

THE PREVALENCE OF LOWER GENITAL TRACT INFECTIONS AMONG ANTE-NATAL CARE (ANC) CLINIC PATIENTS IN TWO CENTRAL HOSPITALS, VIENTIANE, LAO PEOPLE'S DEMOCRATIC REPUBLIC

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Abstract. This study of lower genital tract infections in pregnant women attending antenatal clinics in Vientiane, Lao PDR is a response to the reported rapid increase in the number of HIV infections in neighboring countries, and is a recognition of the important role of reproductive tract infections in facilitating HIV transmission. This cross-sectional study determines the prevalence of lower genital tract infections among 500 antenatal attendees (gestational age \leq 20 weeks) attending two hospitals serving urban areas in Vientiane, between September 2001 and March 2002. Most participants were housewives (64.4%) and government workers (16.0%). Their husbands were mainly government officers (31.4%), laborers or farmers (30.2%), and businessmen (12.4%). Sixty-four percent reported a past history of "any vaginal complaints" with 44.2% having sought treatment. *Candida* spp had the highest prevalence of all infections (27.0%), followed by bacterial vaginosis (14.4% by Amsel's criteria and 22.0% by Nugent's score), *C. trachomatis* (10.2% by nucleic acid hybridization and 9.6% by PCR), *T. vaginalis* (1.8%), and *N. gonorrhoeae* (0.8%), but no syphilis serological markers. Taken in conjunction with other surveillance data from the same period, this study indicates an opportunity to prevent epidemic spread into the community of both sexually transmitted disease and HIV by appropriate preventative programmed activities, including treatment services targeted at higher risk community groups.

INTRODUCTION

The public health importance of reproductive tract infections including sexually transmitted infections (STI) is well documented. Not only do they have serious health, economic and social consequences but epidemiological studies

show that ulcerative and non-ulcerative lower genital tract infections (LGTI) increase the susceptibility to HIV infections (Cameron *et al*, 1989; Plummer *et al*, 1998). Thus, prompt treatment, particularly of STI, combined with health education, including correct condom use, are a cost-effective means of reducing HIV transmission (Grosskurth *et al*, 1995, 2000; Wawer *et al*, 1999). Although high and increasing levels of HIV infection in neighboring countries, including Cambodia (Saphonn *et al*, 2002), Thailand (Kilmarx *et al*, 1998; Limpakarnjanarat *et al*, 1999; Tabrizi *et al*, 2000) and Vietnam (Nguyen *et al*, 1999; Quan *et al*, 2000; Anh *et al*, 2003)

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have been reported, HIV surveillance (Loue *et al*, 1998; Ministry of Health, 1998; Family Health International, 2001) in Lao PDR indicates that the prevalence remains low, even in those community groups believed to be at greater risk of infection. There is, therefore, a very real opportunity to institute HIV transmission preventive measures, which should include the provision of diagnosis and treatment services for LGTI.

Data on LGTI, including STI is limited in Lao PDR, but in order to plan and manage such services, it is clearly important that the present Lao situation be determined. Although three other studies were reported in 2001, the participants in two of them (Ministry of Health, 1998; Family Health International, 2001) were community groups assumed to be at increased risk of genital infection, including STI (Family Health International, 2001). A third study (Amphoy Sihavong, personal communication) evaluated a large group of symptomatic women attending a gynecological clinic (Ministry of Health, 2001).

Pregnant women are a particularly appropriate population in which to conduct periodic surveys of STI since they are sexually active females in the general community, and therefore may reflect levels of STI within the community.

This study on LGTI in antenatal women at the two central hospitals of Vientiane, the capital of Lao PDR, is highly relevant to the broadening scope of surveillance necessary for planning and managing of curative services. This study primarily aimed to determine the prevalence of LGTI, *Candida* spp, *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Trichomonas vaginalis*, syphilis, and the syndrome of bacterial vaginosis, among antenatal attendees at two referral hospitals in Lao PDR.

MATERIALS AND METHODS

Study population and setting

The study participants were recruited from pregnant women of not more than 20 weeks gestation at their first visit to Sethathirath or the Mother and Child Health (MCH) hospital in Vientiane Lao PDR. At the former site, the recruitment took place between September 2001

and February 2002 and at the latter between September 2001 and March 2002. A total of 500 pregnant women who participated in the study were divided equally between the two sites.

Ante-natal clinic (ANC) attendees were screened by a nurse-receptionist using a checklist to determine if the individual's criteria for inclusion were met. Potential subjects were excluded for the following reasons: not pregnant, pregnancy greater than 20 weeks of gestation, any history of bleeding in this pregnancy, previous history of premature labor, previous history of complications during pregnancy, and previous history of multiple pregnancies.

After the purpose of the study had been explained to the subject, she was asked if she would be willing to participate in the study. Those who agreed, read, or had been read to them, a consent form which they signed. It was made clear to those subjects who did not wish to enter the study that there would be no detriment to their care and the routine antenatal care of the particular hospital that she was attending would be provided.

Methods

The study was a cross-sectional prevalence survey (Fleiss, 1981) consisting of structured interviews, gynecological examination and specimen collection, within the normal process of routine antenatal care at each center, plus urine collection and venipuncture.

Structured interview. After enrollment, a history based on a standard interview form was recorded by the investigator and included: demographic data, a general medical history, recent medication, including antibiotics, obstetric and gynecological histories, past and present signs and symptoms possibly relevant to lower genital tract infections.

Obstetric and gynecological examinations. The physicians involved in these procedures were blinded from the interview results. Examination included routine antenatal care at each center together with visual examination of the external genitalia, perineal, and peri-anal areas for warts, rashes, excoriation, vesicles, and ulceration. Using a sterile, non-lubricated speculum visual examination of the cervix and vaginal walls was

made and vaginal and cervical specimens collected. Vaginal material was examined in the clinic for pH determination and a "whiff" test using 10% potassium hydroxide solution (KOH). A wet mount and thin smears were sent to the hospital laboratory for *T. vaginalis* and Gram staining for *Candida* spp. *T. vaginalis*, and evidence of bacterial vaginosis. Endocervical specimens, using two Dacron-tipped swabs, were taken for Gram staining and determination of *N. gonorrhoeae* and *C. trachomatis*. Ayer's spatula was used to collect a cervical specimen for cytological examination.

Blood and urine collections. Antecubital venous blood was taken for syphilis screening as part of routine antenatal care. A first voided urine (FVU) specimen was taken before or after the gynecological examination depending on the time of last micturition. At least two hours after passing urine the participant collected an FVU into a wide topped plastic container without first cleaning the vulval or introital area. As soon as possible, the FVU was transferred to the hospital laboratory where it was homogenized by gentle hand shaking, pipetted into a two-milliliter micro-tube, and placed in a cold box with ice packs. Urine specimens were then transferred within 36 hours to the Lao PDR Ministry of Health's Centre for Laboratory and Epidemiology (CLE) and placed in a $\leq -70^\circ\text{C}$ freezer until after completing the samples. The collection was transferred on dry ice by courier to Bangrak Hospital, Department of Diseases Control, Ministry of Public Health, Bangkok, Thailand. These urine specimens remained deep frozen at $\leq -70^\circ\text{C}$ for 30 months before they were sent to Bangrak Hospital for analysis.

Cytological and laboratory examinations. The laboratory staff were blinded from the results of the clinical gynecological examinations. Vaginal specimens were examined for bacterial vaginosis using Amsel's criteria (Amsel *et al*, 1983) and Nugent's score (Nugent *et al*, 1991), *T. vaginalis* by microscopy of wet-mount preparations, and *Candida* spp by KOH treated wet films and Gram stains. One of the endocervical swabs was Gram stained and examined for intracellular gram negative diplococci indicative of *N. gonorrhoeae* (Koneman *et al*, 1988). The other swab was used

for determination of *C. trachomatis* using a nucleic acid hybridization test (Gen-Probe Pace[®]-2 System *Chlamydia trachomatis*, Gen-Probe, San Diego, CA, USA). Ayer's spatula was used to collect cervical specimens for cytological examination using Papanicolaou's stain. Blood drawn for syphilis was screened by a Rapid Plasma Reagin test (Syphilis RPR Test, Human Gessellschaft für Biochemica und Diagnostica GmbH, Wiesbaden, Germany; and Bangrak RPR Card Test, Bureau of AIDS, TB and STIs, Department of Diseases Control, Ministry of Public Health, Thailand), and if positive, was confirmed by a *Treponema pallidum* hemagglutination test (Syphilis TPHA Test, Human Gessellschaft für Biochemica und Diagnostica GmbH, Wiesbaden, Germany). The stored FVU was assayed for *C. trachomatis* and *N. gonorrhoeae* using Polymerase Chain Reaction (PCR) (Amplicore[®] *Chlamydia trachomatis/Neisseria gonorrhoeae*, Roche Diagnostics, Branchburg, NJ, USA) performed at Bangrak Hospital in Bangkok, Thailand.

N. gonorrhoeae cultures were prepared by inoculation on Modified Thayer-Martin medium. Anti-microbial susceptibilities for ceftriaxone, ciprofloxacin, penicillin, spectinomycin and tetracycline was determined on *N. gonorrhoeae* sub-cultures using the E test (Biodisk, E test[®] for MIC Determination of Antibiotics, Stockholm, Sweden) at the Bacteriology Unit, CLE, Vientiane (Wentworth *et al*, 1991; van Dyck *et al*, 1999). Quality control was provided by the bacteriology department at the CLE with review of 10% of Gram smears judged to be negative for *N. gonorrhoeae* selected at random, all cervical smears reported as positive, any positive blood specimens and *N. gonorrhoeae* cultures. Repeat testing of positive syphilitic samples was done by an author (SP) at Khon Kaen University, Thailand.

Subject's' follow-up, clinical management and counseling. After review of the clinical findings and the history given by the subject, any necessary treatment was offered, based on the STI syndromic case management approach recommended in the National STD Case Management Guidelines (NSCMG) (Ministry of Health, 1998). Education on LGTI including STI was provided to all participants with counseling as necessary

to those with identified infection. The individual hospital laboratories reported the results of the tests to the investigator and at the next appointment one to two weeks later, any further treatment required was provided together with appropriate health education and counseling. Where an STI was identified, partner management, including notification and treatment, was instituted according to the NSCMG. Multivitamins, iron supplements, and LGTI treatment were provided at no cost to the participant. Participants were followed regularly according to the guidelines on safe motherhood (World Health Organization, 1994). Tests of cure for all conditions found were undertaken at subsequent routine antenatal clinic attendance. Subjects who failed to return were followed up by telephone call or home visit.

This project was approved by the Ministry of Health of Lao PDR, and received clearance by the Ethics Committee (Council of Medical Science) of the Lao Ministry of Health and the Scientific and Ethical Review Group of the WHO Department of Reproductive Health and Research, Geneva, Switzerland. Formal permission was obtained from the administrative authority and the directors of the two study centers.

Data management and analysis. All data obtained were entered using Epi Info version 6.04d (Atlanta, GA, USA: Centers for Disease Control and Prevention, 2001) and analyzed using Intercooled Stata version 8.2 for Windows (StataCorp LP, College Station, TX, USA, 2004). The frequencies, means, standard deviations, and proportions were used for the data analysis. The data analysis emphasized the total number of each LGTI identified, number of participants with an infection, number of participants with single infections, number and percentage of participants with more than one infection and combinations of infections, signs, symptoms and clinical findings to selected infections and selected data on disease characteristics, eg, antimicrobial susceptibility of *N. gonorrhoeae*, etc. Kappa (κ -statistics) was used as a measure of agreement between two different methods and was scaled to be 0 when the amount of agreement is what would be expected to be observed by chance and 1 when there was a perfect

agreement (Landis and Koch, 1977; Fleiss, 1981). The 95% confidence intervals and the chi-square (χ^2) tests were used to explore the association of variables (Fleiss, 1981). Comparisons of means were based on either the Student's *t*-test or one-way analysis of variance, where appropriate; and if the data did not follow the Gaussian distribution then appropriate non-parametric tests (Mann-Whitney or Kruskal-Wallis test) were used (Daniel, 1991).

RESULTS

Demographic, medical and obstetrics histories

Of the 520 eligible subjects who were recruited and initially screened, 20 from MCH hospital (3.8%) declined to participate in the study. The mean age (\pm SD) of the study participants was 25.7 (\pm 4.8) years (range 17-40 years), 41.2% of participants had completed at least eleven years in school. Most participants were housewives (64.4%) or government workers (16.0%). Their husbands were mainly government officers (31.4%), laborers or farmers (30.2%), or businessmen (12.4%). Nearly half (46.2%) of the women were primigravida, and 29.8% were in their second pregnancies (number of previous pregnancies: range 1-8). Among those who had been pregnant previously, 6.0% reported having at least one stillbirth, and 28.6% of these reported having no currently living children. 27.6% reported having at least one miscarriage prior to this visit.

Most (90.0%) of the women could recall the date of onset of their last menstrual period (LMP) and there was a very high correlation between the reported weeks of pregnancy and those based on calculation from their reported LMPs (Pearson's $r = 0.98$, $p < 0.001$). The patients who attended these two study sites were generally comparable in terms of age, main occupation, husband's occupation, years of completed schooling, numbers of live-births, still-births and living children ($p > 0.1$ for any variables, Table 1). They were, however, significantly different with respect to the number of miscarriages and previous pregnancies ($p < 0.001$, Table 1).

Of the 500 women, 17.8% reported at least one "any past illness" and 4.4% reported a his-

Table 1

Comparisons of demographic characteristics of the study participants between the two study sites.

Variables	MCH	Sethathirath	p-value
Age (mean \pm SD, years)	26 \pm 4.8	25.4 \pm 4.7	0.14
Occupation			
Government worker	46	36	0.11
Housewife	161	161	
Farmer/worker	8	3	
Other	35	50	
Husband's occupation			
Government worker	97	79	0.18
Laborer/farmer	68	83	
Other	85	88	
Years of completed schooling (mean \pm SD)	8.9 \pm 2.7	9.2 \pm 2.2	0.29
Number of live-births			
(mean \pm SD)	0.59 \pm 0.87	0.50 \pm 0.82	0.27
(median, range)	0, 0 - 5	0, 0 - 5	0.22
Number of still-births			
(mean \pm SD)	0.02 \pm 0.14	0.06 \pm 0.28	0.07
(median, range)	0, 0 - 1	0, 0 - 2	0.12
Number of living children			
(mean \pm SD)	0.58 \pm 0.84	0.50 \pm 0.82	0.33
(median, range)	0, 0 - 5	0, 0 - 5	0.12
Number of abortions			
None	157	205	< 0.001
1	65	35	
> 1	28	10	
Number of previous pregnancies			
(mean \pm SD)	1.2 \pm 1.4	0.8 \pm 1.1	< 0.001
(median, range)	1, 0 - 8	0, 0 - 6	< 0.001

tory of "present general illness". A past history of malarial infection was reported more than other illnesses (14.6%) while the current illnesses were non-specific. Few patients (3.6%) reported taking antibiotics within the past two weeks. More than half (64.2%) of the participants reported a past history of "any vaginal complaints" and 44.2% of them had sought treatment for these problems. The median time from the last episode of vaginal problems to the present visit was 50.5 days ($n = 14$). Eleven (2.2%) of the total women in the study had a past history of genital ulcer, nearly half of whom (5) described painful vesicular ulceration and slightly more than half (6) had received treatment. The majority (99.2%) of patients replied either "no" or "not known" to the inquiry on a past history of syphilis and gonorrhoea with only 4 (0.8%) study par-

ticipants admitting to previous gonorrhoea or syphilis. About one quarter (25.2%) of all participants had sought care for past reproductive-tract infections. More than half (54.0%) chose care at public hospitals, 24.6% at private clinics, and 17.5% at pharmacies. Less than 4.0% (5) identified themselves as receiving medical care or advice from either friends or traditional medicine.

The history of present gynecological symptoms showed that 56.8% of participants reported the presence of vaginal discharge, including 22.2% with heavy discharge, 18.0% with odor, 19.4% with dyspareunia, 9.8% with dysuria and 13.2% with vaginal itching.

Gynecological examinations

External examination of the vulval, perineal

Table 2
Prevalence of reproductive tract infections among antenatal clinic attendants, overall, and by clinics (n = 500), Vientiane Municipality, Lao PDR.

Infection	Prevalence (%) and (95% CI)
Bacterial vaginosis (Amsel's criteria)	
Overall	14.4 (11.3-17.5)
MCH Hospital	16.8 (12.1-21.5)
Sethathirath	12.0 (7.9-16.1)
Bacterial vaginosis (Nugent's score) ^a	
Overall	22.0 (18.4-25.6)
MCH Hospital	24.0 (18.7-29.3)
Sethathirath	20.0 (15.0-25.0)
<i>Candida</i> spp	
Overall	27.0 (23.1-30.9)
MCH Hospital	26.4 (20.9-31.9)
Sethathirath	27.6 (22.0-33.2)
<i>Chlamydia trachomatis</i> (nucleic acid hybridization)	
Overall	10.2 (7.6-12.9)
MCH Hospital	12.0 (8.0-16.1)
Sethathirath	8.4 (4.9-11.9)
<i>Chlamydia trachomatis</i> (PCR)	
Overall	9.6 (7.0-12.2)
MCH Hospital	12.8 (8.9-17.6) ^b
Sethathirath	6.4 (3.7-10.2) ^b
<i>Neisseria gonorrhoeae</i> (culture)	
Overall	0.8 (0.2-2.0) ^b
MCH Hospital	0.0 (0.0-1.5) ^c
Sethathirath	1.6 (0.4-4.0)
<i>Neisseria gonorrhoeae</i> (PCR)	
Overall	0.4 (0.05-1.4) ^b
MCH Hospital	0.4 (0.01-2.2) ^b
Sethathirath	0.4 (0.01-2.2) ^b
Syphilis	
Overall	0.0 (0.0-0.7) ^b
MCH Hospital	0.0 (0.0-1.5) ^b
Sethathirath	0.0 (0.0-1.5) ^b
<i>Trichomonas vaginalis</i>	
Overall	1.8 (0.6-3.0)
MCH Hospital	0.8 (0.0-2.9) ^b
Sethathirath	2.8 (1.1-5.7) ^b

^aPrevalence of definite scores as compared to normal or intermediate

^bExact confidence interval

^cOne-sided, 97.5% confidence interval

and perianal areas revealed 12 (2.4%) vesicular lesions indicating probable *Herpes simplex*, 11 (2.2%) non specific, but possibly herpetic shallow ulcerations and 3 (0.6%) condylomatous lesions. On speculum examination, 41.2% of all

subjects had cervical ectropion and/or erosion, including 34.6% among nulligravidas. Nearly half of all subjects had an opaque (46.2%) or clear mucoid discharge (42.6%) in the cervical canal after cleaning of the cervical os.

Prevalence of LGTI

The results of the prevalence of the studied LGTI, namely, *Candida* spp, *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Trichomonas vaginalis*, syphilis, and bacterial vaginosis are summarized in Table 2. The prevalence of each infection across the different sites was comparable, except for *C. trachomatis* where it was about twice as high at the MCH Hospital compared to Sethathirath using PCR. *Candida* spp had the highest prevalence of all infections (27.0%), followed by bacterial vaginosis (14.4% by Amsel's and 22.0% by Nugent's, $\kappa = 0.51$ ($p < 0.001$)), *C. trachomatis* (10.2%), *T. vaginalis* (1.8%), and *N. gonorrhoeae* (0.8%), but no syphilis. There were 43 (8.6%) who had co-infections with two or more of the surveyed organisms. The most common co-existing conditions were bacterial vaginosis and candidal infection (3.6%), followed by candidal and chlamydial infections (3.4%), and bacterial vaginosis and chlamydial infection (2.6%), respectively. There were four subjects (0.8%) who had three conditions with bacterial vaginosis, candidal infection, and chlamydial infection, while one (0.2%) had simultaneous infections with *Candida* spp, *C. trachomatis*, and *N. gonorrhoeae*. It is important to note that the overall prevalences of *C. trachomatis* determined by both nucleic acid hybridization and PCR were quite similar, but there was a two-fold difference when *N. gonorrhoeae* was determined by Gram stain and culture (Table 2).

All four *N. gonorrhoeae* isolates were sensitive to ceftriaxone and spectinomycin; two were sensitive to ciprofloxacin but only one to penicillin, and none to tetracycline. The results of the cervical cytology revealed no striking abnormal results. Most (80.0%) of participants were in class I and the rest were in class II.

DISCUSSION

We document in this study the results of LGTI prevalence among ANC attendants at two free access antenatal clinics of two referral hospitals in the capital city, Vientiane, Lao PDR. The highest prevalence observed was for *Candida* spp infection (27.0%), followed by bacterial

vaginosis (22.0% by Nugent's score, 14.4% by Amsel's criteria), *C. trachomatis* (about 10% for both nucleic acid hybridization and PCR), *T. vaginalis* (1.8%), and *N. gonorrhoeae* (0.8% by nucleic acid hybridization, 0.4% by PCR), but no syphilis. The prevalence of *Candida* spp and *C. trachomatis* were strikingly high when compared with those reported among maternal and child health attendees in Hanoi but neither study detected syphilis (Anh *et al*, 2003). Such a high proportion of *Candida* spp is not unexpected among pregnant women. We chose to compare our study with international ones of similar design and found that our study results closely resembled a study carried out in Bangladesh (Begum *et al*, 2003) except that our study did not find any syphilis. Another similar study from Nigeria (Aboyeji and Nwabuisi, 2003) showed a much higher prevalence of *Candida* spp, *T. vaginalis*, syphilis, and *N. gonorrhoeae* but less bacterial vaginosis. The differences observed in this study from the others may be because clients who visit these two hospitals in Vientiane may not be representative of the general Lao female urban population but rather relatively well educated and of a higher socio-economic status as suggested by their demographic characteristics. Unfortunately, our data do not allow us to explore such differences. Moreover, substantially higher proportion of bacterial vaginosis as determined by Nugent's score in our study when compared to Amsel's criteria was not unexpected and would agree with a multi-centered study result (Schwebke *et al*, 1996), although different findings were observed in another study (Chaijareenont *et al*, 2004).

The presence of clinical findings, such as the substantially high proportion of patients with vaginal discharge and vesicular or ulcerative or condylomatous lesions may indicate that the lower genital tract infections among antenatal care clients are of concern. There seems to be a homogeneous prevalence of the various infections across the two clinics except for the prevalence of *C. trachomatis* detectable by PCR (Table 2). This again may reflect a different socio-economic status of the clients between the two hospitals which is suggested by a higher number of miscarriages and previous pregnancies among

MCH Hospital clients (Table 1). It is also important to note that the results of PCR and nucleic acid hybridization tests for *C. trachomatis* were consistent ($\kappa = 0.85$, $p < 0.001$) but the agreement between culture and PCR was less clear for *N. gonorrhoeae* ($\kappa = 0.33$, $p < 0.001$). The yield for *N. gonorrhoeae* was about twice in this study (Table 2). PCR should serve as the gold standard for the identification of this organism. This low yield could be because of long term storage resulting in degradation of the materials stored for more than two years or from improper shipment. Nevertheless, as PCR is the gold standard with high sensitivity and specificity, it may be that the two inconsistent positive cultures represent false positives.

Several other surveillance studies (Family Health International, 2001, Ministry of Health, 2001) were undertaken in 2001 and it is valuable to consider our results in their context. A study of community groups believed to be at increased risk for STI, including HIV, revealed that "service women", 60% of whom sold sexual services, had a high prevalence of gonococcal and chlamydial cervicitis, with nearly 40% having *N. gonorrhoeae* and/or *C. trachomatis*. Amongst truckers, acknowledged to be potential clients of the service women, gonorrhoea and chlamydia were identified in about 4%, probably reflecting earlier treatment than in infected women resulting from the earlier recognition of male urethritis signs and symptoms.

These findings in high risk women are confirmed by a smaller study of 108 women admitting selling sex in Vientiane which looked at the same LGTI as our study, and apart from *N. gonorrhoeae* and *C. trachomatis*, had similar magnitudes of prevalence. Fifty-eight percent, had either gonorrhoea or chlamydial infection, or both.

A study of LGTI in some 1,125 gynecology outpatients at one of the two sites of our study also revealed similar LGTI findings, similar chlamydial cervicitis at 4.1%, but with 3.7% gonococcal cervical infection. The only study to include HIV testing was that of service women and truckers. In spite of the remarkably high cervicitis infection rate, HIV infection was uncommon, with only three women (0.33%) found to

be HIV positive, all of whom were in Vientiane.

Data from service women admitting selling sex, self presenting gynecological patients and our own ANC study, noted clinical evidence of ulceration and genital warts (Loue *et al*, 1998; Family Health International, 2001); clinically diagnosed genital herpes was more common in service women at 13% compared to 1.3 and 2.4%, respectively. Clinical evidence of genital warts were also more common in the service women at 3.7%, compared to 0.3 and 0.6%.

These data indicate that STI are common in the target groups and that although HIV has entered Lao PDR, it is uncommon and confined to women selling sexual services. It is interesting to note that the other STI transmitted by bodily fluids, such as blood and semen, are uncommon in all the community groups. The low rates of STI and absence of HIV in our antenatal study suggests that identifying and making preventative and treatment efforts concentrated on those selling sex in Lao PDR may be effective in avoiding an HIV epidemic and a case can be made for periodic presumptive treatment of those identified as being at increased risk by reason of their sexual behavior.

It is interesting to speculate on why very high rates of chlamydia and/or gonococcal cervicitis in the service women has not yet lead to a significant prevalence in the surrogate community group of pregnant women. Although the occupations of the husbands in our study group are similar to those of the reported clients of service women, it may be that our study group, 76% of which were in the first or second pregnancy, had younger husbands less likely to wish or be able to afford the services of sex workers.

In conclusion, we document a substantial prevalence of lower genital tract infections among antenatal care subjects attending two free-access antenatal clinics at referral hospitals in Lao PDR. Prevalence data and clinical findings from this study when compared with other surveillance studies performed around the same time period indicate that targeted prevention and control of STI and HIV efforts are appropriate and indeed essential in Lao PDR in order to avoid a major epidemic within the community.

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