

# Long-term effects of condom promotion programmes for vaginal and oral sex on sexually transmitted infections among sex workers in Singapore

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**Objectives:** To evaluate the long-term impact of condom promotion programmes for vaginal and oral sex among female brothel-based sex workers in Singapore.

**Design:** A pre-test/post-test comparison group followed by a time series design was used to compare trends in condom use for vaginal sex and cervical gonorrhoea incidence from 1990 to 2002 across cross-sectional samples of sex workers before and after programme implementation in 1995. The subsequent condom promotion programme for oral sex was evaluated using the interrupted time series with a retrospective pre-test to post-test matched control group design.

**Methods:** Sex workers completed a questionnaire before and 6 months after participation in educational sessions. Cervical and pharyngeal swabs were taken monthly for cultures for *Neisseria gonorrhoeae*.

**Results:** Consistent condom use for vaginal sex increased significantly from < 45.0% before 1995 (pre-intervention period) to 95.1% in 2002, with a corresponding decline in cervical gonorrhoea incidence from > 30 to 2/1000 person-months. Adjustment for temporal changes in sociodemographic characteristics did not materially alter the trends. Consistent oral condom use increased significantly from < 50% before 1996 to 97.2% in 2002, with a corresponding decline in pharyngeal gonorrhoea from > 12 to 4.7/1000 person-months.

**Conclusion:** The interventions produced sustained high levels of condom use for vaginal and oral sex with corresponding declines in cervical and pharyngeal gonorrhoea incidence.

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**Keywords:** condom use, oral sex, vaginal sex, gonorrhoea, long-term effects

## Introduction

Few behavioural interventions on condom use for sex workers have been evaluated on their effects for 5 years or more [1–4]. Interventions for brothel-based sex workers in Africa have increased consistent condom use to 78% [2] and 80.7% [3], with a concomitant decline in HIV and sexually transmitted infections (STI). The intervention in Thailand increased condom use among brothel-based sex workers from 14% in 1989 to 94% in 1993 [1,4], with a concomitant decline

in HIV incidence [1], but subsequent evaluations reported lower levels of condom use [5–7] and high HIV rates [8,9] in some provinces. Condom use among sex workers should be maintained close to 100%, as transmission can occur even with a low level of non-condom use because of their high number of partners and high HIV infection rates [10].

It is unclear why these programmes did not achieve higher condom use levels as programme activities were not evaluated. Given the increasing evidence of HIV

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spread by oral sex [11,12], condom promotion programmes for oral sex should also be evaluated. More research is needed to identify interventions that would sustain condom use for all modes of intercourse to high levels among sex workers.

In Singapore, condom promotion programmes for vaginal [13–15] and oral [16,17] sex among female brothel-based sex workers have produced sustained increases in condom use, with corresponding declines in cervical and pharyngeal gonorrhoea incidence. The effects of both programmes from 1990 to 2002 are reported here.

## Methods

In 2003, approximately 1100 female brothel-based sex workers worked in Singapore. They are required to undergo regular screening for gonorrhoea, chlamydial infections, HIV and syphilis. The condom promotion programme for vaginal sex, implemented as a pilot project in 1994 [13,14], was expanded to all sex workers in 1995. In mid-1996, the condom promotion programme for oral sex [16,17] was incorporated into the programme because of the marked rise in oral sex [18]; since then, all newly recruited sex workers were enrolled monthly in the combined interventions.

Programme development was based on (i) Green's PRECEDE PROCEED framework [19] to change sex workers' risk behaviour and create a supportive work environment; (ii) Bandura's self-efficacy theory [20] to develop sex workers' condom negotiation skills; (iii) continuous quality-improvement principles; and (iv) findings from our studies on condom use for vaginal and oral sex among sex workers [21–25]. Interventions for sex workers consisted of talks on STI and AIDS, problem-solving sessions and video demonstrations of condom use and negotiation techniques, followed by reinforcement sessions held over 2 years. Interventions for brothels included talks and administrative measures, with temporary closure of brothels with high STI rates. Programme activities were monitored and regular meetings were held with health staff and peer leaders of sex workers to provide feedback and involve them in solving problems.

### Evaluation design

A pre-test/post-test comparison group followed by a time series design was used to compare trends in 6-month post-intervention condom use for vaginal sex and cervical gonorrhoea incidence from 1990 to 2002 across cross-sectional samples of sex workers before and after programme implementation in 1995. The subsequent condom promotion programme for oral sex implemented in 1996 was evaluated using an inter-

rupted time series design with a retrospective pre-test/post-test matched control group design. Serial independent cross-sectional surveys rather than repeat surveys within cohorts were used to assess long-term programme effects because three-quarters quit sex work by 1.5 years.

After informed consent was obtained, participants completed a simple questionnaire on demographics and condom use just before and 6 months after the educational sessions. To avoid over-reporting of condom use, health staff stressed the confidentiality of the information. They also explained that the results would be used to plan a better STI prevention programme for them and that '100% condom use' answers were not expected because they were aware of difficulties faced by sex workers in negotiating with clients.

### Outcome measures

Consistent condom use was defined as using a condom with every act of oral or vaginal sex with clients in the last working week. Monthly endocervical and pharyngeal swabs were taken from the sex workers for culture for *Neisseria gonorrhoeae*. Gonorrhoea incidence was used as an objective indicator of the impact of intervention on condom use because of its short incubation period, short duration of the infection, high specificity and sensitivity of the diagnostic test, and rapid and effective response to treatment. In contrast, other STI such as chlamydial infections may become chronic and are prone to relapses, hence might not be influenced by recent condom use. HIV was not used as an outcome measure because of its low incidence (0.02–0.04/100 person-months) among the sex workers.

The 6-month post-intervention cervical and pharyngeal gonorrhoea incidence rate was calculated by dividing the number of new cases of gonorrhoea by the sum of the time periods of observation for all sex workers (person-months) who completed follow-up.

Sex workers also rated the health education methods and messages. In-depth interviews were held with 22 randomly selected participants to explore the process leading to their sustained condom use.

### Statistical analysis

The chi-square test for trend was used to compare proportions in condom use and gonorrhoea incidence across independent cross-sectional samples over time. Cox's proportional hazards regression model [26] was used to assess the independent effect of the time period of the survey on gonorrhoea incidence rates, controlling for confounders. The Cox regression model modified for cross-sectional data [27,28] was used to estimate the adjusted prevalence ratios of condom use.

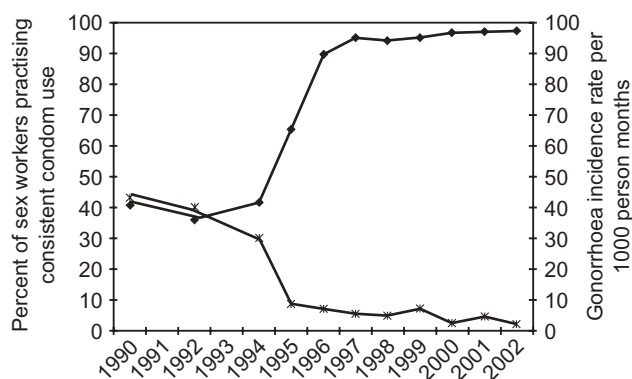
## Results

From 1995 till June 2002, 2737 currently working and newly recruited sex workers (mean age, 25.1 years) were enrolled in the intervention. The majority (> 90%) were non-locals, being Malaysian Chinese and Thai. From July 1996 to June 2002, 1986 newly recruited sex workers were enrolled in the programme, with a mean of 27 per month. About one-third (32.2%) quit work before the 6-month follow-up. Of those still in sex work, 93.5% (1259) completed follow-up. They did not differ significantly from those who quit or were lost to follow-up in age (25.1 versus 24.9 years) and number of clients per day (10.7 versus 10.2).

### Condom use for vaginal sex and pharyngeal gonorrhoea

Consistent condom use among newly recruited sex workers (worked < 6 months) increased by more than twofold from < 45% before programme implementation in 1995 to > 90% after 1996 ( $P < 0.001$ ), reaching 95.2% in 2002 (Fig. 1). Cervical gonorrhoea incidence declined from 30–42/1000 person-months pre-intervention to < 5/1000 person-months since 2000 ( $P < 0.001$ ). Adjustment for temporal changes in socio-demographic characteristics did not materially alter the trends.

As reported previously [14], the intervention group at 5-month follow-up was twice as likely as the compar-



**Fig. 1. Trends in consistent condom use for vaginal sex (◆) and cervical gonorrhoea incidence rates (\*) among sex workers in Singapore from cross-sectional surveys 1990–2002.** The condom promotion programme was implemented for all currently working sex workers in 1995 and for all new recruits in 1996. The condom use percentages from 1996 to 2002 represent the 6-month post-intervention condom use (i.e. 6 months after enrolment of new recruits to educational sessions in the condom promotion programme for vaginal sex). Figures before 1996 were based on cross-sectional samples of sex workers who had worked 6 months or less to ensure comparability with new recruits after 1996.

son group to use condoms always (adjusted prevalence ratio 1.90; 95% confidence interval, 1.22–2.94). Cervical gonorrhoea incidence declined significantly in the intervention group compared with a non-significant decline in the comparison group.

### Condom use for oral sex and pharyngeal gonorrhoea

Consistent condom use for oral sex increased from < 50% pre-intervention to 87% in 1999 ( $P < 0.001$ ), following implementation of the condom promotion programme for oral sex (Fig. 2). When measures targeting brothels were subsequently withheld, condom use decreased to 79.7% ( $P = 0.081$ ). After intensification of brothel measures in 2000, condom use increased to 97.1% in 2002 ( $P < 0.01$ ). Pharyngeal gonorrhoea incidence declined from 12.5 to 16.6/1000 person-months pre-intervention to 4.7/1000 person months in 2002 ( $P < 0.01$ ), with a peak corresponding to the decline in condom use when brothel interventions were withheld.

As reported previously [17], sex workers exposed to brothel interventions showed a significant increase in oral condom use to 92.5%, compared with a decrease among matched controls without brothel interventions. The pharyngeal gonorrhoea incidence rate was also lower than the control group (adjusted risk ratio, 0.22; 95% confidence interval, 0.06–0.78).

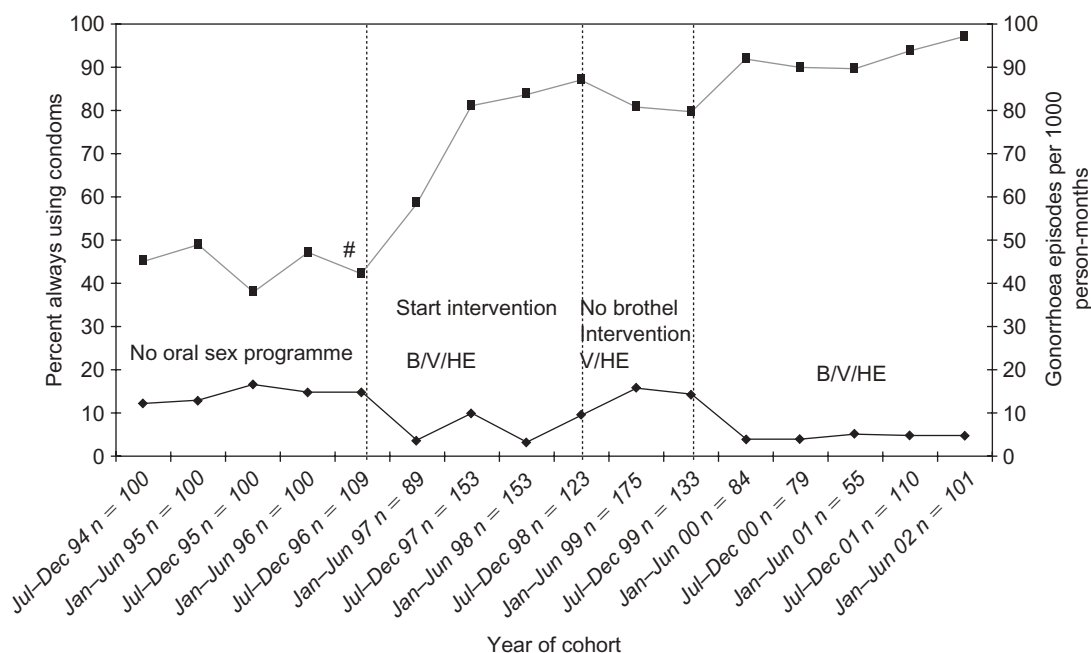
### Process evaluation

Video demonstrations of condom negotiation strategies for vaginal and oral sex were rated very useful by 98.5% of sex workers, compared with < 40% for other educational methods. They attributed their sustained condom use to the skills learnt from the interventions and support from the health staff.

## Discussion

Consistent condom use of > 90% for vaginal and oral sex was sustained, with corresponding declines in cervical and pharyngeal gonorrhoea incidence, among female brothel-based sex workers in Singapore after implementation of condom promotion programmes for vaginal and oral sex over 8 and 7 years respectively.

As there was no control group, maturation, increased awareness of condom use over time or public education could have explained the observed increase. However, changes in condom use over the 5-year pre-intervention period were negligible compared with the significant increase post-intervention, suggesting that increased awareness could not have contributed solely to the increase. There was no public education targeting clients or sex workers because of local sensitivities.



**Fig. 2. Effects of interventions on trends in consistent condom use (■) and pharyngeal gonorrhoea (◆) from 1994 to 2002.** Cross-sectional samples from 1994 to June 1996 were group matched by ethnicity and work duration with the overall group of sex workers recruited from 1996 to 2002 to ensure comparability with sex workers recruited to the programme starting from July 1996. #This point represents pre-intervention condom use. The 6-month post-intervention condom use for this cohort was 56.2%. After this cohort, all condom-use percentages were taken 6 months post-intervention. This means that the condom use percentage for the last cohort (January to June 2002) was taken from July to Dec 2002. B, brothel intervention activities (e.g. talks, brothel checks); V, video sessions for sex workers; HE, health education talks for sex workers.

Self-reported condom use was also corroborated by high self-reported condom use for vaginal and oral sex (98.2 and 92.6%, respectively) in a recent survey on 400 clients of brothel-based sex workers.

Continuous quality improvement principles were incorporated to monitor and improve the programme activities that have not been reported elsewhere. This led to early detection of (i) condom-use-related problems; (ii) inadequate measures targeting brothels; and (iii) the unexpected marked increase in oral sex and pharyngeal gonorrhoea. The last two findings prompted the strengthening of brothel measures and the implementation of a specific condom promotion programme for oral sex. We, therefore, recommend that continuous quality improvement principles be incorporated into on-going programmes for brothel-based sex workers in other countries to sustain condom use.

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