

# Cost-effectiveness of screening and management strategies for chlamydia control in Hong Kong: abridged secondary publication

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## KEY MESSAGES

1. *Chlamydia trachomatis* is the most common bacterial sexually transmitted infection worldwide. Untreated infections can lead to onward transmission and serious complications.
2. Cost and staff attitude are the most important factors for patients to test and treat chlamydia, respectively.
3. Targeted testing with strengthened contact tracing is the most cost-effective way to reduce the prevalence of chlamydia in the general population.
4. Upskilling primary care to identify at-risk individuals may improve efficiency and cost-effectiveness of any future chlamydia testing

programmes in Hong Kong.

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## Introduction

*Chlamydia trachomatis* is the most common bacterial sexually transmitted infection (STI) worldwide. Untreated infections can lead to onward transmission and serious complications to women, pregnant women, newborn, and men. Its prevalences in sexually active young women and men (aged 18 to 26 years) and middle-aged women (aged 40 to 49 years) in Hong Kong are comparable to those in the west.<sup>1</sup> The effectiveness of population and opportunistic screening programmes in reducing the burden of chlamydia is mixed. Recent focus has shifted from universal screening to a more targeted approach of strengthening patient testing and linkage-to-care.<sup>2</sup>

Discrete choice experiment quantitatively captures consumer preferences and can be used to predict the uptake of various detection and management programmes. Mathematical modelling can evaluate the efficacy and cost-effectiveness of health interventions. Recent advancements on modelling chlamydia control strategies enable evaluation of hypothetical strategies without actual implications on resources and manpower. This study aims to quantify the preferences of sexually active people in Hong Kong for the uptake of chlamydia testing services and management (if diagnosed), and to evaluate the cost-effectiveness of various chlamydia control strategies.

## Methods

Individuals living in Hong Kong aged >18 years who reported having vaginal/anal sex in the past 12 months were invited to participate in the survey. Members of an online panel whose profile matched the sample frame were invited to participate through email. Participants were asked about their preferences for chlamydia testing and management services. Their sociodemographic characteristics, sexual behaviours, testing history for chlamydia, and attitudes towards contact tracing were collected. Preference data were analysed using random parameters logit models. Interactions for attribute levels with significant coefficients and standard deviations were presented, and the probabilities of people choosing not to opt out under various scenarios were estimated. The impact of altering attributes from the status quo was examined.

A model that could represent dynamics of highly connected individuals, contain flexible options for treatment-seeking, and include variable delays and options for partner notification was developed to examine the cost-effectiveness of chlamydia control strategies. The baseline scenario was derived from local chlamydia statistics. Population of interest were those who were sexually active aged 18 to 49 years. A sample size network of 10 000 was selected and symptomatic proportion was set at 10%. Treatment was given to those who were symptomatic. Three

control strategies were evaluated: screening without contact tracing, screening plus expedited partner therapy, and screening plus partner testing with re-testing and targeted testing for higher risk population (>1 partners). Successfully traced partners would receive treatment without a laboratory test to confirm infection (ie, over-treatment) or treatment after a positive result was returned.

A cost-effectiveness model was constructed, with the outputs of the dynamic transmission model to estimate the cost, benefits, and resulting quality adjusted life year (QALY) gained from each scenario (Table 1). In universal screening (scenarios A), coverage of 10% and 30% of the sexually active population per year was applied, without consideration of number of partners or symptoms. In targeted testing with follow-up testing at 3 months, 6 months, or 1 year (Scenarios B and C), two fractions of symptomatic patients who sought treatment was applied: a worst-case scenario of 10% and a more realistic scenario at 30%. In targeted testing for a higher risk population (>1 partners)

[Scenarios D and E], all scenarios were implemented in a network with 10% symptomatic population with a similar proportion of screened patients as universal screening. Each scenario was run with a range of partner trace efficiency of 2%, 10%, 20%, and 40%.

## Results

A total of 520 individuals (40% males) [mean age, 36.8 years] participated in the discrete choice experiments. 66% of them had a bachelor's degree or higher. The choice of chlamydia testing was most influenced by cost, followed by speed of results, delivery of results, extra testing for STI, availability of testing, and location of testing. Those aged >35 years and women had greater dislike for paying HK\$600 than their counterparts. Heterogeneity related to the appointment time, whether extra tests were offered, and opt out was not explained by age, sex, born in Hong Kong, or having >1 sexual partner. The most important factor in chlamydia management was staff attitude, followed by cost, who to consult, availability

TABLE 1. Different scenarios used in analysis

Scenario	Universal screening	Targeted screening only	Targeted screening plus partner tracing		Fraction symptomatic, %	Follow-up period, mo	% of population screened in a year	Partner trace efficiency, %
			Treatment to all	Testing to all				
Universal screening								
Ai	X	-	-	-	10	-	~10	-
Aii	X	-	-	-	10	-	~30	-
Targeted testing and follow-up testing of patients seeking treatment								
Bi	-	X	-	-	10	3	-	-
Bii	-	X	-	-	-	6	-	-
Biii	-	X	-	-	-	12	-	-
Biv	-	-	X	-	-	3	-	40
Bv	-	-	-	X	-	-	-	-
Ci	-	X	-	-	30	-	-	-
Cii	-	-	X	-	-	-	-	40
Ciii	-	-	-	X	-	-	-	-
Targeted testing of population with >1 partners								
Di	-	X	-	-	10	-	~10	-
Dii	-	-	X	-	-	-	-	2
Diii	-	-	X	-	-	-	-	10
Div	-	-	X	-	-	-	-	20
Dv	-	-	X	-	-	-	-	40
Ei	-	-	-	X	-	-	-	2
Eii	-	-	-	X	-	-	-	10
Eiii	-	-	-	X	-	-	-	20
Eiv	-	-	-	X	-	-	-	40

of patient-delivered partner therapy, travel time, and treatment location. There was significant variation in preferences for cost, availability of patient-delivered partner therapy, travel time, who to consult, and staff attitude.

The average chlamydia prevalence for universal screening (10% coverage) and targeted testing of higher-risk population at equilibrium was  $3.24\% \pm 0.31\%$  and  $3.35\% \pm 0.38\%$ , respectively, and after intervention was  $2.75\% \pm 0.30\%$  and  $2.35\% \pm 0.21\%$ , respectively. This could be further reduced to  $1.48\% \pm 0.13\%$  with 40% contact tracing efficiency (Fig). We did not observe a significant change in the overall prevalence from scenarios targeting follow-up screening simulations. The most cost-effective scenarios were those with intervention focusing on the higher-risk population with contact tracing (Table 2). Reasonable-to-good cost-effectiveness were obtained in targeted testing scenarios with follow-up screening to patients seeking attention. There was extensive over-treatment (ie, treatment of un-infected traced

individuals) in scenarios. Scenarios with testing preceded treatment for traced individuals almost eliminated the over-treatment problem but were less cost-effective owing to the high testing costs.

## Discussion

The most influential factor in improving uptake of chlamydia testing is cost. Currently, Hong Kong residents can be tested for free at social hygiene clinics, but only 14% reported they had ever tested for chlamydia. To improve chlamydia testing uptake in Hong Kong, wider availability of free testing in other primary care settings is needed. The most influential factor in improving uptake of chlamydia management is staff attitude. Self-stigma and anticipated provider stigma are major barriers for people accessing testing services.<sup>3</sup> Availability of patient-delivered partner therapy may increase uptake of management, which is not available in Hong Kong. Further explorations may be warranted.

Universal screening is not cost-effective

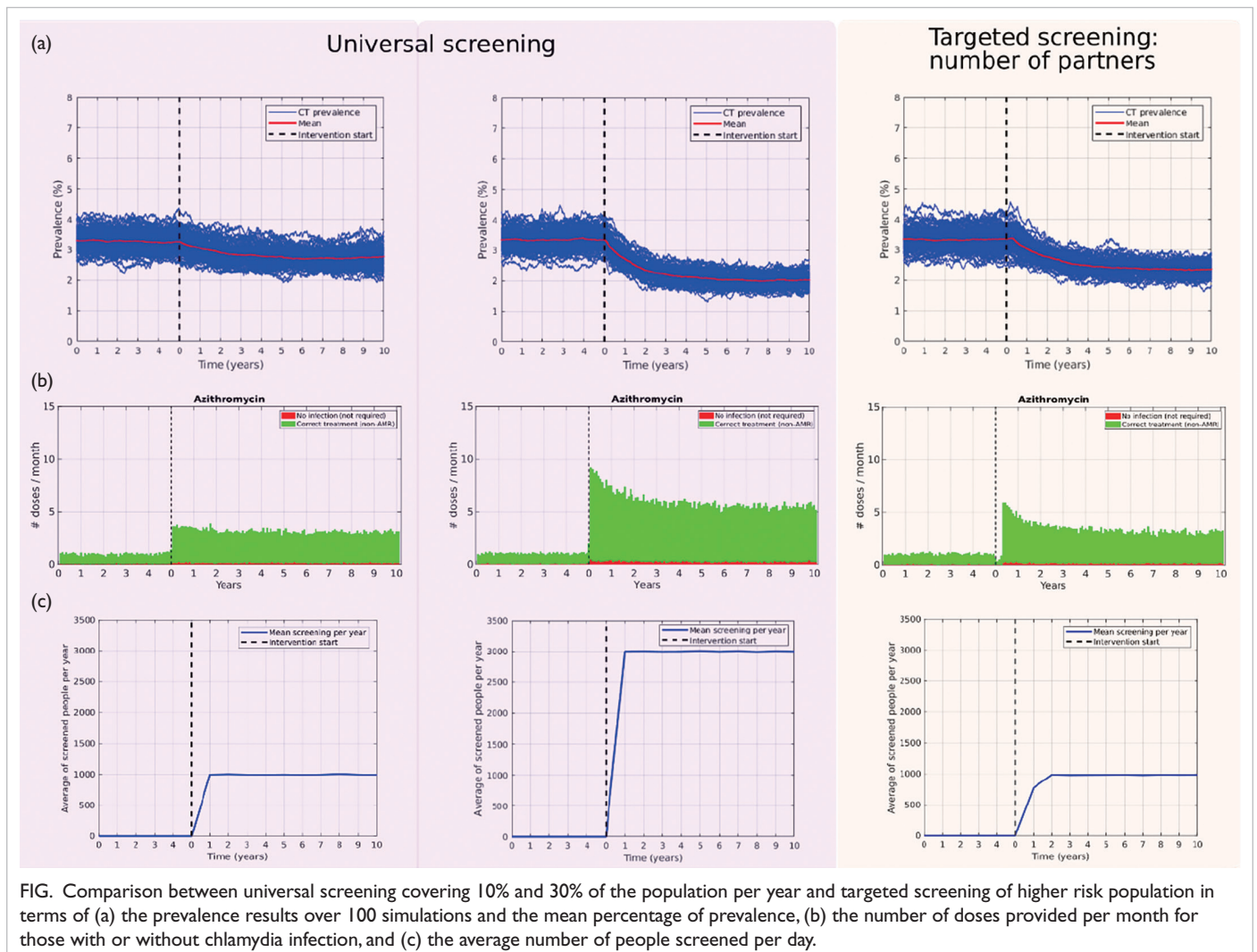


FIG. Comparison between universal screening covering 10% and 30% of the population per year and targeted screening of higher risk population in terms of (a) the prevalence results over 100 simulations and the mean percentage of prevalence, (b) the number of doses provided per month for those with or without chlamydia infection, and (c) the average number of people screened per day.

TABLE 2. Cost-effectiveness analysis of different scenarios\*

Scenario	Newly incurred direct cost/quality adjusted life year gain, HK\$		Net cost/quality adjusted life year gain, HK\$	
	Year 1	Year 10	Year 1	Year 10
Universal screening				
Ai	512 499	343 590	487 348	318 438
Aii	596 685	423 059	571 533	397 907
Targeted testing and follow-up testing of patients seeking treatment				
Bi	-110 978	54 265	-136 130	29 113
Bii	55 798	67 573	30 646	42 421
Biii	-1978	19 254	-27 130	-5898
Biv	40 943	-87 493	15 791	-112 645
Bv	90 293	219 212	65 142	194 060
Ci	115 551	125 699	90 399	100 547
Cii	79 901	100 692	54 749	75 540
Ciii	354 610	255 767	329 458	230 615
Targeted testing of population with >1 partners				
Di	362 043	185 584	336 891	160 432
Dii	45 335	49 740	20 183	24 588
Diii	29 622	31 921	4470	6769
Div	28 511	30 398	3359	5246
Dv	28 845	30 612	3693	5460
Ei	356 063	200 862	330 911	175 710
Eii	521 497	322 297	496 345	297 145
Eiii	593 423	422 323	568 271	397 171
Eiv	634 844	540 549	609 692	515 397

\* Direct costs include clinic attendance, treatment, tracing, and testing costs, whereas net costs additionally include the reduction in costs owing to averted complications

compared with targeted testing with strengthened patient management and contact tracing. However, this could be challenging as people may not accurately disclose their sexual activity or under-report the number of sexual partners. At-risk individuals with multiple partners should be targeted to improve efficiency and cost-effectiveness of any chlamydia testing programmes. Measures to decrease stigma such as normalising sexual health checks and routine sexual health history taking by health providers are critical for improving the uptake of chlamydia testing among higher-risk individuals.

Contact tracing of partners of infected individuals is important for STI control. Testing plus contact tracing performs better in reducing the prevalence with increased effectiveness, compared with testing only. Prompt evaluation and treatment of sexual contacts are important to interrupt transmission, prevent reinfection, and prevent

sequelae. However, contact tracing is challenging in Hong Kong owing to the stigma associated with STIs, feeling uncomfortable disclosing an STI diagnosis to sexual partners, and fear of relationship breakup or violence.<sup>5</sup> In addition, expedited partner therapy does not significantly affect overall chlamydia prevalence and may cause overtreatment. Partners should ideally be tested before treatment to avoid overtreatment and antimicrobial resistance.

## Conclusion

Discrete choice experiments and comprehensive modelling evaluation are used to identify patient preferences and optimal strategies to control chlamydia in Hong Kong. Cost and staff attitude are the most important factors to test and treat chlamydia, respectively. Targeted screening with contact tracing is the most cost-effective strategy to reduce chlamydia prevalence in Hong Kong.

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## Disclosure

The results of this research have been previously published in:

1. Ong JJ, Fairley CK, Hocking JS, et al. Preferences for chlamydia testing and management in Hong Kong: a discrete choice experiment. *Sex Transm Infect* 2022;98:408-13.
2. Montes-Olivas S, Homer M, Turner K, et al. Evaluating the impact and cost-effectiveness of chlamydia management strategies in Hong Kong: a

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