approximately 12 000–13 000 FSWs per month and is one of India's largest HIV interventions, founded on the belief that the social and economic empowerment of FSWs will enable these women to protect themselves from health threats including HIV/STIs. The programme was designed in collaboration with the sex worker community to provide a personalised set of services. These include STI prevention and treatment services, positive prevention, crisis response facilities, deaddiction services, social entitlement facilitation, organisational development and microfinance support. *Pragati*'s 'backbone' comprises peer educators (PEs) and outreach workers (ORWs). Each PE provides outreach services to between 60 and 120 FSWs for whom she is responsible. PEs are supported by the ORWs, who also manage the secondary stakeholders in their assigned areas. Each ORW is responsible for six to seven PEs. The ORWs

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report to zonal field coordinators who are members of SMS. A zonal manager supports the field coordinators. A field operations manager from SMS and a technical programme manager from *Swasti* jointly oversee the project and are responsible for the monitoring, evaluation and learning components.

To assess trends in HIV/STI prevalence and behavioural changes within the context of interventions such as *Pragati*, a series of anonymised cross-sectional surveys were implemented to measure key HIV-related behavioural and biological parameters among FSWs for HIV infection. The results from two rounds of these surveys, conducted in 2006 and 2009, have been previously presented.^{7, 8} In this paper we extend the findings to 2011 and present evidence for a changing dynamic in the FSW population, providing valuable information to fine-tune programme interventions.

METHODOLOGY

Integrated behavioural-biological assessments

The integrated behavioural-biological assessments (IBBAs) are a series of cross-sectional surveys designed to measure behavioural and biological parameters among most-at-risk populations. The methodologies used have been previously described.⁷ Briefly, sample size calculations were designed to detect a 10–15% increase in condom use with 90% power and α error of 5%, assuming a baseline value for consistent condom use with commercial clients of 50%. Thus it was estimated that 385 participants (rounded to 400) were required for each cross-sectional survey round in each district. In the urban Bangalore district, two sampling domains were used (street-based FSWs and non-street-based FSWs), with a target sample of 400 FSWs in each domain for each round. A probability-based sampling method was used. Conventional cluster sampling was used for FSWs selling sex at home, or in brothels and other locations where the population of FSWs was relatively stable. Conventional time location cluster sampling was used for street-based FSWs. The same sampling technique was used for all survey cycles.

Face-to-face interviews were conducted by trained field work assistants in the local language, *Kannada*, using a comprehensive behavioural questionnaire, which included questions about demographic and sex work characteristics, sexual behaviour, condom practices and use of the programme drop-in centre. For this report, data from the 2006, 2009 and 2011 IBBA cycles conducted in the urban Bangalore district were used, with the 2006 survey data serving as the baseline.

Laboratory methods

HIV seropositivity was determined with a two-test algorithm using different enzyme immunoassays and was defined as both tests being positive. Syphilis serology was determined using the rapid plasma reagin (RPR) test and a confirmatory *Treponema pallidum* haemagglutination assay. Any positive RPR test confirmed by *T pallidum* haemagglutination assay was defined as reactive syphilis. RPR titres $\geq 1:8$ were defined as high-titre syphilis. Chlamydia and gonorrhoea tests were conducted using the Gen-Probe Aptima assay (Gen-Probe, San Diego, California, USA) using protocols that have been previously described.⁸

Data analysis

All statistical analyses were performed using STATA, V.12.0. Weights were used to account for the differential recruitment of FSWs in clusters, and for non-response rates in IBBA rounds. The χ^2 test was used for trend analyses. ORs were used to measure associations and the Wald χ^2 test was the statistical test

used. Primary outcomes were programme coverage, STI/HIV prevalence and reported condom use. Age stratified and typology stratified results are presented to account for potential confounders. Typology refers to the self-reported primary place of solicitation. FSWs were categorised as being brothel-based, lodge-based or 'dhaba' (road-side restaurant)-based, street-based or public place-based, cellphone-based, or home-based. Due to the unlinked, anonymous nature of the survey, women who participated in multiple rounds of data collection were included in all analyses. The enter method was used to determine factors significantly associated with the outcome(s) of interest and only those variables significant at the univariate level ($p < 0.10$) were included in the multivariate model. The explanatory variables included current age, marital status, age at starting sex work, duration in sex work, place of solicitation, place where the client is usually entertained, amount charged per sex act, weekly income from sex work and proportion of FSWs with occasional and regular clients (commercial and non-paying).

This study was approved by the Institutional Ethical Review Board of St. John's Medical College and Hospital, Bangalore, India and the Health Research Ethics Board of the University of Manitoba, Winnipeg, Canada. The study was also approved by the Research Reference Group of SMS and *Swasti*.

RESULTS

A total of 673 FSWs participated in the baseline survey (2006); 754 and 718 FSWs participated in follow-up surveys conducted in 2009 and 2011, respectively. While some demographic characteristics were relatively unchanged (eg, age, literacy, duration of sex work and non-commercial partner types, table 1), some significant changes merit mention. A significantly higher proportion of FSWs reported being currently married in 2011 (70.2%) compared with 2006 (43.2%, $p < 0.01$), and a lower proportion reported a dissolved marriage in 2011 (26.0%) compared with 2006 (51.5%, $p < 0.01$). A higher proportion of FSWs reported conducting sex work outside the district in the past 6 months (10.0% in 2006 vs 16.0% in 2011, $p = 0.01$). The proportion reporting sexual debut at under 15 years of age increased from 21.7% in 2006 to 37.6% in 2011 ($p < 0.01$) but in 2011, the mean age of initiation into commercial sex work was higher than reported for 2006 (27.6 years vs 26.9 years, $p < 0.01$, table 1). A much higher proportion (57.5%) of FSWs reported using a cellphone to contact clients in 2011 compared with only 4.4% in 2006 ($p < 0.001$), and 77.8% of FSWs reporting use of homes to entertain clients compared with 61.4% in 2006 ($p < 0.01$). The proportion of FSWs reporting $> 50\%$ of their clients as 'new' declined from 86.0% in 2006 to 72.7% in 2011 ($p < 0.01$). Overall, a higher proportion of FSWs reported having paying clients compared with non-paying clients but the proportion of FSWs reporting paying (regular and occasional) clients declined. Reported weekly earnings increased from 3400 rupees (US\$65) in 2006 to 5260 rupees (US\$100) in 2011 (table 1).

Pragati programme exposure

Pragati programme exposure, which was already high in 2006, incrementally increased over time. By 2011, virtually all known FSWs had been visited by a PE (91.3%, table 2), and had witnessed a condom demonstration (95.7%, table 2). The proportion of FSWs who reported ever visiting a drop-in centre remained relatively unchanged at 69.2% in 2011 versus 68.0% in 2006 ($p = 0.48$). However, there was a significant increase in the proportion of FSWs attending a sexual health clinic in the past 6 months from 68.2% in 2006 to 86.2% in 2011 ($p < 0.001$, table 2).

Table 1 Profiles of FSWs by selected background characteristics, IBBA baseline and follow-up surveys, urban Bangalore district

	Round 1 (2006) 673	Round 2 (2009) n=754	Round 3 (2011) n=718	p Value
<i>Characteristic</i>				
Current age (years)				
<20	4.3	3.8	2.1	0.30
20–24	17.2	21.3	16.5	
25–29	22.4	21.5	23.1	
30–34	21.4	18.4	18.3	
35–39	22.5	21.7	25.1	
40+	12.2	13.4	14.9	
Mean	30.7	30.7	31.7	<0.01
Literacy				
Illiterate	47.8	49.6	45.7	0.49
Marital Status				
Never married	5.2	7.5	3.6	0.00
Cohabiting	0.1	0.8	0.2	
Currently married	43.2	59.6	70.2	
Marriage dissolved	51.5	32.1	26.0	
Devadasi	0.0	0.0	0.0	
Additional income				
Yes	56.0	51.9	55.6	0.01
Residency				
Localised	99.6	99.9	98.8	0.03
Sex work outside district in past 6 months				
Yes	10.0	10.9	16.0	0.01
Sex work in the city <2 years				
Yes	34.8	32.4	28.5	0.05
Duration of sex work (years)				
0–1	32.7	32.2	28.1	0.22
2–3	29.6	30.8	31.9	
4–9	25.0	23.7	30.0	
10+	12.7	13.3	10.0	
Mean	3.8	4.1	4.1	<0.01
Age at first sex (years)				
<15	21.7	31.6	37.6	<0.01
15–19	57.6	58.7	49.1	
20+	20.7	9.7	13.3	
Mean	16.8	16.1	15.9	<0.01
Age started sex work (years)				
<20	14.3	14.1	7.7	0.01
20–24	24.9	26.9	27.4	
25–29	28.9	27.1	26.5	
30+	32.0	31.9	38.4	
Mean	26.9	26.5	27.6	<0.01
Usual place of solicitation				
Home	13.8	28.9	6.4	<0.01
Brothel/lodge/dhaba	3.8	7.3	1.4	
Public place	78.0	52.5	34.7	
Phone/other	4.4	11.2	57.5	
Usual place of entertaining clients				
Home	61.4	69.1	77.8	<0.01
Brothel/lodge/dhaba	34.4	24.7	16.5	
Public place	3.4	5.1	5.8	
Other	0.5	1.1	0.0	
Weekly client volume				
1–4	21.4	26.8	24.0	0.02
5–9	35.2	35.0	42.2	

Continued

Table 1 Continued

	Round 1 (2006) 673	Round 2 (2009) n=754	Round 3 (2011) n=718	p Value
10+	43.4	38.1	33.8	
Mean	9.6	9.2	9.4	<0.01
Proportion of clients who are new				
>50%	86.0	77.5	72.7	<0.01
Partner types				
Repeat (paying)	98.0	78.0	90.1	<0.01
Occasional (paying)	99.9	90.5	84.1	<0.01
Regular (non-paying)	69.0	63.1	67.8	0.50
Earnings per week from sex work (rupees)				
<500	6.4	6.9	4.3	<0.01
501–1500	28.9	22.3	18.4	
1501+	64.7	70.8	77.3	
Mean	3402	4500	5259	<0.01

FSW, female sex worker; IBBA, integrated behavioural and biological assessment.

HIV/STI prevalence and reported condom use

There was an overall decline in the adjusted HIV prevalence among FSWs, but this was not statistically significant (12.7% in 2006, 9.3% in 2011, p value=0.39, table 3). As cross-sectional surveys were unlinked and anonymised, HIV incidence could not be ascertained. However, the HIV prevalence rates among younger FSWs (<25 years), which have been used as a proxy for new HIV infections, were not significantly different from that of their older peers (7.2% and 9.8%, respectively in 2011, table 3). There was a significant decline in the prevalence of reactive syphilis (12.6% in 2006 vs 4.0% in 2011, $p=0.02$) and high-titre syphilis (9.5% in 2006 vs 2.5% in 2011, $p=0.01$, table 3). Chlamydia and gonorrhoea infection rates increased marginally between 2006 and 2009. However, as testing for these STIs was not conducted during the 2011 round of the IBBA, trends over the 6-year time period could not be ascertained. The rates of condom use with paying clients, which were already high (at 91.8% in 2006), increased even further to 97.2% in 2011 ($p=0.009$). This increase was driven largely by condom use among FSWs 25+ years of age (table 3). Among repeat (paying) clients, condom use increased significantly from 66.6% in 2006 to 93.5% in 2011 ($p<0.001$), and these increases were not age-dependent. However, there were no changes in condom use with regular, non-paying partners, including among younger FSWs (table 3).

Sex work typology

Overall, the prevalence of HIV was substantially higher among FSWs soliciting clients on the streets (14.6% in 2006 and 13.1% in 2011, table 4). HIV prevalence increased from 5.8% in 2006 to 8% in 2011 ($p=0.49$) among FSWs using cellphones to solicit clients (table 4). The prevalence of treatable STIs such as chlamydia and gonorrhoea also increased, from 0% in 2006 to 3.8% in 2009 in this group (table 4). These findings are concerning in light of the finding that the proportion of FSWs who report using cellphones to solicit clients has increased over time (table 1).

Reported condom use at last sex with commercial clients remained above 90% among brothel-based and street-based FSWs and among FSWs soliciting using cellphones, but was lower (76% in 2011) among home-based FSWs (table 4). With

Table 2 Univariate and multivariate analyses of programme exposure among FSWs at follow-up compared with baseline

Programme exposure	2006 (n=673)	2009 (n=756)	2011 (n=718)	Crude OR (95% CI)	Adjusted OR (95% CI)	p Value adjusted model
Visited by peer educator in past 1 month	86.9	83.7	91.3	1.6 (1.0 to 2.5)	1.9 (1.2 to 3.0)	0.01
Ever attended drop-in centre	68.0	79.2	69.2	1.1 (0.72 to 1.6)	1.2 (0.76 to 1.8)	0.48
Attended programme sexual health clinic in past 6 months	68.2	68.4	86.2	2.9 (2.0 to 4.3)	3.5 (2.2 to 5.6)	<0.01
Ever witnessed condom distribution	92.0	86.0	95.7	1.9 (1.1 to 3.3)	2.3 (1.3 to 4.2)	0.01

Multivariate models were adjusted for the following variables: current age, marital status, age at starting sex work, duration in sex work, place of solicitation, place where the client is usually entertained, amount charged per sex act, weekly income from sex work, proportion of clients who were new and whether has a regular client.
FSW, female sex worker.

repeat (paying) clients, there was a significant increase in the proportion of FSWs reporting condom use at last sex regardless of typology, with the highest increase reported among FSWs

using cellphones to solicit their clients (54.6% in 2006, 94.2% in 2011, $p < 0.01$, table 4). In contrast, the proportion of home-based FSWs reporting condom use at last sex with commercial

Table 3 Univariate and multivariate analyses of STI prevalence, condom use and programme exposure in 2006 and 2011, according to age of FSW

Characteristic	Age <25 years baseline/follow-up n=148/130	Age 25+ years baseline/follow-up n=525/588	Overall baseline/follow-up n=673/718
HIV prevalence			
%	11.2/7.2	13.0/9.8	12.7/9.3
Crude OR (95% CI)	0.62 (0.20 to 1.9)	0.72 (0.43 to 1.2)	0.71 (0.43 to 1.2)
Adjusted OR (95% CI)	0.39 (0.12 to 1.3)	0.86 (0.59 to 1.4)	0.83 (0.54 to 1.23)
Adjusted p value (Wald test)	0.14	0.52	0.39
Reactive syphilis			
Percentage	9.4/4.3	13.4/4.0	12.6/4.0
Crude OR (95% CI)	0.43 (0.06 to 3.0)	0.27 (0.13 to 0.57)	0.29 (0.12 to 0.71)
Adjusted OR (95% CI)	0.14 (0.04 to 0.52)	0.37 (0.17 to 0.83)	0.36 (0.15 to 0.85)
Adjusted p value	0.002	0.02	0.02
High-titre syphilis			
%	6.8/*	10.2/3.1	9.5/2.5
Crude OR (95% CI)	*	0.28 (0.11 to 0.73)	0.25 (0.09 to 0.60)
Adjusted OR (95% CI)	*	0.43 (0.17 to 1.10)	0.31 (0.13 to 0.76)
Adjusted p value (Wald test)	*	0.08	0.01
Chlamydia and/or gonorrhoea infection			
%	2.9/5.5†	0.75/1.1†	1.2/2.2†
Crude OR (95% CI)	2.0 (0.50 to 7.7)	1.4 (0.38 to 5.1)	1.8 (0.62 to 5.4)
Adjusted OR (95% CI)	2.54\ (0.45 to 14.5)	1.8 (0.5 to 6.1)	2.3 (0.76 to 7.0)
Adjusted p value (Wald test)	0.29	0.38	0.14
Condom use at last sex with occasional (paying) client			
%	94.8/95.6	90.9/97.6	91.8/97.2
Crude OR (95% CI)	1.0 (0.31 to 3.5)	3.3 (1.6 to 6.7)	2.5 (1.4 to 4.7)
Adjusted OR (95% CI)	1.3 (0.37 to 4.8)	3.4 (1.46 to 8.0)	2.6 (1.3 to 5.2)
Adjusted p value (Wald test)	0.660	0.005	0.009
Condom use at last sex with repeat (paying) client			
%	71.3/96.1	65.0/92.9	66.6/93.5
Crude OR (95% CI)	9.8 (3.0 to 31.6)	7.1 (4.0 to 12.5)	7.2 (4.3 to 11.8)
Adjusted OR (95% CI)	66.5 (7.7 to 570.7)	9.2 (5.0 to 17.1)	9.6 (5.5 to 16.8)
Adjusted p value (Wald test)	<0.001	<0.001	<0.001
Condom use at last sex with regular (non-paying) partner			
%	21.5/15.8	18.3/18.0	19.0/17.6
Crude OR (95% CI)	0.69 (0.30 to 1.6)	0.98 (0.58 to 1.6)	0.90 (0.59 to 1.4)
Adjusted OR (95% CI)	0.53 (0.14 to 2.1)	1.5 (0.8 to 2.6)	1.2 (0.74 to 2.1)
Adjusted p value (Wald test)	0.36	0.23	0.42

Multivariate models were adjusted for the following variables: current age, marital status, age at starting sex work, duration in sex work, place of solicitation, place where the client is usually entertained, amount charged per sex act, weekly income from sex work, proportion of clients who were new and whether has a regular client. ORs are in relation to follow-up versus baseline (2006).

*No diagnosis of high-titre syphilis in this age group during 2011.

†Follow-up in 2009.

FSW, female sex worker; STI, sexually transmitted infection.

Table 4 Univariate and multivariate analyses of STI prevalence, condom use and programme exposure in 2006 and 2011, according to place of solicitation

Characteristic	Home baseline/follow-up n=164/46	Brothel/lodge/dhaba baseline/follow-up n=50/14	Street/public place baseline/follow-up n=425/222	Phone baseline/follow-up n=34/436
HIV prevalence				
Percentage	5.8/2.8	5.3/0.0	14.6/13.1	5.8/8.0
Crude OR (95% CI)	0.46 (0.06 to 3.4)	*	0.88 (0.42 to 1.8)	1.4 (0.29 to 6.9)
Adjusted OR (95% CI)	0.50 (0.12 to 2.2)	*	0.94 (0.43 to 2.0)	1.6 (0.42 to 6.2)
Adjusted p value	0.36	NA	0.88	0.49
Reactive syphilis				
Percentage	8.2/3.1	6.5/0.0	13.9/6.5	7.8/2.8
Crude OR (95% CI)	0.36 (0.05 to 2.7)	†	0.43 (0.11 to 1.7)	0.34 (0.07 to 1.7)
Adjusted OR (95% CI)	0.27 (0.04 to 2.0)	†	0.57 (0.2 to 1.6)	0.15 (0.02 to 1.1)
Adjusted p value	0.2	NA	0.31	0.06
High-titre syphilis				
Percentage	6.3/‡	1.9/0.0	10.5/3.5	7.8/2.3
Crude OR (95% CI)	‡	‡	0.31 (0.08 to 1.2)	0.27 (0.05 to 1.4)
Adjusted OR (95% CI)	‡	‡	0.44 (0.14 to 1.4)	0.1 (0.01 to 0.81)
Adjusted p value	NA	NA	0.170	0.03
Chlamydia and/or gonorrhoea infection				
Percentage	1.5/2.5§	2.1/2.9§	1.2/1.5§	0.00/3.8§
Crude OR (95% CI)	1.7 (0.40 to 7.5)	1.4 (0.13 to 15.1)	1.4 (0.13 to 15.1)	NA
Adjusted OR (95% CI)	1.5 (0.3 to 7.4)	1.9 (0.04 to 85.9)	1.85 (0.04 to 85.9)	NA
Adjusted p value	0.62	0.73	0.73	NA
Condom use at last sex with occasional (paying) client				
Percentage	89.5/76.0	92.0/100.0	93.8/98.6	97.1/98.0
Crude OR (95% CI)	0.37 (0.13 to 1.1)	NA	4.6 (1.2 to 17.5)	1.4 (0.17 to 12.5)
Adjusted OR (95% CI)	0.12 (0.02 to 0.86)	NA	5.0 (1.3 to 21.3)	1.3 (0.21 to 7.6)
Adjusted p value	0.04	NA	0.03	0.79
Condom use at last sex with repeat (paying) client				
Percentage	71.4/70.2	65.8/100.0	66.8/96.3	54.6/94.2
Crude OR (95% CI)	0.94 (0.31 to 2.9)	NA	13.0 (5.5 to 30.4)	13.6 (3.6 to 51.5)
Adjusted OR (95% CI)	1 (0.27 to 3.7)	NA	15.9 (5.8 to 43.1)	34.1 (6.8 to 171.4)
Adjusted p value	0.98	NA	<0.001	<0.001
Condom use at last sex with regular (non-paying) partner				
Percentage	23.6/26.2	22.2/20.1	17.7/19.1	22.5/15.8
Crude OR (95% CI)	1.1 (0.36 to 3.7)	0.88 (0.17 to 4.6)	1.1 (0.61 to 2.0)	0.65 (0.21 to 2.0)
Adjusted OR (95% CI)	2.2(0.70 to 7.0)	0.14 (0 to 6.9)	1.4 (0.67 to 3.2)	0.70 (0.1 to 4.7)
Adjusted p value	0.18	0.3	0.35	0.7
Visited by peer educator in past 1 month				
Percentage	83.4/92.9	88.7/83.4	88.1/94.4	77.1/89.5
Crude OR (95% CI)	2.6 (0.64 to 10.5)	0.64 (0.83 to 5.0)	2.3 (1.1 to 4.8)	2.5 (0.94 to 6.9)
Adjusted OR (95% CI)	1.9 (0.56 to 6.3)	0.67 (0.11 to 3.9)	3.5 (1.7 to 7.1)	2.4 (0.79 to 7.5)
Adjusted p value	0.31	0.65	0.001	0.12
Ever attended drop in centre				
Percentage	62.5/49.2	60.7/61.9	69.2/70.7	71.9/70.6
Crude OR (95% CI)	0.58 (0.24 to 1.4)	1.1 (0.27 to 4.1)	1.1 (0.615 to 1.9)	0.94 (0.29 to 3.0)
Adjusted OR (95% CI)	0.51 (0.20 to 1.3)	1.9 (0.11 to 34.4)	0.98 (0.5 to 1.8)	1.1 (0.3 to 4.1)
Adjusted p value	0.14	0.65	0.96	0.87
Attended programme sexual health clinic in past 6 months				
Percentage	61.8/88.3	69.9/83.4	69.5/85.8	65.1/86.4
Crude OR (95% CI)	4.7 (1.7 to 12.8)	2.2 (0.46 to 11.8)	2.7 (1.4 to 5.1)	3.4 (1.5 to 7.5)
Adjusted OR (95% CI)	4.0(1.4 to 11.6)	1.9 (0.06 to 60.8)	2.8 (1.3 to 6.2)	4.8 (1.6 to 14.8)
Adjusted p value	0.01	0.71	0.01	0.004

Multivariate models were adjusted for the following variables: current age, marital status, age at starting sex work, duration in sex work, place of solicitation, place where the client is usually entertained, amount charged per sex act, weekly income from sex work, proportion of clients who were new and whether has a regular client. ORs are in relation to follow-up versus baseline.

*Not tested positive for HIV.

†No reactive syphilis.

‡No high titre syphilis diagnosis for this age group.

§Follow-up in 2009.

STI, sexually transmitted infection.

partners remained at approximately 70% (table 4). Notably, only a quarter or less of FSWs, regardless of typology, reported condom use with their regular, non-paying partners (table 4), and this did not change over time. Attendance at drop-in centres did not change significantly, but there was a significant increase in attendance at programme sexual health clinics across all typologies, except among brothel-based FSWs (table 4).

DISCUSSION

Our findings indicate that the demographic characteristics of FSWs in the urban Bangalore district are changing, with implications for HIV prevention programming. Compared with 2006, in 2011 sexual debut occurred earlier, but initiation into sex work later. The majority of FSWs in 2011 were in 'stable relationships' or married (71% vs 43% in 2006). Almost all FSWs self-identified as a 'resident' of Bangalore in 2011 (vs 43% in 2006), but in 2011, 16% reported sex work outside the district in the past 6 months (vs 10% in 2006). There has been a striking increase in the proportion of FSWs who reported using cellphones to solicit clients, and a concomitant increase in the proportion of FSWs citing their homes to entertain clients.

HIV/STI rates

In the urban Bangalore district, there was a decline observed in HIV prevalence, but it was not statistically significant. The reported increase in access to testing, treatment and other HIV-related care services in the urban Bangalore district may have helped to stabilise HIV infection rates. Indeed, evidence supports the notion that embedding HIV interventions within the context of an enabling environment to improve access to health services by FSW populations can have positive impacts on HIV prevention.^{6 9–12} We also observed a significant reduction in reactive and high-titre syphilis over time. The relationship of programme exposure with the observed trends is difficult to evaluate directly, since prevention programmes were initiated prior to the first round of IBBA data collection in 2006. As a consequence, there is no suitable control group to assess whether results were independent of the intervention and reflected secular trends. However, programme exposure did increase over time, in parallel with increasing condom use and observed trends in STI and HIV prevalence.

Condom use

Several studies among FSWs and clients have reported increases in condom use following focused HIV prevention programming.^{7 13 14} The IBBA indicates incremental increases from an already high rate of reported condom use with commercial clients (occasional and repeat), suggesting that programme exposure could have facilitated increased condom use. The increase to 100% of reported condom use among brothel-based FSWs suggests that exposure to HIV prevention programming in this venue was particularly effective. However, the sample size of brothel-based FSWs is small, and any interpretations need to be made with caution. Furthermore, over-reporting of condom use due to social desirability bias may also play a role. In contrast to high reported condom use with commercial clients, consistent condom use with regular, non-paying partners is still problematic. Only 15% to 25% of FSWs, across all typologies, reported the use of a condom during last sex with these partner types, and this did not change over time. The various facets of the client-FSW relationship which affect attitudes to condoms have been previously described,¹⁵ and underscore the

importance that attachments, emotional or otherwise, play in decision-making. Of note, client violence has been shown to be associated with inconsistent condom use and vice versa.¹⁶ Programming will therefore need to be more innovative in addressing human relationships and social/structural environments in the context of safer sex with regular, non-paying partners.

Sex work typology

Since a substantial proportion of HIV transmission is related to sexual networks,¹⁷ understanding the distribution and organisation of female sex work is crucial for HIV prevention programming. Our results found striking differences in the prevalence of HIV and other STIs with respect to place of solicitation. In 2011, HIV prevalence was highest among street-based FSWs (13%), followed by FSWs using cellphones to contact clients (8%). In 2011, 6.5% and 3.5% of street-based FSWs were diagnosed with reactive and high-titre syphilis, respectively. The corresponding rates for FSWs using cellphones to solicit clients were 2.3% and 2.8%. With respect to chlamydia and gonorrhoea, 3.8% of FSWs using cellphones to solicit clients were diagnosed with either/both infections in 2009 compared with 2.5% of home-based FSWs. These results reinforce the need to enhance HIV/STI prevention programme outreach, enhance sensitivity training for care providers and other stakeholders, and use other mechanisms to create enabling environments which encourage FSWs to seek care regardless of typology.

Study limitations

There are some study limitations that should be noted, in addition to the ones indicated above. First, due to the transient nature of sex work, we could not monitor all movements in and out of the urban Bangalore district. Programme coverage is therefore based on a best estimate of FSW population size, informed by an extensive process of triangulating multiple data sources.¹⁸ Second, as this was not a randomised, controlled trial design with a suitable control group, results may have occurred independently of the intervention and may reflect secular trends. Furthermore, true baseline data are not available, since programme interventions began, for operational reasons, before data could be comprehensively collected. As a result, the IBBA conducted in 2006 was used as our baseline, and there was a 15 month gap between the inception of intervention programmes and data availability. However, the large sample size and the magnitude of the observed changes would suggest a true programme effect. In addition, the strong linear associations seen between the duration of programme exposure and measures such as increased condom use, further supports the likelihood of programme effectiveness. Third, the design and implementation challenges with the IBBA approach have been previously described.⁹ Desired behaviour changes were clear to all participants and probably became even clearer with multiple years of programme exposure, which could have led to more socially desirability responses. However, the use of biological data for STI and HIV prevalence estimates is a major advantage of this study.

In summary, the results presented here emphasise the changing dynamics among the FSW population in Bangalore at multiple levels, including sociodemographic characteristics, sex-work typologies and condom use behaviours. As a consequence, more robust strategies, at the local level, are needed to address emergent trends.

Key messages

- ▶ An increasing proportion of female sex workers (FSWs) in the urban Bangalore district are older, report sex work outside the district, use cellphones to solicit clients and homes to entertain clients.
- ▶ Syphilis prevalence has declined and HIV prevalence has stabilised over time but they differed by typology with the highest HIV prevalence among street-based FSWS (13%) and FSWS using cellphones to contact clients (8%).
- ▶ Consistent condom use with regular, non-paying partners remains low (17.6%).
- ▶ There is a need to develop prevention interventions customised to meet local emerging needs.

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