Hong Kong's First Population-based Sexually Transmitted Infections Study by HKU Identifies High Chlamydia Trachomatis Prevalence among Youths and Middle-aged Females

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Chlamydial Infection

- Chlamydia is a common bacterial infection caused by bacteria of *Chlamydia trachomatis*, transmitted through sexual contacts with the infected.

- It is the most common notifiable sexually transmitted infections (STIs) globally. It is also the most common notifiable disease in the European Union and the United States.

Chlamydial Infection

- *Chlamydia trachomatis* increases the risk of HIV infection. Serious chlamydial infection might lead to testicularitis, seminal vesiculitis, vasitis and infertility in males, as well as cervical mucositis, endometritis, salpingitis, ectopic pregnancy and infertility in females, if not treated timely. If *Chlamydia trachomatis* is hidden in the body, even if successfully pregnant, the bacteria could be transmitted to the baby through birth giving, leading to chlamydia conjunctivitis or pneumonia.

- Among those males infected with non-gonococcal urethritis and females infected with cervical mucositis, about half was caused by chlamydial infection. Unfortunately, as many as 80% of women and 25% of men infected with *Chlamydia Trachomatis* have no obvious symptoms, so the general public's awareness of this STI is insufficient.

Treatment of Chlamydial Infection

- If the infection is identified and diagnosed early, it can be easily treated with a course of antibiotics.
- In order to avoid cross-infection, the sexual partner(s) should also be treated at the same time. They should also be consulted with the proper use of condoms to reduce further infections.
- Since most patients are asymptomatic and STIs are highly stigmatised, it is very difficult to disclose to the sexual partner(s) about the infection, leading to further spread of the infection and heavy social burden of the disease.

STI in Hong Kong

- There are NO official STI surveillance data in Hong Kong since none of the STIs is notifiable in Hong Kong.
- Many STI prevalence studies from Hong Kong were focused on high-risk groups, e.g. female sex workers, men-having-sex-with men and attendees of the Department of Health's Social Hygiene Clinics (SHC).
- Some evidence shows STIs are on the rise:
  - 2011-2015, the STI cases diagnosed at SHCs had increased by 9.8% whilst primary and secondary cases of syphilis had been more than doubled (Sit & Yim, 2016).
  - Rate of reported chlamydial cases increased from 29.1 per 100,000 population in 2008 to 37.2 in 2010; 43.9 in 2012; 49.95 in 2013 and 51.27 in 2014 – in the neighbouring Guangdong Province.

National Chlamydia Prevalence Studies

Country project name & year	Sample size	Age	Prevalence
The US NHANES 2007–2012	**8,330**	**14–39**	**Overall females 2.0%(1.5–2.5); males 1.4% (1.1–1.8)** Non Hispanic black 5.2%(4.0–6.4) Highest 20-24yrs having sexual experience 2.9% (2.1–3.6)
The UK Natsal-3 2010-2012	**4,550**	**16-44**	**Overall females 1.5% (1.1–2.0); males 1.1% (0.7–1.6)** 16–24yrs sexually experienced females 3.1% (2.2–4.3) 16–24yrs sexually experienced males 2.3% (1.5–3.4)
France NatChla 2005-2006	**4,957**	**18-44**	**Overall females 1.6% (1.0–2.5); males 1.4% (0.8–2.6)** 18-29yrs sexually experienced females 3.2% (2.0–5.3) 18-29yrs sexually experienced males 2.5% (1.2–5.0)
China CHFLS 1999-2000	**3,426**	**20-64**	**Overall females 2.6% (1.6–4.1); males 2.1% (1.3–3.3)** 25-34yrs sexually experienced females 3.4% (1.5-7.0) 25-34yrs sexually experienced males 3.9% (1.8-8.2)

Aims and Objectives

Ultimate aims: To understand the prevalence of STIs and better control and prevent STIs in Hong Kong

Objective 1: Prevalence of STIs

- To determine the prevalence of three major STIs among individuals 18-49yrs old in Hong Kong:
  - ❖ Chlamydia
  - ❖ Gonorrhoea
  - ❖ Syphilis

Objective 2: Individual & Contextual Risk Factors of STIs

- ❖ To identify individual-level risk factors
- ❖ To identify contextual risk factors using multilevel and spatial analyses

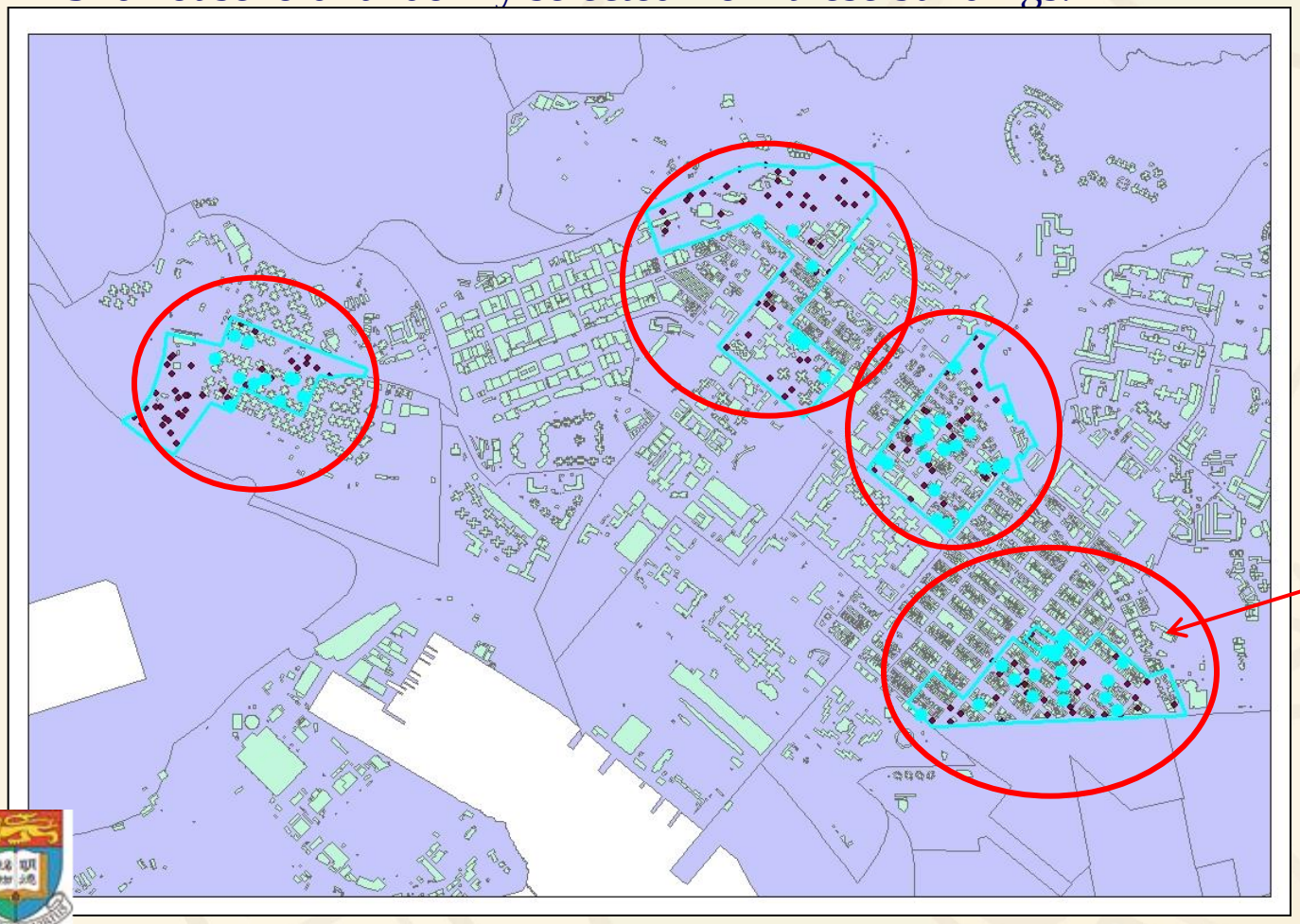
Random Sampling Method

*Hong Kong – **18 Districts** further divided into **412** District Council, Constituency Areas (DCCAs) each based on population of 17,000 people. (All data from 2011 Census boundary map):*

- 79 DCCAs proportionally selected based on number of DCCAs in each district.
- Geospatial Modelling Environment used to drop random points within the selected DCCAs.
- Points matched to proximally located residential buildings.
- Proportional number of households relative to the buildings was selected (roughly 7-20).

Random Sampling Method Example: Sham Shui Po

- 200 points randomly dropped across 4 randomly selected DCCAs.
- 48 buildings proximal to randomly dropped points were selected.
- 526 household randomly selected from these buildings.

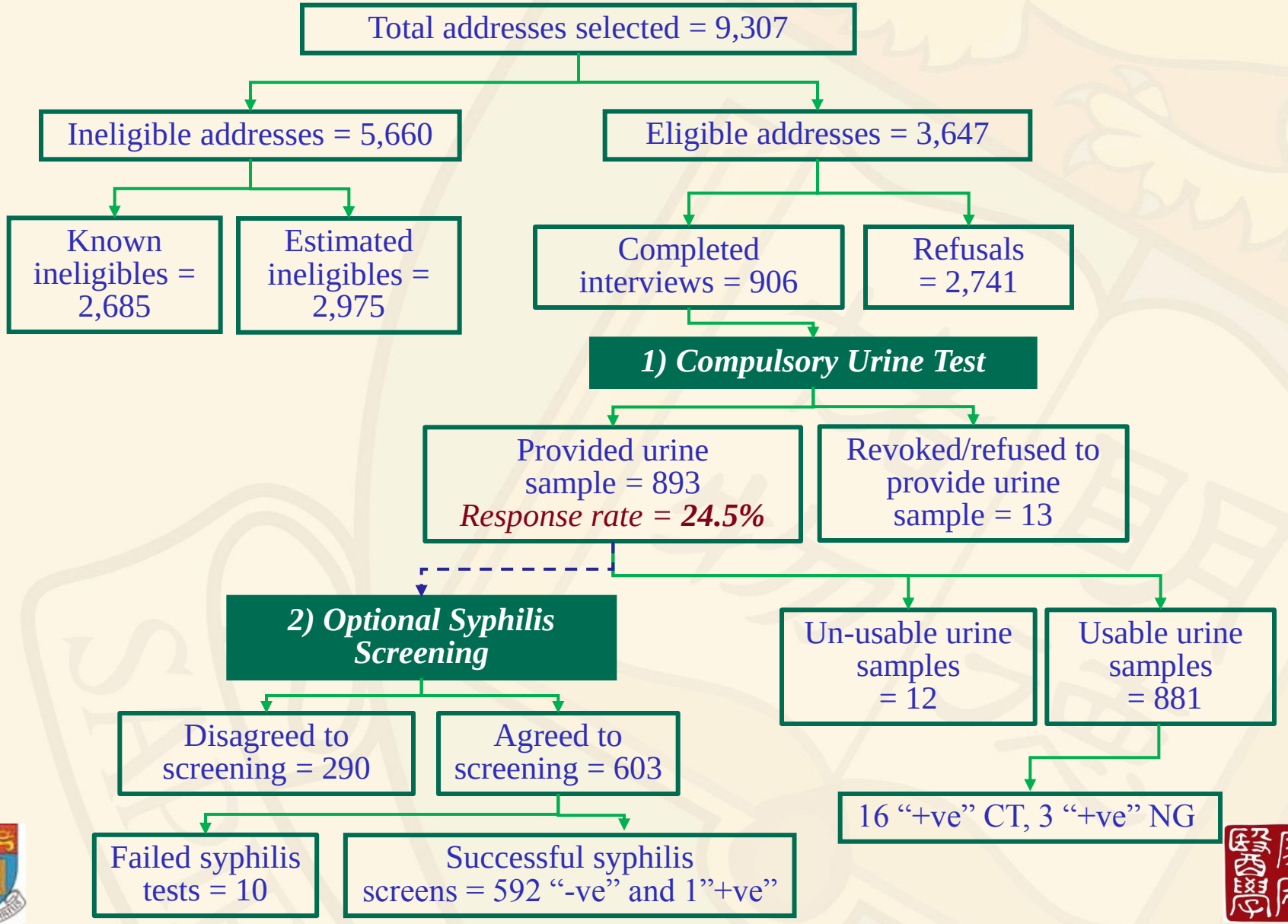


1 of 4 randomly selected DCCAs in Sham Shui Po district

Sampling Procedures and Size

- The invitation letters were sent to household a week prior to visits from interviewers.
- A team of interviewers would visit them thrice to identify if there were eligible persons.
- Next Birthday Methods if >1 eligible & willing
- Computer-assisted interview program for sensitive issues
- Questionnaire and testing could take place at home or at the three centres scattered in Hong Kong
- Urine collected for PCR testing for Chlamydia trachomatis and Neisseria gonorrhoeae; and optional point-of-care testing for syphilis
- Sample size based on prevalence (of the Mainland China CT Study of 2.3%): Using $Z^2 * (p) * (1-p)/c^2$, our targeted sample Size: 863 participants

Survey Response and Outcomes



Distribution of the Demographics (N=881)

	Unweighted observations, No.			Weighted distributions, %		
	Male	Female	All	Male	Female	All
General Characteristics	346	535	881	47.2	52.8	100
Age, y						
18 to 29	146	152	298	35.4	31.4	33.3
30 to 39	91	158	249	29.6	31.3	30.6
40 to 49	109	225	334	35.0	37.3	36.1
Education						
<=Junior high school	69	181	250	20.7	28.0	24.5
=Senior high school	115	183	298	34.0	36.0	35.1
>Senior high school	162	171	333	45.3	36.0	40.4
Birthplace						
Hong Kong	249	269	518	77.1	67.8	72.2
Mainland/Macao/Taiwan	93	263	356	21.7	31.4	26.8
Other	4	3	7	1.2	0.8	1.0
Residency^						
Permanent ID	335	472	807	97.3	91.6	94.3
Non-Permanent ID	11	63	74	2.7	8.4	5.7
Working Status						
Working	269	342	611	79.9	64.9	72.0
Not working	77	193	270	20.1	35.1	28.0
Housing types						
Public Housing	217	334	551	63.1	59.9	61.4
Home Ownership	43	86	129	13.0	18.7	16.0
Private	80	106	186	23.9	21.4	22.6
Number of people living with						
0	20	15	35	6.4	3.4	4.8
1-2	131	182	313	37.5	33.3	35.3
More than 2	195	338	533	56.1	63.3	59.9

^ Permanent resident is defined in article 24 of the Hong Kong Basic Law and paragraph 2 of schedule 1 to the Immigration Ordinance, it includes those born in HK and those live in Hong Kong for more than seven years

Distribution of Sexual Behaviour & Health (N=881)

	Unweighted observations, No.			Weighted distributions, %		
	Male	Female	All	Male	Female	All
Characteristics related to sexual health/behaviour	346	535	881	47.2	52.8	100
Marital Status						
Single	204	179	383	56.1	39.5	47.4
Widowed/divorced/separated	8	47	55	2.5	8.1	5.5
Married/cohabiting	134	309	443	41.4	52.3	47.2
No. of sexual partners in the past 12 months						
0~	133	184	317	37.1	36.7	36.9
1	195	338	533	57.7	60.6	59.2
>=2	18	13	31	5.2	2.7	3.9
Condom use with MSP						
Never	52	117	169	20.8	26.3	23.7
Always	85	145	230	32.7	38.7	35.9
Sometimes	111	151	262	46.6	35.0	40.4
Duration with main sex partner						
<=2yrs	87	87	174	33.6	23.6	28.3
>2yrs	156	319	475	66.4	76.4	71.7
Ever STIs						
No	301	481	782	87.0	90.2	88.7
Yes	45	54	99	13.0	9.8	11.3
Ever HIV test						
No	291	448	739	83.2	83.5	83.3
Yes	55	87	142	16.8	16.6	16.7
Preferred testing & treatment place if STIs						
Private	235	334	569	68.2	67.2	67.7
Public	111	201	312	31.9	32.8	32.4
Partner travelled out of HK in the past 12 months*						
Yes	NA	211	NA	NA	36.9	NA
No	NA	324	NA	NA	63.1	NA

~ 0 sex partners in the past 12 months included 57 married people who did not have sex in the past 12 months and they were later regrouped into the sexually experienced group

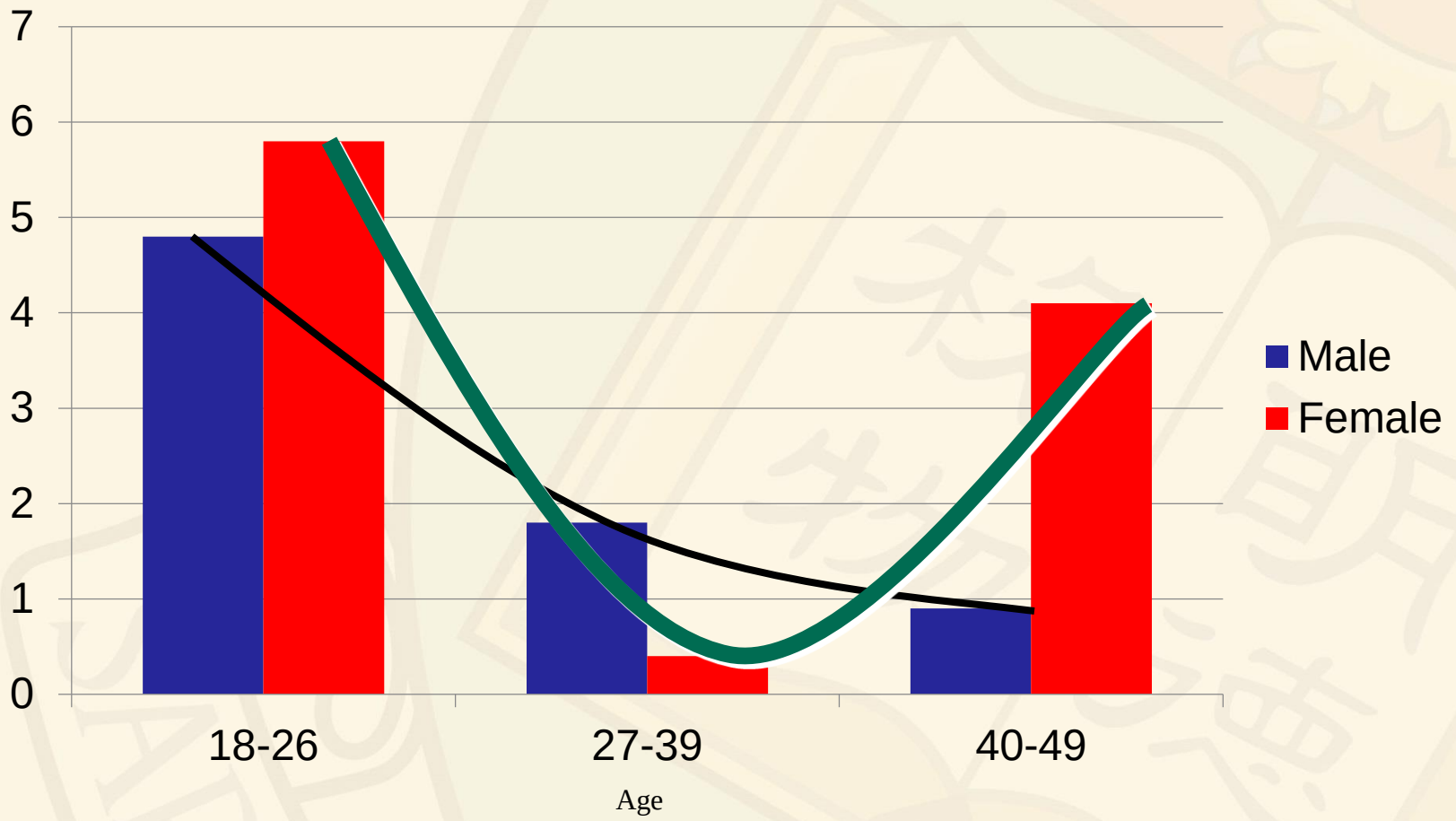
* Only to be answered by female participants (please note that "No" here includes "partner didn't leave" and "no partner" and "sexually inactive".

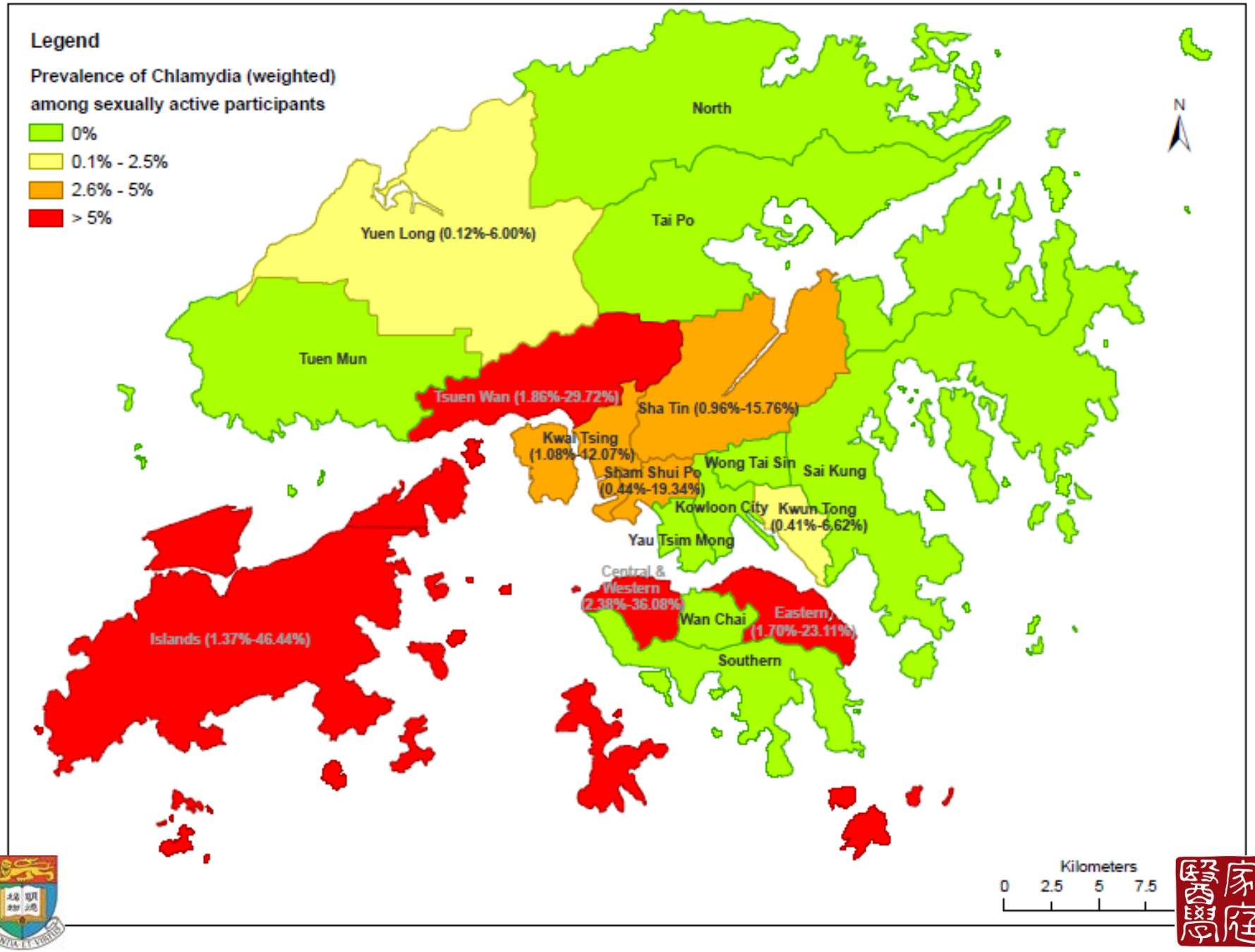
Prevalence of Chlamydia Trachomatis (N=881)

	All (n=881) (95%CI)	Sexually experienced[1] (N_e=733) 95%CI	Sexually active[2] (N_a=566) (95%CI)
Prevalence of *Chlamydia trachomatis*	**1.4% (0.8-2.5)**	**1.8% (1.0-3.0)**	**2.3% (1.3-3.9)**
Male (n=346)	1.2% (0.5-2.8)	1.5% (0.6-3.6)	1.9% (0.8-4.4)
18-26	1.7% (0.4-6.7)	**3.3% (0.8-12.0)**	**4.8% (1.2-17.6)**
27-39	1.3% (0.3-5.1)	1.6% (0.4-6.2)	1.8% (0.4-7.0)
40-49	0.6% (0.1-4.6)	0.7% (0.1-4.8)	0.9% (0.1-6.1)
Female (n=535)	1.7% (0.9-3.1)	2.0% (1.1-3.7)	2.6% (1.4-4.9)
18-26	2.2% (0.7-6.9)	**3.5% (1.1-11.0)**	**5.8% (1.7-18.2)**
27-39	0.3% (0-2.3)	0.4% (0.1-2.6)	0.4% (0.1-3.1)
40-49	2.8% (1.2-6.2)	2.9% (1.3-6.5)	**4.1% (1.8-9.0)**

1. Sexually active: reported having sex in the last 12 months
2. Sexually experienced: admitted having sex in the last 12 months and those who indicated sex experience beyond the last 12 months.

Prevalence of Chlamydia Trachomatis among the Sexually Active Participants (n=566)




Legend
Prevalence of Chlamydia (weighted)
among sexually active participants
0%
0.1% - 2.5%
2.6% - 5%
> 5%
North
Tai Po
Yuen Long (0.12%-6.00%)
Tuen Mun
Tsuen Wan (1.86%-29.72%)
Sha Tin (0.96%-15.76%)
Kwai Tsing
(1.08%-12.07%)
Sham Shui Po
(0.44%-19.34%)
Wong Tai Sin
Sai Kung
Kowloon City
Kwun Tong
(0.41%-6.62%)
Yau Tsim Mong
Central &
Western
(2.38%-36.08%)
Wan Chai
Eastern
(1.70%-23.11%)
Southern
Islands (1.37%-46.44%)
N
Kilometers
0
2.5
5
7.5

Multivariable Analysis for Risk Factors of CT Infection

Variables	No restrictions		Sexually experienced		Sexually active (in last 12 months)	
	aOR	CI	aOR	CI	aOR	CI
Male travelled out of HK (no)	1.00		1.00		1.00	
Yes	**11.1**	(2.65-46.6)**	**8.40**	(2.10-33.5)**	**5.35**	(1.25-22.8)*
Born in HK? (yes)	1.00		1.00		1.00	
No	3.79	(0.96-15.0)+	3.32	(0.89-12.4)+	3.21	(0.82-12.6)+
Lives with (>2 others)	1.00		1.00		1.00	
0 (alone)	**12.1**	(1.85-79.1)**	**12.3**	(1.93-78.8)**	**11.9**	(1.89-75.1)**
1 or 2 other	2.12	(0.74-6.09)	2.15	(0.74-6.24)	2.21	(0.71-6.90)
STI testing facilities (private)	1.00		1.00		1.00	
public	2.50	(0.78-8.04)	2.67	(0.84-8.46)+	2.77	(0.97-7.91)+
Age (27-39yrs)	1.00		1.00		1.00	
18-26yrs	**6.82**	(1.36-34.2)*	**8.04**	(1.67-38.6)**	**9.96**	(2.09-47.5)**
40-49yrs	3.32	(0.72-15.2)	3.24	(0.72-14.7)	3.67	(0.80-16.8)+
Male	1.00		1.00		1.00	
Female	2.27	(0.74-6.96)	1.87	(0.65-5.35)	1.78	(0.62-5.16)
Observations	881		733		566	

Robust cieform in parentheses. ** p<0.01, * p<0.05, + p<0.1

Multivariable Analysis for Risk Factors of CT Infection in Women

Variables	No restrictions		Sexually experienced		Sexually active (in last 12 months)	
	aOR	CI	aOR	CI	aOR	CI
Male travelled out of HK (no)	1.00		1.00		1.00	
Yes	**10.3**	(2.06-51.2)**	**7.73**	(1.66-35.9)**	4.84	(0.92-25.6)+
Born in HK? (yes)	1.00		1.00		1.00	
No	2.05	(0.44-9.61)	2.00	(0.44-9.13)	1.99	(0.41-9.70)
Lives with (>2 others)	1.00		1.00		1.00	
0 (alone)	**10.8**	(1.79-65.6)*	**10.00**	(1.73-58.2)*	**8.99**	(1.46-55.4)*
1 or 2 other	1.51	(0.49-4.64)	1.44	(0.47-4.40)	1.44	(0.42-4.93)
STI testing facilities (private)	1.00		1.00		1.00	
public	**8.15**	(1.88-35.4)**	**8.12**	(1.91-34.5)**	**7.65**	(1.96-29.9)**
Age (27-39yrs)	1.00		1.00		1.00	
18-26yrs	**18.5**	(1.40-243)*	**20.9**	(1.83-240)*	**25.4**	(2.81-230)**
40-49yrs	**11.4**	(1.06-123)*	**11.00**	(1.01-119)*	**11.9**	(1.10-128)*
Observations	535		468		351	

Robust cieform in parentheses. ** p<0.01, * p<0.05, + p<0.1

Major Findings

- The overall *Chlamydia trachomatis* prevalence was at 1.4% in Hong Kong, similar to those of the western countries. However, among the young (18-26 years) women and men who had sexual experience in the past 12 months, the prevalence could be as high as 5.8% and 4.8%, respectively in Hong Kong.
- A unique U-shape prevalence was observed with peaks in younger and older (40-49 years) women in Hong Kong. This pattern was also observed in human papillomavirus (HPV) studies in Hong Kong and it was speculated that many couples break up and seek for new partners in their later life resulting in more sexual partners and unprotected sex.
- Amongst the women with sexual experience in the past 12 months, the risk factors of *Chlamydia trachomatis* infection were: 25 times higher in younger age compared to the 27-39 years old; 9 times higher in those living alone and, about five times higher in those having partners who had travelled out of Hong Kong in the previous 12 months.

Strengths & Limitations of this Research

Strengths:

- First population-based STI prevalence study in Hong Kong
- Geospatial random sampling to locate people infected with STIs
- Duration and mode of data collection comparable to other international studies

Limitations:

- The response rate – selection bias
- Self-reported (sensitive nature)
- Duration of the data collection (no major change in policies)

Recommendations/ Future Research Directions

- *CT* screening for sexually active youth between 18-26yrs of age and older women (40-49yrs) could be considered.
- Feasibility of *CT* screening in different facilities targeting different populations should be tested and compared.
- Cost-effectiveness study of *CT* screening using different approaches should be conducted.
- After screening, the linkage to the treatment is important to reduce the disease burden of *CT* in Hong Kong.
- Partner notification – acceptability of different methods and results to be tested and compared.
- Targeted education messages to the higher risk groups (e.g. young adults) to be formulated.

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