Risk factors associated with human immunodeficiency virus (HIV) infection among attendees of public sexually transmitted infection clinics in Hong Kong: implications for HIV prevention

PM Lee 李培文
KM Ho 何景文

CME

Objective To examine the risk factors for human immunodeficiency virus (HIV) transmission among attendees of public sexually transmitted infection clinics in Hong Kong.

Design Retrospective matched case-control study.

Setting All public sexually transmitted infection clinics in Hong Kong.

Patients All public sexually transmitted infection clinic attendees' records from January 1995 to December 2002 were reviewed.

Main outcome measures HIV sero-positivity in corresponding clinic attendees.

Results A total of 196 HIV-positive cases among 149 336 sexually transmitted infection clinic attendees were recruited into the study. Multivariate analysis using conditional logistic regression revealed that HIV infection was associated with the following factors: belonging to non-Chinese ethnic groups (mainly South-East Asian) [odds ratio=9.32; 95% confidence interval, 3.27-26.55], coexisting syphilis (other than primary) [5.67; 1.66-19.36], current non-gonococcal urethritis (2.10; 1.08-4.07), current genital warts (1.94; 1.10-3.43), history of prior sexually transmitted infection (2.19; 1.29-3.72), having casual sex with friends (2.89; 1.07-7.80), and casual sex in Mainland China (1.91; 1.04-3.49). Sexual orientation was also considered to be a potential risk factor, as only those who tested positive reported to be homosexual or bisexual.

Conclusion Sexually transmitted disease patients represent an identifiable group who are at high risk of HIV infection. This study found that there were certain factors which increased the risk of HIV infection among patients attending public sexually transmitted infection clinics. Targeted interventions should therefore be offered to such high-risk individuals, so as to prevent and control HIV transmission.

Introduction

Hong Kong has been experiencing a low level human immunodeficiency virus (HIV) epidemic for two decades since the first report of the case in 1984. Nevertheless, over the last 3 years, the HIV situation in Hong Kong has entered a period of rapid growth. In 2006, the Hong Kong Department of Health was notified of 373 HIV infected case.[1] Thus there was a 19% and 17% annual increase respectively, when compared to the total of 313 infections in 2005 and 268 in 2004.

Sexual contact is the main mode of transmission, accounting for 81% of the cumulative total. Sexually transmitted infections (STIs) share some similarities with HIV. First, both have the same route of transmission. Second, high-risk sexual behaviours are related to both STIs and HIV infection. Moreover, some STIs are themselves the risk factors for HIV infection.[2,3] This epidemiological synergism has important implications, whereby prevention of either STI or sexual transmission of HIV could help reduce transmission of the other. Therefore, targeted education and efficient treatment services for STI patients could play an effective role in preventing and controlling HIV transmission.

In view of the relatively low prevalence of HIV infection in Hong Kong (<0.1% in all

Centre for Health Protection, Department of Health, Hong Kong
PM Lee, MB, ChB, MSc
KM Ho, MB, BS, FRCP

Correspondence to: Dr PM Lee
E-mail: smonda_hk@dh.gov.hk

與香港公立性病診所就診者感染愛滋病病毒相關的風險因素：對預防愛滋病的一些啟示

目的　檢視與香港公立性病診所就診者感染愛滋病病毒相關的風險因素。

設計　回顧性的病例對照研究。

安排　香港的所有公立性病診所。

患者　檢視1995年1月至2002年12月香港公立性病診所的所有病歷。

主要結果測量　性病診所就診者的愛滋病病毒感染率。

結果　在149 336位就診者中，有196宗愛滋病病毒測試呈陽性的病例。多因素的條件邏輯回歸分析顯示，愛滋病病毒感染與下列因素相關：非華裔（主要東南亞族裔）〔比值比＝9.32；95％置信區間＝3.27-26.55〕、同時患梅毒（除原發性外）〔5.67；1.66-19.36〕、當時已患非淋病性尿道炎〔2.10；1.08-4.07〕、當時已患生殖道尖銳濕疣〔1.94；1.10-3.43〕、曾患性病〔2.19；1.29-3.72〕、與朋友隨意發生性行為〔2.89；1.07-7.80〕，和在中國大陸嫖妓〔1.91；1.04-3.49〕。由於只有測試結果呈陽性的患者中才有報稱是同性戀或雙性戀，性取向亦是其中一個可能的風險因素。

結論　性病患者明顯屬愛滋病病毒感染的高危一群。研究亦發現，有好些因素提高了香港公立性病診所就診者感染愛滋病病毒的風險，因此，針對性地為這類高危人士採取措施，有利於預防和控制愛滋病的傳播。

population groups tested), a prevention programme focusing on high-risk groups (such as patients with STIs) appears to be strategically sound. Evidence has shown that interventions targeted at modifying high-risk behaviours among STI clinic attendees can effectively reduce their unsafe sexual behaviours, and thus reduce the risk of HIV transmission in the long run.[4] A greater knowledge of the behavioural characteristics of STI clinic attendees is necessary for the epidemiologists to better understand who might be more at risk of HIV infection and who might respond well to different types of interventions. This could then be used for planning of targeted interventions on high-risk STI clinic attendees. According to literature reviews of overseas studies,[5-25] factors including people who were: not married, uncircumcised men, having sex with commercial sex workers, multiple sexual partners, anal receptive sexual intercourse, illicit drug use, genital warts, gonococcal infection, syphilis and warts, were associated with an increased risk of HIV infection among STI clinic attendees. However, as the culture and the prevalence of STIs might differ among nations/regions, the results obtained might not be applicable to all populations. Moreover, there is no published study examining these risk factors in the Hong Kong Chinese population.

Methods

Study population

A retrospective matched case-control study was undertaken in the later half of 2006 at eight public STI clinics in Hong Kong. All STI clinic attendees' records from January 1995 to December 2002 were reviewed. Eligible patients were those who were HIV seropositive during the study period. Controls were the next (or nearest antecedent) attendees of the same gender, seen in the same clinic during the same month and within the same decade with respect to their age. The case-to-control ratio was one to one.

Exposure measurement

The demographics, STI pattern, and behavioural data (including illicit drug use) of these patients were extracted from the pre-medical consultation assessment form (a standard assessment tool routinely used to collect these data from all new attendees at STI clinics). The STI diagnosed at the consultation when HIV was tested, was determined by reviewing the medical records of the subjects.

Assessment for the presence of sexually transmitted infections

Assessment for the presence of STIs was based on standard protocols, developed by the Hong Kong Government Social Hygiene Service in 2004. Presence of genital ulcers was noted on physical examination reports, and *Neisseria gonorrhoeae* was diagnosed by demonstration of intracellular diplococci by Gram stain of urethral smear (for males) or cervical/urethral smear (for females), or positive culture of *N gonorrhoeae*. Syphilis was diagnosed by the VDRL (Venereal Disease Research Laboratories) screening test followed by confirmation by the treponemal antibody test. Non-gonococcal urethritis (NGU) was diagnosed by the demonstration of 5 or more polymorphonuclear cells per high-power field (x1000) in the absence of Gram-negative intracellular diplococci in the urethral smear. Genital herpes was diagnosed by the culture of herpes simplex virus in specimens from vesicles or erosions.[26]

Diagnosis of human immunodeficiency virus infection

The serum samples were first screened by an extremely sensitive but relatively less specific enzyme-linked immunosorbent assay (ELISA) test (the sensitivity and specificity of ELISA test is 99.9% and 92.6%, respectively).[27] In persons testing HIV-positive, a confirmatory Western blot test was also performed. The Western blot test was extremely specific for HIV infection (specificity, 99.9%).[27,28]

Statistical analysis

Matched analysis was used for this matched case-control study, ie pairs were analysed as units. For each variable, a separate univariate conditional logistic regression was performed to examine its association with HIV sero-positivity in STI patients. The category with no exposure was regarded as baseline. For other variables without the 'no exposure' category, the group with 'least exposure' was regarded as the baseline. Respective observations with missing data were excluded, in order to maintain consistency in the univariate and multivariate analyses.

In each instance the crude odds ratio (OR) and 95% confidence intervals (CIs) were reported, as well as the P value for the strength of the crude association. In all analyses, P=0.05 was taken as the level of statistical significance.

Selected variables associated with HIV infection in the univariate analysis were subsequently assessed in a multivariate analysis, using conditional logistic regression. Age, sex, and clinics were the matching factors and were controlled in the matched analysis; these three variables were not included in the multivariate analysis. Variables identified as significant risk factors in the univariate analysis were included in a multiple conditional logistic regression model to examine their independent effects. Other variables, which were of borderline significance in the univariate analysis but were known important risk factors from the literature, were also included. Each significant and important variable was first examined to determine whether it was a confounder. This was by examining the association with each of the exposures and comparing the crude and adjusted ORs. If association and a difference between crude and adjusted OR was observed, then the independent variables were considered as confounders. The confounders were tested with a forward modelling strategy, with likelihood ratio tests (LRTs) performed to assess the goodness of fit achieved by adding each to the model. The order in which the variables should add into the model was indicated by the results of the crude univariate analysis. Eventually, a best-fit model was developed in which the variables were mutually adjusted.

As the conditional logistic regression model assumed no interaction between the variables and the risk factor, the interaction of the corresponding variable on risk factors (including both regular and casual partners) and outcomes was examined by LRTs. In addition, the matching factors (age, sex, and clinic) were assessed as effect modifiers by LRTs. For all exposure variables and matching factors, there was no evidence to reject the null hypothesis of no interaction.

Results

In all, there were 149 336 subjects who attended the eight public STI clinics between 1995 and 2002. The number of patients consulting these clinics per year rose by 70% during this period.[29] It was estimated that up to 75% of attendees were male.[29] As for their ages, most (59%) were aged 20 to 39 years; those aged over 40 years accounted for only 37%.[29] Although the total number of attendees per year increased within the study period, the percentage distribution of age and sex remained relatively stable.[30] Among the STIs reported from these clinics within this 8-year period, non-gonococcal infection affecting the genitalia (ie NGU in males and non-specific genital infection in females) was the most common, accounting for 49% of all cases. Other commonly reported STIs included: genital warts (13.7%), gonorrhoea (11.9%), herpes genitalis (4.8%), syphilis (3.4%), and genital ulcer (2.7%).[29] The numbers of gonorrhoea infection increased by 64% from 1985 to 2002, and constitutes a useful indicator for risky sexual behaviours[31,32] that suggest increasingly risky sexual activity in the community over these 8 years. However, other factors also need to be considered, including possible changes in the size of the sexually active population, or a shift of symptomatic clients from private to public STI clinics.

During the same period, a total of 310 HIV-infected patients were diagnosed (based on a 99.5% HIV testing uptake rate among STI clinic attendees), yielding an average prevalence of 0.1%. However, only 196 out of 310 clinical records could be traced. In Hong Kong, HIV infection and STI are treated separately; once STI clinic attendees are confirmed as having HIV infection, they are referred to a specialised service for continued management. In the normal practice of STI clinics, all medical records inactive for 5 years from the last visit date are destroyed, and thus 114 medical records could not be retrieved for analysis. Hence, the number of eligible cases was 196, of which 160 were men and 36 were women. Based on the above-mentioned selection criteria, 196 STI clinics attendees without HIV infection were selected as controls.

More cases than controls were single (55% vs 44%), non-Chinese (21% vs 5%), and women who were commercial sex workers (30% vs 6%) [Table 1]. Syphilis (other than primary), current NGU, and current warts were more commonly diagnosed in cases than controls. A higher percentage of cases (32%) had a known history of STI than controls (22%) [Table 2]. Concerning the major behavioural risk factors for HIV infection, a larger proportion of the cases had casual sex in Mainland China than controls (56% vs 40%). Moreover, 32 of the cases, but none of the controls, reported being homosexual or bisexual (Table 3). There was no significant difference between the cases and controls for the other exposure variables.

Potential risk factors

The exposure variables that emerged as significant

TABLE 1. Demographic characteristics of human immunodeficiency virus (HIV)–positive patients and HIV-negative controls*

Characteristic	No. (%) of cases	No. (%) of controls	P value†
Marital status			
Married	71 (36)	100 (51)	0.03
Single	107 (55)	87 (44)	
Separated/divorced/widowed	17 (9)	9 (5)	
Ethnicity			
Chinese	151 (79)	183 (95)	<0.001
Non-Chinese	41 (21)	9 (5)	
Occupation for women			
Commercial sex workers‡	10 (30)	2 (6)	0.04
Others	23 (70)	31 (94)	

* Missing values were excluded from the analysis
† P values for differences between the cases and the controls were obtained using Chi squared tests or Fisher's exact test for categorical variables
‡ No male attendee reported to be a commercial sex worker

TABLE 2. Sexually transmitted infection (STI) pattern of human immunodeficiency virus (HIV)–positive patients and HIV-negative controls*

STI pattern†	No. (%) of cases	No. (%) of controls	P value‡
Diagnosis on completion of consultation			
Syphilis	0	5 (3)	0.07
Herpes	14 (7)	9 (5)	0.28
Ulcer	7 (4)	3 (2)	0.20
Syphilis (other than primary)	18 (9)	5 (3)	0.01
Gonorrhoea	22 (11)	21 (11)	0.87
Non-gonococcal urethritis	54 (28)	30 (15)	<0.001
Genital wart	45 (23)	29 (15)	0.04
A known history of STI before first presentation to Social Hygiene Clinic			
Yes	62 (32)	43 (22)	0.05

* Missing values were excluded from the analysis
† Information on STI patterns was extracted from the same consultation when HIV was screened
‡ P values for differences between the cases and the controls were obtained using Chi squared tests or Fisher's exact test for categorical variables

independent risk factors in the multivariate model included: non-Chinese (mainly South-East Asian) persons (OR=9.32; 95% CI, 3.27-26.55), syphilis other than primary (OR=5.67; 95% CI, 1.66-19.36), current NGU (OR=2.10; 95% CI, 1.08-4.07), current genital warts (OR=1.94; 95% CI, 1.10-3.43), a known history of STI prior to the first presentation to an STI clinic (OR=2.19; 95% CI, 1.29-3.72), having casual sex with friends (OR=2.89; 95% CI, 1.07-7.80), and having casual sex in Mainland China (OR=1.91; 95% CI, 1.04-3.49). Having a regular sexual partner, either a spouse (OR=0.32; 95% CI, 0.18-0.60) or a friend (OR=0.49; 95% CI, 0.25-0.96), emerged as significant independent protective factors. Homosexual or bisexual sex

orientation reported by a few of the cases but none of the controls was also considered to be a potential risk factor. Risk factors, which were significant in the univariate analysis but failed to predict the HIV status in the multivariate model, included marital status, women who were commercial sex workers, and having sex with female sex workers (Tables 4 and 5).

Discussion

The associations—between having engaged in casual sex in Mainland China, being homosexual or bisexual, being non-Chinese (mainly South-East Asian), having an STI before the first presentation to an STI clinic, having syphilis (other than primary), current NGU, and genital warts, which were revealed in this study—were consistent with findings reported elsewhere.[6-8,13-17,19,21] This reflects the need to design interventions to take account of all these factors.

Having casual sex in Mainland China is one of the important risk factors for HIV infection among Hong Kong people, which was identified in this study and is on the increase. The odds for acquiring HIV infection in STI patients who had casual sex in Mainland China as opposed to Hong Kong was 1.91, after controlling for other confounding factors. This finding was consistent with the results of another study, which evaluated the risk of HIV transmission among commercial sex workers and their clients in Hong Kong and concluded that a significant proportion was due to infections acquired in Mainland China, which may be related to a low level of condom use among clients visiting sex workers across the border.[33] Hence, it is necessary to augment HIV awareness, the appreciation of associated risks, and promotion of safer sex practices among cross-border travellers who seek sex in Mainland China.

Notably, HIV sero-positivity was significantly associated with men who reported participating in homosexual or bisexual activities; remarkably, only HIV-positive cases reported being homosexual or bisexual. However, the percentage of STI clinic attendees who were men having sex with men (MSM) was unknown, though it was known that in recent years HIV infections were on the rise in the MSM community in Hong Kong.[34] These findings highlight the need to expand the services for diagnosis and treatment of STIs and HIV, specially targeting MSM.

Studies involving patients with STIs as possible risk factors suggest that ulcerative genital diseases are increasingly associated with HIV infection[35,36]; data pertaining to non-ulcerative diseases (including gonorrhoea, genital warts, NGU, etc) are less conclusive in this respect.[37,38] In Hong Kong however, as the prevalence of non-ulcerative genital diseases is much higher than that of the genital ulcer disease, the former may well contribute a greater absolute

risk of HIV transmission.

Although the results of this study did not show a statistically significant effect from condom use (probably due to the small sample size), increasing condom usage is still the most effective public health measure proven to reduce sexually driven HIV outbreaks in overseas studies.[39] Such behaviour should therefore be vigorously promoted among patients attending STI clinics,[39] whilst appreciating that 'always using a condom' is not synonymous with 'consistently using a condom throughout the encounter'. It is necessary to achieve more widespread safer sex practices among at-risk populations, eg the cross-border travellers and the homosexual population. Increasing condom use apart, at-risk persons should also be advised to avoid risky sexual practices, eg having multiple sex partners or with persons they are not familiar with. Moreover, further epidemiological research is needed, particularly with a view to assessing the effectiveness of targeted interventions on high-risk STI attendees. The effect of circumcision on HIV transmission in the Hong Kong population also warrants study.

Women who were commercial sex workers,[16,17] having illicit drug use,[6,8,9,15] genital ulcers,[5,6,9,11,13,16] and gonococcal infection,[13,14,16,23] have been shown to be important significant risk factors for HIV in other studies from elsewhere. Although these putative risk factors did not attain statistical significance according to both the univariate and multivariate analyses in this study, the small sample size may be the reason.

Finally, biases (due to selection, reporting, and recall) could not be avoided, just as in other case-control studies. Persons engaged in risky sexual behaviour were more likely to have repeated STI episodes, and return for repeated tests of HIV infection than people who avoided such risky sexual activities. Therefore, the OR for engaging in risky sexual behaviour may be over-estimated. As mentioned, there were a total of 310 HIV-infected patients identified within the study period, but only 196 cases were included in the analysis. The characteristics of the enrolled and non-enrolled cases may be different. However, as the clinical records of the non-enrolled cases were not available, the baseline characteristics of the non-enrolled subjects could not be examined. Moreover, since the collection of behavioural exposure information relied on self-reporting (through a pre-medical consultation assessment form), it was possible that STI patients might not report their behaviour accurately. Recall bias might be more significant when the topic of interest was sensitive. The magnitude and direction of such biases are difficult to ascertain, as STI patients who perceive themselves at high risk of HIV infection may be less willing to disclose their

TABLE 3. Information on sexual behaviour and illicit drug use in human immunodeficiency virus (HIV)–positive patients and HIV-negative controls*

Information	No. (%) of cases	No. (%) of controls	P value[†]
History of casual sex			
Yes	164 (84)	155 (79)	0.18
Type of casual partners			
None	31 (16)	41 (21)	0.09
Commercial sex workers	117 (60)	125 (64)	
Casual friends	47 (24)	30 (15)	
Place of contact of last casual sex			
Hong Kong	60 (37)	84 (57)	<0.001
Mainland China/Macau	90 (56)	58 (40)	
Others	12 (7)	5 (3)	
Frequency of casual sex last year			
Never	47 (25)	55 (30)	0.28
1-few/year	74 (40)	76 (42)	
1-few/month	46 (25)	42 (23)	
1-few/week	19 (10)	9 (5)	
Condom use in the past 3 months with casual sex partners			
Never	37 (30)	25 (22)	0.36
Sometimes	50 (41)	52 (46)	
Always	36 (29)	37 (33)	
Regular sexual partners			
None	78 (41)	45 (24)	0.48
Spouse	71 (38)	100 (53)	
Friend	40 (21)	45 (24)	
Condom use in the past 3 months with regular sex partners			
Never	57 (59)	60 (48)	0.27
Sometimes	24 (25)	41 (33)	
Always	16 (17)	24 (19)	
Sexual orientation			
Heterosexual	152 (83)	178 (100)	<0.001
Homosexual	20 (11)	0	
Bisexual	12 (7)	0	
Illicit drug use			
Yes	11 (6)	7 (4)	0.24

* Missing values were excluded from the analysis
† P values for differences between the cases and the controls were obtained using Chi squared tests or Fisher's exact test for categorical variables

sexual behaviour than those not aware of the known risks of infection. Furthermore, the investigators only recruited patients visiting public STI clinics during a specific period of time. It should be noted that only 20% of symptomatic STI patients presented to the public STI clinics in Hong Kong. Hence, caution should be exercised before generalising the findings of this study to the entire Hong Kong population.

TABLE 4. Risk factors (demographic variables and sexually transmitted infection [STI] patterns) associated with human immunodeficiency virus infections according to the univariate and multivariate analyses

Risk factor	Crude odds ratio (95% confidence interval)*	P value	Adjusted odds ratio (95% confidence interval)†	P value
Demographic variables				
Marital status				
Married	1		1	
Single	2.09 (1.24-3.51)	0.005	1.15 (0.33-4.00)	0.82
Separated/divorced/widowed	2.48 (1.07-5.77)	0.035	2.18 (0.64-7.42)	0.21
Ethnicity				
Chinese	1	<0.001	1	<0.001
Non-Chinese	8.75 (3.11-24.62)		9.32 (3.27-26.55)	
Occupation‡				
Others	1	0.037	1	0.17
Commercial sex workers	9 (1.14-71.04)		5.79 (0.47-72.03)	
STI pattern				
Chief complaint				
Symptomatic	1.33 (0.81-2.20)	0.258	1.29 (0.70-2.36)	0.42
STI diagnosed on completion of consultation				
Herpes	1.71 (0.67-4.35)	0.257	2.18 (0.77-6.21)	0.14
Ulcer	2.33 (0.6-9.02)	0.22	3.82 (0.44-33.12)	0.22
Syphilis (other than primary)	3.6 (1.34-9.70)	0.011	5.67 (1.66-19.36)	0.01
Gonorrhoea	1 (0.55-1.83)	1	1.45 (0.74-2.87)	0.28
Non-gonococcal urethritis	2.1 (1.26-3.48)	0.003	2.10 (1.08-4.07)	0.03
Genital wart	1.84 (1.05-3.22)	0.032	1.94 (1.10-3.43)	0.02
A known history of STI before first presentation to Social Hygiene Clinic				
Yes	1.77 (1.09-2.86)	0.02	2.19 (1.29-3.72)	<0.001

* Unadjusted odds ratio

† Adjusted for significant risk factors including marital status, ethnicity, occupation (commercial sex worker), syphilis other than primary, non-gonococcal urethritis, genital wart, a known history of STI, type of casual sex partner, place of contact and type of regular sex partner; insignificant risk factors in the univariate analysis including illicit drug use, genital ulcer, gonorrhoea, syphilis and condom use with casual/regular sex partner in the past 3 months

‡ For female cases and controls only

References

1. 2006 HIV/ AIDS situation in Hong Kong 2006. Hong Kong Department of Health website: http://www.info.gov.hk/aids/pdf/g192.pdf. Accessed 12 Jul 2007.
2. Aral SO. Heterosexual transmission of HIV: the role of other sexually transmitted infections and behavior in its epidemiology, prevention and control. Annu Rev Public Health 1993;14:451-67.
3. Wasserheit JN. Epidemiological synergy. Interrelationships between human immunodeficiency virus infection and other sexually transmitted disease. Sex Transm Dis 1992;19:61-77.
4. Kamali A, Quigley M, Nakiyingi J, et al. Syndromic management of sexually-transmitted infections and behaviour change interventions on transmission of HIV-1 in rural Uganda: a community randomised trial. Lancet 2003;361:645-52.
5. Simonsen JN, Cameron DW, Gakinya MN, et al. Human immunodeficiency virus infection among men with sexually transmitted diseases. Experience from a center in Africa. N Engl J Med 1988;319:274-8.
6. Quinn TC, Glasser D, Cannon RO, et al. Human immunodeficiency virus infection among patients attending clinics for sexually transmitted diseases. N Engl J Med 1988;318:197-203.
7. Cameron DW, Simonsen JN, D'Costa LJ, et al. Female to male transmission of human immunodeficiency virus type 1: risk factors for seroconversion in men. Lancet 1989;2:403-7.
8. Chiasson MA, Stoneburner RL, Lifson AR, et al. Risk factors for human immunodeficiency virus type 1 (HIV-1) infection in patients at a sexually transmitted disease clinic in New York city. Am J Epidemiol 1990;131:208-20.
9. Chirgwin K, DeHovitz JA, Dillon S, McCormack WM. HIV infection, genital ulcer disease, and crack cocaine use among patients attending a clinic for sexually transmitted diseases. Am J Public Health 1991;81:1576-9.
10. Diallo MO, Ackah AN, Lafontaine MF, et al. HIV-1 and HIV-2 infections in men attending sexually transmitted disease clinics in Abidjan, Côte d'Ivoire. AIDS 1992;6:581-5.
11. Plourde PJ, Plummer FA, Pepin J, et al. Human

TABLE 5. Risk factors (sexual behaviour and illicit drug use) associated with human immunodeficiency virus infections according to the univariate and multivariate analyses

Risk factor	Crude odds ratio (95% confidence interval)*	P value	Adjusted odds ratio (95% confidence interval)†	P value
History of casual sex				
Yes	1.85 (0.94-3.63)	0.075	2.16 (0.85-5.54)	0.11
Type of casual partner				
None	1		1	
Commercial sex workers	1.59 (0.79-3.19)	0.192	1.40 (0.60-3.30)	0.44
Friends	2.59 (1.19-5.64)	0.017	2.89 (1.07-7.80)	0.04
Place of contact of last casual sex				
Hong Kong	1		1	
Mainland China/Macau	2.26 (1.27-4.03)	0.006	1.91 (1.04-3.49)	0.04
Others	3.24 (0.98-10.71)	0.054	1.39 (0.36-5.35)	0.63
Condom use in the past 3 months with casual sex partners				
Never	1		1	
Sometimes	0.96 (0.41-2.26)	0.927	1.21 (0.46-3.19)	0.70
Always	0.82 (0.30-2.25)	0.704	0.85 (0.28-2.61)	0.78
Regular sexual partners				
None	1		1	
Spouse	0.30 (0.16-0.54)	<0.0001	0.32 (0.18-0.60)	<0.001
Friend	0.42 (0.22-0.80)	0.008	0.49 (0.25-0.96)	0.04
Condom use in the past 3 months with regular sex partners				
Never	1		1	
Sometimes	0.51 (0.21-1.24)	0.137	0.51 (0.21-1.24)	0.14
Always	0.71 (0.27-1.86)	0.492	0.71 (0.27-1.86)	0.49
Illicit drug use				
Yes	1.67 (0.61-4.59)	0.323	2.05 (0.7-5.96)	0.19

* Unadjusted odds ratio
† Adjusted for significant risk factors including marital status, ethnicity, occupation (commercial sex worker), syphilis other than primary, non-gonococcal urethritis, genital wart, a known history of sexually transmitted infection, type of casual sex partner, place of contact and type of regular sex partner; insignificant risk factors in the univariate analysis including illicit drug use, genital ulcer, gonorrhoea, syphilis and condom use with casual/regular sex partner in the past 3 months

immunodeficiency virus type 1 infection in women attending a sexually transmitted diseases clinic in Kenya. J Infect Dis 1992;166:86-92.

12. Rodriguez EM, de Moya EA, Guerrero E, et al. HIV-1 and HTLV-1 in sexually transmitted disease clinics in the Dominican Republic. J Acquir Immune Defic Syndr 1993;6:313-8.

13. Figueroa JP, Brathwaite A, Morris J, et al. Rising HIV-1 prevalence among sexually transmitted disease clinic attenders in Jamaica: traumatic sex and genital ulcers as risk factors. J Acquir Immune Defic Syndr 1994;7:310-6.

14. Kassler WJ, Zanilman JM, Erickson B, Fox R, Peterman TA, Hook EW 3rd. Seroconversion in patients attending sexually transmitted disease clinics. AIDS 1994;8:351-5.

15. Cleghorn FR, Jack N, Murphy JR, et al. HIV-1 prevalence and risk factors among sexually transmitted disease clinics attenders in Trinidad. AIDS 1995;9:389-94.

16. Mehendale SM, Rodrigues JJ, Brookmeyer RS, et al. Incidence and predictors of human immunodeficiency virus type 1 seroconversion in patients attending sexually transmitted

disease clinics in India. J Infect Dis 1995;172:1486-91.

17. Rodrigues JJ, Mehendale SM, Shepherd ME, et al. Risk factors for HIV infection in people attending clinics for sexually transmitted disease in India. BMJ 1995;311:283-6.

18. Figeroa JP, Ward E, Morris J, et al. Incidence of HIV and HTLV-1 infection among sexually transmitted disease clinic attenders in Jamaica. J Acquir Immune Defic Syndr Hum Retrovirol 1997;15:232-7.

19. Jenkins RA, Jenkins PR, Nannis ED, McKee KT Jr, Temoshok LR. Correlates of human immunodeficiency virus infection risk behavior in male attendees of a clinic for sexually transmitted disease. Clin Infect Dis 2000;30:723-9.

20. Gilbart VL, Williams DI, Macdonald ND, et al. Social and behavioural factors associated with HIV seroconversion in homosexual men attending a central London STD clinic: a feasibility study. AIDS Care 2000;12:49-58.

21. Schwarcz SK, Kellogg TA, McFarland W, et al. Characterization of sexually transmitted disease clinic patients with recent human immunodeficiency virus infection. J Infect Dis 2002;186:1019-22.

22. Joesoef MR, Cheluget B, Marum LH, et al. Differential of HIV prevalence in women and men who attended sexually transmitted disease clinics at HIV sentinel surveillance sites in Kenya, 1990-2001. Int J STD AIDS 2003;14:193-6.

23. Kehinde AO, Lawoyin TO, Bakare RA. Risk factors for HIV infection among special treatment clinic attendees in Ibadan, Nigeria. Afr J Med Med Sci 2004;33:229-34.

24. Mehta SD, Ghanem KG, Rompalo AM, Erbelding EJ. HIV seroconversion among public sexually transmitted disease clinic patients: analysis of risks to facilitate early identification. J Acquir Immune Defic Syndr 2006;42:116-22.

25. Reynolds SJ, Risbud AR, Shepherd ME, et al. High rates of syphilis among STI patients are contributing to the spread of HIV-1 in India. Sex Transm Infect 2006;82:121-6.

26. Recommendations in case management of sexually transmitted infections (STIs) in Hong Kong 2004. Hong Kong Department of Health website: http://www.info.gov.hk/aids/pdf/g134.pdf. Accessed 31 Jul 2006.

27. Papadopulos-Eleopulos E, Turner VF, Papadimitriou JM. Is a positive western blot proof of HIV infection? Biotechnology (N Y) 1993;11:696-707.

28. HIV Manual. 2001. Hong Kong Department of Health website: http://www.info.gov.hk/aids/english/hivmedcare/manual.htm. Accessed 3 Aug 2006.

29. STD/ AIDS update–a quarterly surveillance report, 2002 Vol.8, No.2. Hong Kong Department of Health website: http://www.info.gov.hk/aids/archives/backissuestd/std02q2.pdf. Accessed 15 Jul 2006.

30. STD/ AIDS update–a quarterly surveillance report, 2000 Vol.6, No.3. Hong Kong Department of Health website: http://www.info.gov.hk/aids/archives/backissuestd/std0007.

pdf. Accessed 15 Jul 2006.

31. Lee SJ, Cho YH, Ha US, Kim SW, Yoon MS, Bae K. Sexual behavior survey and screening for chlamydia and gonorrhea in university in South Korea. Int J Urol 2005;12:187-93.

32. When gonorrhea rates rise, can HIV be far behind? CDC's latest STD report notes disturbing trend. AIDS Alert 2001;16:25-6.

33. Report on community assessment and evaluation of HIV prevention for commercial sex workers and their clients in Hong Kong. 2006. Hong Kong Department of Health website: http://www.info.gov.hk/aids/pdf/g169.pdf. Accessed 15 Aug 2007.

34. PRiSM-HIV Prevalence and risk behavioural survey of men who have sex with men in Hong Kong 2006. Hong Kong Department of Health website: http://www.info.gov.hk/aids/english/new2007/nm15.htm. Accessed 15 Aug 2007.

35. Greenblatt RM, Lukehart SA, Plummer FA, et al. Genital ulceration as a risk factor for human immunodeficiency virus infection. AIDS 1988;2:47-50.

36. Stamm WE, Handsfield HH, Rompalo AM, Ashley RL, Roberts PL, Corey L. The association between genital ulcer disease and acquisition of HIV infection in homosexual men. JAMA 1988;260:1429-33.

37. Plummer FA, Simonsen JN, Cameron DW, et al. Cofactors in male-female sexual transmission of human immunodeficiency virus type 1. J Infect Dis 1991;163:233-9.

38. Laga M, Manoka A, Kivuvu MT, et al. Non-ulcerative sexually transmitted diseases as risk factors for HIV-1 transmission in women: results from a cohort study. AIDS 1993;7:95-102.

39. Weller S, Davis K. Condom effectiveness in reducing heterosexual HIV transmission. Cochrane Database Syst Rev 2002;(1):CD003255.