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Studying complex interactions among determinants of healthcare-seeking behaviours:  
Self-medication for STI symptoms in female sex workers

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## **KEY MESSAGES**

- A high prevalence of medication use from the community was observed in a female sex worker population in Peru.
- Awareness of STI services available for female sex workers increases access to healthcare, which in turn decreases self-medication.
- Communication in brothels between female sex workers and managers is related to a diminishing prevalence of self-medication and to awareness of STI services.
- Understanding the predictors of self-medication is key to the effective design of programmes to reach out and improve practices of treatment providers outside clinics.

## **ABSTRACT**

**Objectives:** To describe frequency and determinants of self-medication for symptoms of sexually transmitted infections in a female sex worker population. To present a methodology exploring the best predictors as well as the interactions between determinants of self-medication.

**Methods:** Cross-sectional survey of 4,153 female sex workers carried out in Peru. We estimated the prevalence of self-medication from the subsample of participants who had experienced symptoms of sexually transmitted infections in the last 12 months (n=1,601), and used successive logistic regression models to explore the determinants.

**Results:** Self-medication prevalence for a reported symptomatic episode during the last 12 months was 32.1% [95% CI 29.8 to 34.6]. It was negatively correlated with work in brothels (adjusted OR 0.51 [95% CI 0.28-0.93], p=0.028) and awareness of STI services available for female sex workers (adjusted OR 0.49 [95% CI 0.29-0.81], p=0.006). Other determinants were organised at different levels of proximity to the outcome creating pathways leading to self-medication.

**Conclusions:** The importance of the staggered analysis presented in this study resides on its potential to improve the understanding of associations between determinants and, consequently, the targeting of interventions. We observed that awareness of STI services available for female sex workers increases access to healthcare, which in turn decreases self-medication. Additionally, the sharing of information that takes place between brothel-based female sex workers was also related to a diminishing prevalence of self-medication. These two main predictors provide an opportunity for prevention programmes, in particular those designed to be led by peers.

## **INTRODUCTION**

Self-medication is the choice to medicate oneself in response to symptoms without a clinician's diagnosis or prescription. It has consequences for the potential treatment success for the individual and the potential control of the spread of infection within the population.[1-3] It is reported more frequently in patients with symptoms of sexually transmitted infections (STI) than in those with a general health problem.[4-6] However, the prevalence of self-medication for STI symptoms varies broadly across populations and over time, ranging from 7.1% to 74.5% in prior reports.[7]

The choice to self-medicate will be motivated by various factors related to the severity of symptoms, previous infections and treatment, information about the disease, availability of healthcare, income, and cultural background. To be able to promote the best option of healthcare-seeking behaviour, it is important to understand why the choice to self-medicate is made, which are the main predictors, and how they relate to one another.

For this, we can explore individual and societal dimensions influencing self-medication and the expected direction of effects. A previous review found no clear determinants of self-medication at population level, other than a lower rate for more recently published studies.[7] Therefore, in this study we focused on individual level determinants that can be explored in regression models. This statistical method will identify associations (causal and confounding), but our interpretation depends upon the creation and testing of hypotheses. In this study, we control for variables following a set of hypotheses to help distinguish between those measuring the same effect (an intervention targeted on one will have also an effect on the other), variables lying on the causal pathway (intervening over these would have an effect on self-medication), and confounding variables (intervening over these would have no influence on self-medication).

## **METHODS**

### **Subjects and data collection**

We analysed data collected within the Urban Community Randomised Trial for Prevention of STI (PREVEN),[8] which evaluates the impact of a multicomponent STI/HIV preventive intervention in Peru. The intervention targeted female sex workers (FSW) and the general population of young adults. The general population arm of the intervention lasted three years (December 2003 to December 2006) and promoted healthcare-seeking for STI symptoms at either clinics or pharmacies. Pharmacy workers and clinicians were trained in the syndromic management of STI. Training began in July 2003 and was completed in late fall 2003, with an Internet-based course for clinicians in 2004, and ongoing educational outreach for pharmacy workers. The FSW arm of the intervention lasted from July 2003 until December 2006. It included a mobile team visiting FSW at commercial sex venues in eight-week cycles to screen and treat for STI as well as to promote condom use and provide counselling. Counselling included information about STI, symptom recognition, and services available for FSW to have regular STI check-ups. Outreach teams did not encourage FSW to go to pharmacies for treatment. The trial was evaluated through three prevalence surveys.

In December 2006, the final FSW survey was completed and provided the data for this analysis. The enrolment of approximately 200 FSW per city in 20 cities, following a time-location sampling, took place at sex work venues selected from an updated census of venues. After giving verbal informed consent and receiving STI/HIV counselling, a total of 4,153 FSW agreed to participate (99.5% of those approached). A member of the local survey team administered the questionnaire face-to-face. It included socio-demographic, reproductive health, healthcare-seeking, and sexual behavioural data. The participants then provided self-obtained vaginal swabs for nucleic acid amplification testing for

*Trichomonas vaginalis* (TV), *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), and blood for *Treponema pallidum* (TP) serology.

The PREVEN study obtained ethics approval from IRBs at the Universidad Peruana Cayetano Heredia, the University of Washington in Seattle and the US Navy Medical Research Center Detachment in Lima. This has been renewed every year.

### **Statistical methods**

Data were analysed using Stata/SE 10.0 (STATA Corporation, TX, USA). We classified participants as “self-medicated” if they reported having had a symptomatic episode (vaginal discharge or genital sore or ulcer) in the last 12 months, and if the first action they took at the time upon noticing those symptoms was either seeking treatment from a private pharmacy or a traditional healer, or taking medicine they had at home or that a relative or friend gave them.

Continuous data were described by mean and standard deviation (SD), then grouped in categories, and introduced as categorical variables into the models.[9] We classified the department/province/district of birth into the three natural regions in Peru (coast, mountain, and jungle).[10] Income from last client was calculated from data available for the last three sexual partners. Participants were considered as having a current STI if they tested positive for any of four curable STI: TV, CT, NG, or TP. A participant was considered to have active syphilis if she had a positive *Treponema pallidum* haemagglutination particle agglutination assay (TPPHA) positive and rapid plasma reagin (RPR) reactive at 1:8 dilutions. Due to the nature of the intervention, we also added being recruited in an intervention city as a potential determinant of self-medication. We assessed associations between self-medication and its determinants

using univariable and multivariable logistic regression models. Robust standard errors were calculated for all models to allow for intra-group correlations and the sample structure, FSW nested in cities.[9, 11] Variables significant at  $p < 0.20$  in the univariable analysis were retained for the multivariable models.[11]

### **Definition of determinants and logistic regression model building**

There are multiple ways to generate a multivariable model with several possible sequences in which variables can be included or excluded. We chose to group our variables into three categories that reflect our initial assumptions. In doing so, our aim was to explore the associations within and between groups of characteristics to identify which variables are related in their effect on self-medication, and which ones predict it. At a population level, awareness of availability and access, as well as the perception of quality of healthcare play a role in determining self-medication. Therefore we grouped, at individual level, variables related to sexual health and healthcare (diagnosis of a curable STI, knowledge of infections transmitted through sexual intercourse, awareness of STI services for FSW, and being recruited in an intervention city). General socio-demographic factors that might interact were grouped (age, education, region of origin, living alone, and having an income separate from sex work), whilst sex work characteristics were considered a separate category (place of work in the last week, condom use at last sex by type of last sexual partner, number of sexual partners in the last week, age at first sex work, duration of sex work, and income from last client).

Ultimately, the direction of the effect is likely to depend upon what is perceived as the best option in terms of quality, feasibility, acceptability, cost, and outcome. After identifying the predictors of self-medication, we tested the fit of the model including only the predictors of the data using the Hosmer-Lemeshow goodness-of-fit test.[11]



## RESULTS

A total of 1,601 FSW (38.5%) reported having had a vaginal discharge or a genital sore or ulcer in the last 12 months. The mean age for this group was 25.9 years (SD=7.0) with 76.6% being less than 30 years old. All but six (0.4%) were born in Peru, and most were educated to secondary school level (75.7%). Few were married (3.6%) and the majority reported not living with a partner (61.1%).

Just over half of the FSW (55.7%) worked in bars and nightclubs. The average income from the last client was S./59.1 (SD= 62.7) equivalent to US\$18.2 (SD= 20.26), and 35.1% reported having an income separate from sex work. The mean age of start of sex work was 21.7 years (SD=4.9) with a mean duration of sex work of 36.4 months (SD=52.2). Only 6.7% of this sample had not heard of infections transmitted through sexual intercourse. However, 22.4% reported not being aware of STI services available for FSW. Finally, 20.7% tested positive for a curable STI (TV, CT, NG, or TP).

Of 1,601 FSW who reported abnormal vaginal discharge or genital sore or ulcers during the past year, 58 (3.9%) did nothing, 957 (63.9%) sought treatment from a public or private hospital or clinic or the PREVEN mobile team, and 481 (32.1% [95% CI 29.8-34.6]) reported self-medicating. Of these 481, 75.7% reported going to a pharmacy for medication, 13.9% obtained medication from friends, 8.5% from a traditional healer, and 1.9% used medication available at home from previous episodes.

Of FSW who reported having had a genital ulcer or sore or vaginal discharge in the last 12 months, approximately 44% reported having sex while symptomatic (n=641/1,465). Those self-medicating were more likely to have sex while symptomatic (OR 1.69 [1.34-2.13], p<0.0001). Additionally, during this symptomatic episode, 90.5% reported using

condoms with clients, whilst 46.6% reported doing so with partners. If they were self-medicating for their reported symptoms, they were significantly less likely to use condoms with their partners (OR 0.57 [0.45-0.72],  $p < 0.0001$ ) and somewhat less likely to use condoms with clients (OR 0.80 [0.54-1.19],  $p = 0.274$ ).

### **Determinants of self-medication**

Table 1 shows the determinants associated with self-medication in univariable analyses. Self-medication was significantly more common in younger FSW, those living alone, and having an income separate from sex work. It was also higher for those having a current STI, and those not knowing about STI. It was lower in those FSW being aware of STI services available, brothel-based, those with a higher number of new, occasional, or regular clients, and with a longer duration in sex work.

In Table 2, we present the adjusted odds ratios for determinants included in seven multivariable models.

**Table 1.** Determinants of self-medication in FSW: univariable analyses (n=1,601).

		Self-medication		Univariable analyses		
		n/ total	%	OR	95% CI	p values
<i>Socio-demographic characteristics</i>						
Age (n=1,587)	< 20y	107/251	42.6	1		
	20-29y	275/874	31.5	0.62	0.48-0.80	<0.001
	30-39y	77/284	27.1	0.50	0.31-0.79	0.004
	≥ 40y	18/76	23.7	0.42	0.19-0.90	0.026
Education (n=1,585)	Primary school	64/198	32.3	1		
	High/secondary school	371/1,121	33.1	1.04	0.67-1.61	0.875
	Higher education	39/163	23.9	0.66	0.30-1.51	0.301
Region of origin (n=1,598)	Coast	149/497	29.9	1		
	Mountain	197/519	37.9	1.43	0.84-2.42	0.185
	Jungle	132/472	28.0	0.91	0.53-1.54	0.718
	Not Peru	1/6	16.7	0.47	0.04-5.03	0.530
Living alone (n=1,575)	No	154/576	26.7	1		
	Yes	318/895	35.5	1.51	1.20-1.19	0.030
Income separate from sex work (n=1,496)	No	265/926	28.6	1		
	Yes	190/494	38.5	1.55	1.17-2.07	0.003
<i>Sexual health and healthcare characteristics</i>						
Current STI (n=1,599)	No	358/1,188	30.1	1		
	Yes	122/308	39.6	1.52	1.16-2.01	0.003
Knowledge of STI (n=1,559)	Yes	425/1,369	31.0	1		
	No	49/88	55.7	2.79	1.68-4.63	<0.0001
Awareness of STI services for FSW (n=1,600)	No	158/307	51.5	1		
	Yes	323/1,190	27.1	0.35	0.22-0.55	<0.0001
Intervention (n=1,600)	No	235/677	34.7	1		

		Yes	246/820	30.0	0.80	0.44-1.47	0.481
<i>Sex work characteristics</i>							
Place of work (n=1,601)	Brothel	No	431/1,195	36.1	1		
		Yes	50/302	16.6	0.36	0.21-0.59	<0.0001
	Bar/night club	No	177/650	27.2	1		
		Yes	304/847	35.9	1.49	0.88-2.53	0.133
	Street	No	427/1,337	32.0	1		
		Yes	54/160	33.8	1.08	0.65-1.81	0.753
Condom use at last sex (n=1,527)							
(controlling for type of last sexual partner – new/occasional client, regular client, husband/boyfriend)							
		No	101/295	34.2	1		
		Yes	364/1,149	31.7	0.65	0.37-1.14	0.133
N of sexual partners last week by type							
New/occasional clients (n=1,518)	<5	207/528	39.2	1			
	≥ 5	251/908	27.6	0.59	0.38-0.91	0.018	
Regular clients (n=1,501)	0	233/610	38.2	1			
	≥ 1	220/809	27.2	0.59	0.42-0.87	0.007	
Husband/boyfriend (n=1,515)	0	252/727	34.7	1			
	≥ 1	207/706	29.3	0.78	0.50-1.21	0.272	
Age 1 <sup>st</sup> sex work (n=1,456)	<18y	62/173	35.8	1			
	≥18y	382/1,213	31.5	0.83	0.59-1.14	0.245	
Duration of sex work, months (n=1,463)	< 12m	183/464	39.4	1			
	≥ 12m	258/927	27.8	0.59	0.37-0.94	0.028	
Income from last client (n=1,451)	< S/.50	230/813	28.3	1			
	≥ S/.50	209/569	36.7	1.47	0.83-2.60	0.185	

**Legend:** The number of FSW by category varies because of different levels of data missing. The odds ratio (OR) for self-medication were calculated relative to the baseline.

**Table 2.** Determinants of self-medication in FSW: adjusted odds ratios and 95% confidence intervals from multivariable analyses.

	<b>Model 1. Soc</b> (n=1,381)	<b>Model 2. SH</b> (n=1,456)	<b>Model 3. Soc+SH</b> (n=1,339)	<b>Model 4. SW</b> (n=1,243)	<b>Model 5. Soc+SW</b> (n=1,195)	<b>Model 6. SW+SH</b> (n=1,209)	<b>Model 7. All</b> (n=1,160)
<i>Socio-demographic characteristics</i>							
Age (ref: < 20 years)							
20-29 years	0.65 [0.51-0.84]***		0.84 [0.65-1.09]		0.74 [0.58-0.94]*		0.84 [0.64-1.10]
30-39 years	0.57 [0.39-0.83]**		0.71 [0.50-1.01]		0.84 [0.65-1.10]		0.91 [0.67-1.25]
≥ 40 years	0.43 [0.19-0.97]*		0.62 [0.29-1.34]		0.52 [0.25-1.09]		0.64 [0.30-1.39]
Region of origin (ref: coast)							
Mountain	1.15 [0.69-1.93]		0.99 [0.62-1.56]		1.13 [0.65-1.97]		1.04 [0.62-1.74]
Jungle	0.80 [0.47-1.34]		0.76 [0.47-1.21]		0.75 [0.42-1.34]		0.71 [0.42-1.19]
Not Peru	0.48 [0.05-4.76]		0.53 [0.05-5.37]		0.76 [0.09-6.03]		0.79 [0.09-6.84]
Living alone (ref: no)							
Yes	1.43 [0.98-2.08]		1.37 [0.91-2.04]		1.19 [0.79-1.79]		1.17 [0.76-1.80]
Other income (ref: no)							
Yes	1.45 [1.07-1.96]*		1.38 [0.99-1.92]		1.32 [0.93-1.86]		1.29 [0.90-1.86]
<i>Sexual health and healthcare characteristics</i>							
	<b>Model 1. Soc</b>	<b>Model 2. SH</b>	<b>Model 3. Soc+SH</b>	<b>Model 4. SW</b>	<b>Model 5. Soc+SW</b>	<b>Model 6. SW+SH</b>	<b>Model 7. All</b>
Current STI (ref: no)							
Yes		1.36 [1.03-1.79]**	1.39 [1.04-1.87]*			1.20 [0.94-1.52]	1.22 [0.99-1.53]

STI knowledge (ref: yes)							
No		2.02 [1.30-3.12]**	2.21 [1.33-3.67]**			1.68 [0.89-3.18]	1.64 [0.89-2.97]
Awareness of STI services for FSW (ref: no)							
Yes		0.39 [0.25-0.61]***	0.44 [0.28-0.69]***			0.46 [0.29-0.74]***	0.49 [0.29-0.81]**

*Sex work characteristics*

	<b>Model 1. Soc</b>	<b>Model 2. SH</b>	<b>Model 3. Soc+SH</b>	<b>Model 4. SW</b>	<b>Model 5. Soc+SW</b>	<b>Model 6. SW+SH</b>	<b>Model 7. All</b>
Place of work							
Brothel (ref: no)							
Yes				0.39 [0.21-0.72]**	0.42 [0.23-0.77]**	0.47 [0.26-0.86]*	0.51 [0.28-0.93]*
Bar/night club (ref: no)							
Yes				0.80 [0.43-1.50]	0.77 [0.45-1.30]	0.85 [0.47-1.56]	0.83 [0.51-1.35]
Type of last sexual partner (ref: N/O client)							
Reg client				0.96 [0.67-1.41]	0.96 [0.66-1.40]	0.95 [0.67-1.37]	0.94 [0.65-1.37]
H/BF				0.67 [0.38-1.21]	0.68 [0.37-1.26]	0.69 [0.39-1.23]	0.68 [0.37-1.25]
Condom use at last sex (ref: no)							
Yes				0.89 [0.53-1.49]	0.82 [0.47-1.45]	0.93 [0.55-1.58]	0.85 [0.48-1.49]
N sexual partners last week by type							
N/O client (ref: < 5)							
≥ 5				0.72 [0.46-1.15]	0.75 [0.48-1.19]	0.76 [0.49-1.19]	0.79 [0.50-1.24]
Reg client (ref: 0)							

≥ 1			0.81 [0.46-1.15]	0.82 [0.53-1.26]	0.80 [0.51-1.26]	0.80 [0.52-1.24]
Duration of sex work (ref: < 12 months)						
≥ 12 months			0.63 [0.39-1.03]	0.69 [0.43-1.10]	0.82 [0.50-1.35]	0.85 [0.53-1.38]
Income from last client (ref: < S/.50)						
≥ S/.50			0.98 [0.59-1.66]	1.07 [0.72-1.58]	1.02 [0.61-1.71]	1.11 [0.74-1.66]

**Legend:** Model 1. Soc: socio-demographic characteristics with  $p < 0.2$  in univariate analysis. Model 2. SH: sexual health and healthcare characteristics with  $p < 0.2$  in univariate analysis. Model 3. Soc + SH: socio-demographic and sexual health and healthcare characteristics with  $p < 0.2$  in univariate analysis. Model 4. SW: sex work characteristics with  $p < 0.2$  in univariate analysis. Model 5. Soc + SH: socio-demographic and sex work characteristics with  $p < 0.2$  in univariate analysis. Model 6. SH + SW: sexual health and healthcare and sex work characteristics with  $p < 0.2$  in univariate analysis. Model 7. All: all characteristics with  $p < 0.2$  in univariate analysis.

The adjusted odds ratios (aOR) and 95% confidence intervals (95% CI) for self-medication were calculated relative to the baseline category (ref) and adjusted for all other determinants included in the each model. P values are indicated: \* $< 0.05$ , \*\* $\leq 0.01$ , \*\*\* $\leq 0.001$ . Current STI includes *Trichomonas vaginalis* (TV), *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), or *Treponema pallidum* (TP). FSW, female sex worker; N/O client, new or occasional client; Reg client, regular client; H/BF, husband or boyfriend; S./, nuevos soles (Peruvian currency).

Figure 1 illustrates the determinants of self-medication and their interactions inferred from the comparison across multivariable models. The main predictors of self-medication are placed at the centre of the figure, the next level are determinants related in their effects with other groups of characteristics. In the last level we observe the determinants whose effect is predicted by variables within the same group.

*Socio-demographic variables:* the effect of living alone as a determinant on self-medication is mediated by other socio-demographic determinants. We observe that it becomes not significant once we control for socio-demographic factors (model 1). The effect on self-medication of having an income separate from sex work is attenuated by variables such as sexual health and healthcare-related knowledge (model 3), sex work characteristics (model 5), or both (model 7) independently of other socio-demographic variables; whereas age was associated with a lower rate of self-medication independently of sex work characteristics or other socio-demographic variables but associated with sexual health and healthcare-related variables.

*Sexual health and healthcare-related variables:* there seems to be no association between the intervention and self-medication. The intervention, which involved field visits to FSW every two months to talk about STI, provide STI care including bi-monthly presumptive therapy with metronidazole for vaginal infection, and encourage attendance at specialised STI clinics, resulted as expected, in an increased knowledge of STI (OR 1.94 [95%CI 1.29-2.92],  $p=0.0012$ ) but not in awareness of STI services available (OR 1.14 [95%CI 0.90-1.45]  $p=0.27$ ). In turn, awareness of STI services remains an independent predictor of self-medication after controlling for all other characteristics (model 3 and 6).



*Sex work-related variables:* The associations of self-medication with having a higher number of new, occasional or regular clients, or with a higher duration in sex work became not significant after adjusting for all sex work determinants included in model 4. This was not altered when exploring sex work and socio-demographic (model 5) or sexual health and healthcare-related characteristics (model 6). Being brothel-based was independently associated with a lower rate of self-medication consistently in all models.

The multivariable logistic regression model including only the two main predictors of self-medication (being brothel-based and awareness of STI services for FSW) fitted the data well according to the Hosmer-Lemeshow goodness-of-fit test ( $p=0.4004$ ).

## **DISCUSSION**

In this large study of FSW in 20 cities throughout Peru, we found that self-medication for STI symptoms in the last year was reported by 32%. This high prevalence of self-medication is in accordance with previous estimates.[12-17] In Peru, the prevalence of self-medication for all health issues has been estimated between 36 and 52%.[18-21] For STI symptoms, Garcia *et al.* reported a prevalence of 22.2% in a community sample of rural women (not FSW).[22] Self-medication in FSW has also been reported to be common.[13, 23-26] However, in Peru, only one preliminary study investigated it and reported similar level of 39.2%.[27]

We found self-medication to be negatively correlated with work in brothels and awareness of STI services for FSW. In Peru, these two determinants are associated with each other. Regular STI check-ups are required by brothel managers who request FSW to seek healthcare at local STI clinics, the CERETS (Centro de Referencia de Enfermedades de Transmisión Sexual). However, some FSW might choose not to

access specific healthcare services to avoid being exposed or because it could result in withdrawal of the work permit by brothel management if an STI was found. Indeed, stigma in addition to lack of awareness of services available were the principal obstacles to accessing healthcare and treatment in previous reports from a FSW population in Côte d'Ivoire.[16]

Other studies have also reported an association between place of work and self-medication, with those FSW with a larger number of clients, such as freelance in the Philippines or brothel-based in Thailand, being more likely to use antibiotic prophylaxis or self-medication for STI symptoms.[13, 23] Indeed, Wong *et al.* found that FSW commonly share health information and practices among peers. Yet the self-medication and health advice offered was in general considered inappropriate and at times harmful.[17] In Peru, another key factor influencing this association is a peer-system promoting unusually extensive health services already in place.

Factors initially significantly associated with self-medication, such as age, living alone, other income besides sex work, number of clients, duration of sex work, current STI, and knowledge of STI became not significant after adjustment. However, multivariable analyses suggested interactions among many of these variables. For instance, the place of work is also presumably associated with the income from sex work, the number of clients, and with alternative sources of income separate from sex work. Increased duration in sex work could lead to more knowledge about STI and more awareness of where to access healthcare, thus being related to age and ultimately in their effect on self-medication.

Finally, it has been suggested that self-medication might influence condom use with clients.[2,12] We found that even though self-medicating FSW in our sample were more likely to have sex while symptomatic and were less likely to use condoms with stable partners, they were not less likely to use condoms with clients. These results are in agreement with those of Todd *et al.* who found, in a sample of injection drug users in Uzbekistan, that women were not less likely to use condoms if they self-medicated for STI symptoms.[15]

### **Limitations of the study**

We explored associations between self-medication determinants by using a succession of regression models. This staggered analysis has advantages and limitations. While its importance resides on its potential to improve the understanding of risk pathways and, ultimately, the targeting of interventions; we might lose insights of associations within subgroups. However, a classical stepwise approach will not give us any insights on intermediate interactions between determinants, and the testing of each association across all determinants might put research studies at risk of multiple testing.

As with other studies that rely on self-reported behaviours, there may be a recall bias. We tried to limit this by asking about actions taken during the last symptomatic episode, and by limiting the recall period to a year. The participants were interviewed face-to-face which might lead to a social desirability bias. Indeed, the finding that awareness of STI services was associated with self-medication might indicate some of this bias. It might be more acceptable to explain self-medicating by a lack of awareness of services available. Nonetheless, the prevalence of reported self-medication was high, indicating that many FSW reported this behaviour openly. Further qualitative research would be appropriate

to investigate in detail the extent of social desirability bias in these answers as well as motivations and practices of self-medication.

Although assessment of self-medication was not the primary focus of the PREVEN trial, we observed missing data for this measure only in 6.5% (n=1,497/1,601) of records. We did not look into self-medication use as prophylaxis. This was because self-medication questions were only asked following the report of a symptomatic event. This aspect of self-mediation is relevant in the context of sex work and has been reported frequently, in particular in Asia.[12, 13, 23] In Peru, a study by Paris *et al.* reported 41% of FSW from the Amazonian region self-medicated with antibiotics, often to reduce their STI risk.[28] However, the authors did not specify if the antibiotics were used for prophylaxis or in response to symptoms.

During this study, a social marketing campaign directed to the general population promoted healthcare-seeking for STI symptoms at either clinics or pharmacies which had undergone extensive training in STI management in half of the cities. FSW in intervention cities were also advised on STI symptom recognition and STI services available. Because FSW in these cities are also part of the general population, there is a possibility of contamination. However, this seems unlikely because after controlling for intervention, awareness of STI services available for FSW remained a predictor of self-medication but the PREVEN intervention itself was not associated with it.

Relatively simple interventions for sex workers, including disseminating information, providing access to healthcare and promoting condoms, have been found to be effective in many different settings.[29, 30] This study supports the importance of such basic healthcare interventions while highlighting the key role of a peer-led element in their

dissemination strategy. The implementation of simple but effective interventions will improve the health of sex workers and contribute to a better control of STI.

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## **COMPETING INTERESTS**

Helen Ward is co-editor of the journal Sexually Transmitted Infections. All other authors declare no conflicts of interest.

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## **CONTRIBUTIONS**

GPG, PJG, and KKH were the principal investigators for the PREVEN trial. GBG, HW, and GPG designed the study; GBG performed all the statistical analyses; PEC, CB, CPC, PJG, PS, GPG, and KKH supervised the set up, conduct of the clinical trial, and data collection. WLW, JPH, GPG, and KKH supervised the laboratory analyses and data quality. All authors contributed to the interpretation of results and write up.

**Figure 1.** Interactions among determinants of self-medication.

**Legend:** Levels of proximity to self-medication are demarcated by circles in dashed lines. Gray areas define groups of characteristics: sex work-related characteristics, sexual health and healthcare-related characteristics, and socio-demographic characteristics. Being brothel-based and the awareness of STI services for FSW were the main predictors of self-medication, and therefore they were positioned in the centre of the figure. The effect size is showed as adjusted odds ratio (aOR) with 95% confidence intervals in the boxes to the right of the figure. In the second level of proximity to self-medication, we observe the determinants that interact with characteristics in other groups. The arrows show the determinants' interactions with other groups. In the third level, we positioned the determinants whose effect is controlled by other determinants in the same group.

N, number; SW, sex work;; STI, sexually transmitted infections; N/O client, new or occasional client.



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