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# Reproductive tract infections: prevalence and risk factors in rural Bangladesh

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**Objective** To determine the prevalence of and risk factors for reproductive tract infections among men and women in a rural community in Bangladesh.

**Methods** In the Matlab area a systematic sample of married non-pregnant women aged 15–50 years was drawn from a comprehensive household registration system for married women. A systematic sample of married and unmarried men in the same age group was drawn from a census-derived demographic surveillance list. Private interviews were conducted with 804 women in a clinic, and cervical, vaginal, urinary and serological samples were collected. Urine and blood specimens were obtained from 969 men who were interviewed at home.

**Findings** The prevalence of bacterial and viral reproductive tract infections was low to moderate. For example, fewer than 1% of the women had a cervical infection. No cases of human immunodeficiency virus (HIV) infection were found. However, among men there was a high level of reported risk behaviour and a low level of protection against infection.

**Conclusion** A low prevalence of reproductive tract infections, coupled with a high level of reported risk behaviour, indicated a need for primary programmes that would prevent an increase in the incidence of reproductive tract infections, sexually transmitted infections and HIV infection.

**Keywords** Genital diseases, Female/epidemiology; Genital diseases, Male/epidemiology; Sexually transmitted diseases/epidemiology; HIV infections/epidemiology; Risk factors; Sex behavior; Marital status; Cross-sectional studies; Bangladesh (*source: MeSH, NLM*).

**Mots clés** Gynécologique, Maladie/épidémiologie; Appareil génital masculin, Maladies/épidémiologie; Maladies sexuellement transmissibles/épidémiologie; HIV, Infection/épidémiologie; Facteur risque; Comportement sexuel; Situation matrimoniale; Etude section efficace; Bangladesh (*source: MeSH, INSERM*).

**Palabras clave** Enfermedades de los genitales femeninos/epidemiología; Enfermedades de los genitales masculinos/epidemiología; Enfermedades sexualmente transmisibles/epidemiología; Factores de riesgo; Infecciones por VIH/epidemiología; Conducta sexual; Estado civil; Estudios transversales; Bangladesh (*fuentes: DeCS, BIREME*).

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Voir page 187 le résumé en français. En la página 187 figura un resumen en español.

## Introduction

The control of reproductive tract infections (RTIs), especially sexually transmitted infections (STIs), is an urgent health priority in many countries (1–4). Policy-makers should be able to set health sector priorities in accordance with the disease burden, the availability and estimated cost-effectiveness of technical solutions, and other variables (5). However, this is often difficult because of a paucity of epidemiological data and the absence of a functional surveillance system for such infections, other than infection with human immunodeficiency virus (HIV).

A recent review (6) of cross-sectional studies of RTI prevalence in general population samples found only five

surveys from south Asia, including the present one, which included laboratory results. One of these surveys considered only the prevalence of vaginal infections. Four studies in India relied entirely on clinical diagnosis to define the presence of infection, notwithstanding the lack of correlation between clinical and laboratory results (6). Global burden of disease calculations for these infections have been based on a restricted number of survey results from facility-based or convenience-based samples. There were no studies from Bangladesh and only one population-based survey from India was available (7).

We therefore conducted a population-based survey of RTI/STI prevalence in a rural area of Bangladesh to determine the risk factors for RTIs.

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## Materials and methods

### Study site and population

The study was undertaken in the Matlab area of Bangladesh. Demographic surveillance and field trials have been conducted in this area by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) since the 1960s. The Matlab field research station was set up to learn about the epidemiology of common diseases (8) and to test the efficacy or impact of proposed interventions before their implementation nationally. We have previously reported the results of testing syndromic management for STI control in this area (9).

Matlab, which is situated 60 km south-east of Dhaka, has a population of 210 000 people in 142 villages and is included in ICDDR,B's demographic surveillance system (DSS), which records all marriages, births, deaths, inward and outward migration, and internal movements. The area is subdivided into an intervention area where a maternal, child health and family planning programme carries out intervention studies, and a comparison area where all health services are provided by the government system. A record-keeping system (RKS) is employed to gather information on reproductive status and morbidity episodes among married women aged 15–50 years and on morbidity among children aged 0–4 years in the intervention area; it is updated monthly through household visits in the intervention area.

### Sampling strategy

This study was conducted in the intervention area by using DSS and RKS computerized population lists as the basis for sampling frames. Sample sizes were based on the expected prevalence of selected RTIs as found in previous surveys in Bangladesh (10, 11). For cultural and ethical reasons it was not felt appropriate to include unmarried women and girls in a survey of RTI/STI prevalence. A systematic sample of married non-pregnant women aged 15–50 years was therefore drawn from the RKS registered population in August 1995. Since there were no restrictions on the inclusion of men, the census-derived DSS list was used as the sampling frame for the selection of a systematic sample of men of the same age.

Approval for the study was obtained from the ICDDR,B ethical review committee. The participants were informed that they would be tested for RTIs and STIs and that they would be offered free treatment if found to be infected. Informed consent was obtained in all cases. HIV testing was carried out in accordance with the principles of unlinked anonymous testing, a well-recognized method for obtaining an unbiased assessment of the prevalence of HIV infection in a population (12–14).

### Survey of women

Before being recruited the purpose of the study was explained to eligible women in their homes and to close family members, e.g. husbands, mothers-in-law. Each woman who agreed to participate attended an ICDDR,B clinic and was interviewed in private about her sociodemographic and reproductive history, current and past clinical symptoms affecting the reproductive tract, treatment-seeking history, and sexual behaviour. A physician conducted a comprehensive physical examination that included a speculum-based examination of the cervix and vagina. Samples were taken for laboratory diagnosis of vaginal and cervical infections: a high vaginal swab for bacterial

vaginosis and *Candida* spp., a posterior fornix swab for *Trichomonas vaginalis*, and an endocervical swab from a cleaned cervix for *Neisseria gonorrhoeae* culture. A cervical smear was taken and fixed for cytological analysis and a urine sample was collected for the diagnosis of *Chlamydia trachomatis*. A blood sample was obtained for the diagnosis of syphilis and viral STIs.

All women with symptoms and signs of reproductive tract infection were treated immediately in accordance with syndromic management flow charts. Women were contacted individually if the laboratory analyses indicated a need for any modifications to treatment.

### Survey of men

Eligible men were recruited to the population-based survey by interviewers who visited them at home. The purpose of the study was explained to them and to interested family members, friends, and neighbours. As far as possible the interviews were conducted in private, with the matters discussed being similar to those raised in the women's interviews. A first-void urine specimen and a blood sample were collected from each man for the detection of the same pathogens that were investigated for women. After laboratory analysis, men found to be infected with either *C. trachomatis* or syphilis were asked to attend male sexual health clinics for treatment (15). Infected men who did not attend within two weeks were visited by a male health assistant from the primary care service and treatment was given at home.

### Laboratory methods

Vaginal wet mounts were immediately examined for evidence of candidiasis (fungal hyphae or budding yeasts). Bacterial vaginosis was diagnosed on the basis of Amsel's criteria (16). Trichomoniasis was considered to be present if microscopic examination revealed trichomads during five days of culture of vaginal fluid in commercial *Trichomonas* culture kits (Medical Wire and Equipment Company, Corsham, Wiltshire, England). Cervical specimens were incubated at 36–37 °C on modified Thayer-Martin medium in 5% carbon dioxide for 48 hours and *N. gonorrhoeae* was identified on the basis of colonial morphology, Gram stain, oxidase tests and carbohydrate fermentation reactions. The Amplicor PCR assay (Roche Diagnostic Systems, Branchburg, NJ, USA) was used for diagnosis of *C. trachomatis* in urine specimens. A positive rapid plasma reagin test (Humana, Taunustein, Germany) and *Treponema pallidum* haemagglutination assay (Murex Diagnostics, Dartford, England) were assumed to indicate recent or untreated syphilis. Screening for evidence of cytological abnormalities was conducted at Dhaka Medical College on 482 randomly selected cervical slides. The positive slides and a selection of the negative ones were re-read at King's College, London.

Samples collected from men at home were transported to the central laboratory on the day of collection for initial screening tests. Frozen urine specimens from men and women were transported to Winnipeg, Canada, for polymerase chain reaction (PCR) assay. Because of a newly discovered lack of specificity in the assay it was not possible to test for infection with gonorrhoea, but testing for *C. trachomatis* was performed.

Resource limitations precluded testing all serum samples for every pathogen. In Dhaka a randomly selected subset was screened for HIV by means of ICE HIV-1.O.2 (Murex

Diagnostics, Dartford, England). Samples that were positive by enzyme-linked immunosorbent assay (ELISA) were confirmed by Western blot (Murex Diagnostics, Dartford, England). HSV-2 antibody was detected by the United Kingdom Public Health Laboratory Service, using a validated monoclonal blocking enzyme immunoassay with a sensitivity of 96% and a specificity of 91% relative to Western blot (17).

### Statistical methods

Data were double-entered using FoxPro and were validated by means of Epi-Info. The prevalences of infection (and 95% exact binomial confidence intervals) were calculated using the confirmed laboratory results. There was a possibility that the prevalence of treatable STIs in men would be underestimated because a substantial proportion of men who were out-migrants were not interviewed and because of missing laboratory results on gonorrhoea. A maximum population prevalence was estimated on the basis of data from a concurrent survey of STI in an urban slum area of Bangladesh (18): 10.4% of the 530 men tested in this survey had a current STI (9.3% with syphilis, 0.2% with chlamydial infection and 1.5% with gonorrhoea). Our estimated maximum was based on an assumed prevalence of 1.5% for gonorrhoea among men who were not migrants and a prevalence of 10% for any treatable STI among migrants.

Risk factors for all infections were examined individually using cross-tabulations and Fisher's exact test with the aid of Stata 6 software. Sociodemographic risk factors were examined in relation to STIs for both men and women. Because no women reported non-marital partners, sexual behaviour was examined only for men. Characteristics of husbands were also examined as risk factors for women. Because of the low prevalence of STIs, only bivariate analysis was undertaken to seek associations with the presence of these infections. Sociodemographic and hygiene-related factors were examined as risk factors for endogenous infections (bacterial vaginosis and candidiasis) in women. Adjustment for possible confounding involved fitting a logistic regression model by means of Stata 6 software. All factors associated with endogenous infections ( $P < 0.1$ ) in the bivariate analysis were included in the model. Each factor not contributing significantly to the model ( $P > 0.05$ ) was removed.

## Results

### Participation

At the time of sample selection there were 17 820 married women of reproductive age on the RKS list and 25 650 married and unmarried men on the DSS census list. Systematic samples were drawn from the RKS and DSS lists, with 1216 women and 1618 men selected as eligible for interview. The participation rates were 66.1% (804/1216) for eligible women (Table 1) and 59.9% (969/1618) for eligible men (Table 2). Whereas 18.4% of women declined to participate, the corresponding proportion for men was only 2.3%. Men who were eligible to participate but did not do so were either repeatedly absent from their homes (23.7%; 383/1618 absent during three separate visits) or had migrated out of the area (9.5%; 153/1618).

Table 1 and Table 2 show the sociodemographic characteristics of the participants and the persons eligible for participation relative to those of the entire census and survey lists. The 224 women who declined to participate were more

likely not to be using any form of contraception than the 992 other eligible women (37.5% vs. 25.7%,  $P = 0.004$ ). The 153 out-migrant men were younger, less well educated and more likely never to have married than the 1465 other eligible men (26.4 years vs. 31.5 years,  $P < 0.001$ ; mean, 0.9 years of education vs. 3.9 years,  $P < 0.001$ ; 90.2% never married vs. 40.1%,  $P < 0.001$ ).

### Prevalence of infections

The 804 participating women agreed to a full gynaecological examination and specimen collection. Nine men declined to give a fingerprick blood specimen and for 18 others insufficient serum was collected to allow testing. This left 942 blood specimens for testing. Table 3 shows the prevalences of selected reproductive tract infections in the samples of men and married women aged 15–50 years.

Among married women there was a moderate prevalence of endogenous infections: bacterial vaginosis, 5.9% (28/478; 95% confidence interval (CI) = 4.0–8.2); and candidiasis, 6.7% (53/796; 95% CI = 5.1–8.6). The prevalence of STIs was low, 3% of married women having a current infection (including 1% with chlamydial infection or gonorrhoea), and 1% of men having either chlamydial infection or recent/untreated syphilis infection. Using data from the concurrent study in slums (18) we estimated the maximum likely prevalence of any current treatable STI in men in our survey to be 3.5%.

### Predictors and reported risk factors for infection

None of the women reported having either sex before marriage or any other nonmarital sexual relationships during their lifetime. Other sociodemographic variables were therefore examined as possible risk factors for current STIs. Men reported higher levels of nonmarital sexual activity and low levels of condom use (Table 4). An absence of lifetime sexual activity was reported by 253 men, one of whom was found to be infected with active syphilis. The total of participating men (942 for syphilis) was therefore used as the denominator for STI prevalence, but risk factor analysis was restricted to the 716 men who reported any sexual activity.

Among women there was an increased risk of having a current treatable STI if they had been married more than once or if they had a husband engaged in casual work (Table 4). Among men, being in the age group 25–34 years was the only significant risk factor found for having chlamydial infection or syphilis. No other social, demographic or behavioural risk factors were found to be associated with an increased risk of a current STI.

Investigation of the risk factors for the viral STIs was restricted to herpes simplex 2 virus (HSV2), as no cases of HIV infection were found. Women who worked outside the home and those who reported current STI symptoms in their husbands were more likely to be HSV2-positive than others (Table 5). Among men, no reported risk factors were associated with HSV2 infection. We did not examine the risks associated with an abnormal Pap smear, as there were only three women with any type of abnormality, each with a different cytological classification.

Multivariate analysis showed that endogenous infections were more common among women who were Hindu, women who used an intrauterine device as their method of contraception ( $P = 0.026$  for Fisher's exact test comparing intrauterine device vs. none), women interviewed during the dry

Table 1. Demographic characteristics of participant and non-participant women

Demographic characteristic	Total RKS <sup>a</sup> list	Eligible	Participant	Declined	Absent	Out-migrants	Eligible women not seen
<i>n</i>	17 818	1216	804 (66) <sup>b</sup>	224 (18)	77 (6)	46 (4)	65 (5)
Mean age $\pm$ SD (years)	31.5 $\pm$ 7.8	32.4 $\pm$ 8.0	32.7 $\pm$ 7.7	32.0 $\pm$ 8.7	31.4 $\pm$ 8.3	33.0 $\pm$ 8.6	30.3 $\pm$ 8.3
<b>Marital status (% of total)<sup>c</sup></b>							
Single	0		0				
Married	97.4		99.5				
Divorced/widowed	2.6		0.5				
<b>Occupation (% of total)<sup>c</sup></b>							
Housewife	97.7		95.6	98.6	95.7	97.2	100.0
In service	0.9		1.2	1.0	4.3	2.8	0
Other	1.4		2.1	0.4	0	0	0
<b>Education (mean years <math>\pm</math> SD)</b>	2.7 $\pm$ 3.4	2.6 $\pm$ 3.2	2.7 $\pm$ 3.1	2.5 $\pm$ 3.2	2.5 $\pm$ 3.7	2.9 $\pm$ 3.6	2.7 $\pm$ 3.4
<b>Total pregnancies <math>\pm</math> SD</b>	3.6 $\pm$ 2.3	3.4 $\pm$ 2.3	3.6 $\pm$ 2.2	3.3 $\pm$ 2.4	3.1 $\pm$ 2.7	3.0 $\pm$ 2.8	2.5 $\pm$ 2.4
<b>Contraceptive use (% of total)<sup>d</sup></b>							
None	29.9	27.9	21.4	37.5	40.3	47.8	46.1
OCP	15.5	15.5	16.2	15.2	14.3	13.0	12.3
DMPA	34.4	37.9	43.3	29.0	22.1	23.9	30.8
IUD	1.8	2.1	2.7	0.4	3.9	0	0
Tubectomy	7.6	9.4	11.1	6.5	6.5	10.9	1.5
Condom	2.3	3.8	4.1	3.1	6.5	0	1.5
Other	2.2	1.4	1.1	2.7	0	2.2	1.5

<sup>a</sup> Record-keeping system (RKS) for all married women.

<sup>b</sup> Figures in parentheses are percentages of the number of eligible women.

<sup>c</sup> Data not available for all categories.

<sup>d</sup> OCP = oral contraceptive pill; DMPA = depot medroxyprogesterone acetate; IUD = intrauterine device.

Table 2. Demographic characteristics of participant and non-participant men

Demographic characteristic	Total DSS <sup>a</sup> list	Eligible	Participant	Declined	Absent	Out-migrants	Eligible men not seen
<i>n</i>	25 650	1618	969 (60) <sup>b</sup>	37 (2)	383 (24)	153 (9)	76 (5)
Mean age $\pm$ SD (years)	29.2	31.4 $\pm$ 9.7	30.8 $\pm$ 9.5	35.1 $\pm$ 9.2	32.4 $\pm$ 9.3	26.4 $\pm$ 8.1	42.6 $\pm$ 10.0
<b>Marital status (% of total)</b>							
Single	46.8	40.1	42	29.7	41.3	90.2	52.6
Married	52.8	59.8	57.5	70.3	58.5	9.8	46.1
Divorced/widowed	0.5	0.2	0.5	0	0.3	0	1.3
<b>Education (mean years <math>\pm</math> SD)</b>		3.9 $\pm$ 4.3	5.1 $\pm$ 4.3	3.0 $\pm$ 4.4	2.6 $\pm$ 4.0	0.9 $\pm$ 2.6	0.8 $\pm$ 1.9

<sup>a</sup> All men in the demographic surveillance system.

<sup>b</sup> Figures in parentheses are percentages of the number of eligible men.

cold season, and women examined less than 11 days after their last menstrual period than among other women (Table 5). There was no association between reported hygiene behaviours (type and frequency of changing sanitary protection, vaginal douching after sex or during menstruation) and the risk of having an endogenous vaginal infection.

## Discussion

The cross-sectional survey, with laboratory diagnosis to define the presence of RTIs, provided unique information on the

burden of biomedically defined disease in the community. The use of an established demographic surveillance system and a comprehensive registration system for married women to provide the sampling frames allowed the selection of a representative sample of people and the collection of basic sociodemographic data on non-participants so that possible biases could be assessed. Nevertheless, Matlab was unrepresentative of rural Bangladesh with respect to the quality and coverage of the maternal, child health and family planning services, which were high in this area. However, there was little evidence that the pre-existing maternal and child health

Table 3. Prevalence of reproductive tract infections among men and married women in the general population of Matlab

	Married women		Population-based men	
	No. +ve/total	% prevalence	No. +ve/total	% prevalence
<i>Neisseria gonorrhoeae</i> <sup>a</sup>	4/804	0.5 (0.14–1.27) <sup>b</sup>	–	–
<i>Chlamydia trachomatis</i>	4/753	0.5 (0.14–1.35)	3/607	0.5 (0.10–1.44)
Recent/untreated syphilis (RPR+ve/TPHA+ve)	6/804	0.7 (0.27–1.62)	5/942	0.5 (0.17–1.23)
<i>Trichomonas vaginalis</i> <sup>a</sup>	5/661	0.8 (0.25–1.76)	–	–
Any current STI ( <i>Chlamydia</i> spp., gonorrhoea, syphilis or <i>Trichomonas</i> spp.)	19/620	3.1 (1.86–4.74)	8/607	1.3 <sup>c</sup> (0.57–2.58)
Herpes simplex virus 2	8/134	6.0 (2.61–11.42)	10/178	5.6 (2.73–10.09)
HIV	0/458	0 (0–0.66)	0/444	0 (0–0.69)
Abnormal cytology <sup>a</sup>	3/482	0.6 (0.13–1.1)	–	–
Bacterial vaginosis <sup>a</sup>	28/478	5.9 (4.0–8.2)	–	–
<i>Candida</i> spp. <sup>a</sup>	53/796	6.7 (5.1–8.6)	–	–

<sup>a</sup> Not available or not applicable for men.

<sup>b</sup> Figures in parentheses are 95% confidence intervals.

<sup>c</sup> Rate for *Chlamydia trachomatis* and syphilis only.

Table 4. Reported sexual activity among sexually active men and married women

Possible risk factor	Sexually active men		Married women	
	<i>n</i>	Mean or %	<i>n</i>	Mean or %
Mean age at first marriage (years)	562	22.5 (16–36) <sup>a</sup>	804	16.5 (9–30)
Mean age at first sexual intercourse (years)	716	21.3 (10–36)		16.6 (10–30)
Sex before marriage	400/716	55.9%	0/804	0%
Sex with more than one partner in lifetime	368 <sup>b</sup> /703	52.3%	49 <sup>c</sup> /804	6.1%
Sex with more than one partner in past year	62/703	8.8%	0/804	0%
Ever purchased sex	127/705	18.0% <sup>d</sup>	NA <sup>e</sup>	
Same-sex relationships	55/716	7.7%	NA	
Current condom use among married men	14/558	2.5%	32/804	4.1%
Condom use (ever) among all men	145/716	20.3%	NA	

<sup>a</sup> Figures in parentheses are the range.

<sup>b</sup> 277 reported 2–4 sexual partners; 68 reported 5–9; and 23 reported 10 or more female sexual partners. Altogether 92/142 single men (65%) reported more than one partner.

<sup>c</sup> These 49 women had been married more than once. No women reported sex outside marriage.

<sup>d</sup> 14.5% of married men and 32% of the unmarried respondents reported payment for sex.

<sup>e</sup> NA = not applicable.

services, focused on women, had a significant impact on the incidence and prevalence of STIs in the absence of fully integrated RTI/STI prevention and care activities, which should include service provision for men. Even the highly effective family planning services in the Matlab area were unlikely to have significantly influenced RTI rates, in view of the low rate of reported condom use. The impact of case management on the prevalence of viral STIs, notably HSV2 and human papilloma virus, was likely to be even smaller, since these infections were not curable. Nonetheless, as with any population-based measurement of prevalence at a particular

time, caution should be exercised in basing broad conclusions on the present findings.

Refusal rates for men were low but there were high numbers of absentees and out-migrants. Bangladesh, like many countries in the developing world, is undergoing rapid urbanization accompanied by high rates of internal migration. Male out-migrants were largely young, poorly educated and single — a typical profile of men migrating to cities in search of work and at comparatively high risk of STI transmission (19, 20).

Similarly to the findings of a previous survey of symptomatic women in the same area (11), almost a fifth

Table 5. Risk factors for reproductive tract infections (RTI) among sexually active men and married women

RTI/ risk factor <sup>a</sup>	Positive/total	% positive	Odds ratio <sup>b</sup>	P-value <sup>c</sup>
<b>Men <i>Chlamydia</i>, syphilis</b>				
<b>Age group (years)<sup>d</sup></b>				
<25	0/217	0	–	0.03
25–34	5/182	2.8		
≥35	3/207	1.4		
<b>Women <i>Chlamydia</i>, gonorrhoea, syphilis or <i>Trichomonas</i></b>				
<b>No. of marriages</b>				
1	15/572	2.6	1	0.03
≥2	4/41	9.8	4.01	
<b>Women, herpes simplex 2 virus</b>				
<b>Husband's occupation</b>				
Regular employment	16/598	3	1	0.03
Casual	2/9	22	3.32	
<b>Occupation</b>				
Housewife	6/124	4.8	1	0.03
Outside home	2/5	40	13.1	
<b>Husband symptomatic</b>				
Yes	6/39	15.4	1	0.01
No	1/69	1.45	12.4	
<b>Women, bacterial vaginosis or candidiasis</b>				
<b>Religion</b>				
Muslim	61/426	14	1	0.007
Hindu	19/68	28	1.92	
<b>Days since LMP<sup>e</sup></b>				
<11	15/47	32	1	0.009
>11 or not menstruating	55/494	11	0.44	
<b>Season</b>				
Cold dry	23/73	32	1	0.001
Hot dry and hot wet	57/421	14	0.37	
<b>Contraception<sup>f</sup></b>				
None	24/123	20	1	0.006
OCP	13/78	17	0.75	
DMPA	24/212	11	0.60	
IUD	6/12	50	4.20	
Condom	2/23	9	0.37	
Tubectomy	11/46	24	1.13	

<sup>a</sup> Data only included if  $P < 0.05$  for overall Fisher's test.

<sup>b</sup> Adjusted for possible confounders for bacterial vaginosis and *Candida* in women.

<sup>c</sup> Overall difference between levels using Fisher's exact test.

<sup>d</sup> Odds ratio could not be calculated because no positives at reference level (youngest age group).

<sup>e</sup> Last menstrual period.

<sup>f</sup> See footnote d, Table 1.

of women in our study declined to participate. This is at the lower end of refusal rates reported in other studies in south Asia involving a gynaecological examination, for which the range was 10% to 81% (6). Those who declined to take part were less likely to be using contraceptives than those who agreed. Potentially, they represented a group of women who declined to use ICDDR,B's services in general. However, we have no evidence to suggest that women not using contraceptive services (with low condom use rates) are more likely to be suffering from RTIs than others.

The restriction of the survey to currently married women represented a potentially more serious bias. No never-married girls or women were included because of ethical constraints. Since 99.9% of women in the area marry at some point in life, and since the rates of lifetime STIs as shown by the seroprevalence of HSV2 and TPHA were low among married women, it was unlikely that a higher level of these infections occurred in younger unmarried girls. The social sanctions against female premarital sex are very strong in Matlab. Higher rates of death from induced abortion and suicide among unmarried women than in married women have been reported

(21) in this area. Many of the deaths were apparently a consequence of the strict control exerted by men over women's reproductive and sexual rights. However, these findings also indicate that female premarital sex does occur in Matlab, and that unmarried girls deserve special attention in order to ensure their rights to safer sex. In many societies, younger girls are at relatively high risk of STI transmission because of biological and social vulnerability (22).

Widowed and divorced women are also excluded from the RKS, although four such women were included in our sample because their civil status changed after the sampling frame was drawn. Census data show that, by the age of 49 years, 1.4% of women were divorced, and 17.3% were widowed. We were unable to examine the prevalence of STIs among these women but noted that reproductive health services in Matlab at the time of the survey were restricted to those who were currently married.

The prevalence of STIs was low in both men and women. It was unlikely that there was a large-scale undiagnosed problem of gonorrhoea among men: its prevalence among women belonging to the same population was low (0.5% for culture-confirmed cases), and a concurrent study of the incidence of ophthalmia neonatorum among 964 neonates revealed only three to be infected. The prevalence of chronic viral infections in this community was also low: fewer than 6% of men and women were infected with HSV2, and no cases of HIV were found among the 902 samples tested. Recent sentinel surveillance in Bangladesh found low levels of HIV infection among most population subgroups (sex workers, sexually transmitted disease patients, truck drivers and men having sex with men) (23) but higher levels (2.5%) among injecting drug users. The possibility that Bangladesh is in the early stages of an HIV epidemic cannot be discounted.

In settings with a high prevalence of HSV2, strong associations between infection and the number of lifetime sex partners have been found, particularly among younger age groups (24–26). In our survey there was no association between age group or reported levels of sexual activity and the prevalence of HSV2 infection. However, caution should be exercised when interpreting these results because of the relatively small sample tested for HSV2 and the lack of information on sexual behaviour from married women.

Men reported high levels of risk behaviour: 18% of sexually active male respondents said that they had exchanged gifts, food or money for sex at some point in their lives. This included 14.5% of married men and 32% of unmarried men. More than 50% of men said they had had sex before marriage, a similar result to that found in an earlier survey in Matlab (27). Almost 8% of sexually active men reported same-sex relationships; this included 13 men who reported sex exclusively with other men. The majority of the men who had sex with both men and women reported that their same-sex relationships had been premarital. No women reported non-marital sex. Such a discrepancy between males and females is not uncommon (28), but it seems extreme in the present instance. Some underreporting by women may have been attributable to their concerns about a lack of confidentiality in a health care system in which workers frequently visited them at home.

The current condom usage rate was only 2.5%. A survey of condom use in a brothel in an urban area of Bangladesh indicated that fewer than 6% of the most recent sexual

episodes had been protected (29). There are estimated to be 100 000 female sex workers in Bangladesh (30), each with an average of three male customers per night (31). High levels of STIs occur; for example, 28% of females were found to be infected with gonorrhoea and/or *Chlamydia trachomatis* in a survey of such workers (32). Furthermore, there are large numbers of male sex workers (33). Consequently, there is a potentially high burden of STI risk through unprotected commercial sex. The low levels of STIs among men in our survey may change if the levels of STIs among sex workers continue to be high and if condom use remains low.

Being married more than once and having husbands in casual employment have been reported as risk factors for STIs in women. Because of the low prevalence of infection, however, these findings should be treated with caution. Moreover, it should not be assumed that the only identified risk factor for STIs in men, namely being aged 25–34 years, is valid outside the Matlab area.

The etiology of endogenous infections remains poorly understood. Factors such as personal hygiene and sexual behaviour, which affect the vaginal environment (34), may be important, as may hormone levels (35, 36). Endogenous infections were found more commonly among Hindu than Muslim women. Whereas 31% of Muslim women changed their sanitary protection more than three times a day, only 15% of Hindu women did so ( $P < 0.001$ ), but the difference in endogenous infection rates between Muslim and Hindu women remained after adjustment was made for the difference in hygiene practices. Religion probably represented other factors that affected rates of endogenous infections that were not measured in our study.

Women interviewed during the dry cold season had a higher prevalence of endogenous infections than those interviewed during the hot dry and hot wet seasons. Women bathed in ponds and possibly changed their bathing practices during the cold season. Endogenous infections were also found more frequently in women examined in the first 10 days after their last menstrual period. These results are consistent with those of a small longitudinal study of patients with bacterial vaginosis (34), in which it appeared that the presence of blood in the vagina and increased levels of estrogen might be risk factors for the condition, while the presence of semen might be protective because of changes in pH. Endogenous infections were significantly more prevalent among women using intrauterine devices than among those using other methods of contraception. The latter observation should be treated with caution since it was based on only 12 users of intrauterine devices; however, other researchers have reported similar findings (16).

Cross-sectional studies of the population-based prevalence of STIs and other RTIs give some indication of the likely burden of disease in the population studied, and highlight associated risk factors. A comprehensive surveillance system can usually deal with the issues of generalizability and trends over time, which are particularly important for programme managers. Nevertheless, we believe that the present study offers important guidelines for future work in this area. Further research is needed on this topic. For example, the paucity of STI prevalence data among men in Bangladesh should be remedied so that programmes can be designed which will respond to the burden of disease in a population that is potentially at greater risk. Similarly, the lack of data on



unmarried girls is serious in connection with the determination of appropriate interventions for this potentially vulnerable group. Recent technological developments, such as non-invasive sampling techniques, e.g. the use of urine samples or self-administered swabs, may increase the acceptability of surveys in these populations.

The finding of relatively low levels of STIs and no HIV gives programme managers in the Matlab area a unique opportunity to prevent a potential epidemic in a low-income, disadvantaged community. However, the high levels of reported sexual activity among men and the low levels of

condom use in the population mean that there is no room for complacency. ■

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## Résumé

### Infections de l'appareil reproducteur : prévalence et facteurs de risque dans une région rurale du Bangladesh

**Objectif** Déterminer la prévalence et les facteurs de risque des infections de l'appareil reproducteur chez les hommes et femmes d'une communauté rurale du Bangladesh.

**Méthodes** Dans la région du Matlab, un échantillon systématique de femmes mariées non enceintes âgées de 15 à 50 ans a été constitué à partir d'un système complet d'enregistrement des ménages et des données sanitaires concernant les femmes mariées. Un échantillon systématique d'hommes mariés ou célibataires de la même tranche d'âge a été établi à partir d'une liste de surveillance démographique obtenue par recensement. Des entretiens individuels ont eu lieu avec 804 femmes dans un dispensaire et des prélèvements cervicaux, vaginaux, urinaires et sérologiques ont été effectués. Des entretiens ont été réalisés et des échantillons de sang et d'urine ont été recueillis chez 969 hommes vus à leur domicile.

**Résultats** La prévalence des infections bactériennes et virales de l'appareil reproducteur était faible à modérée. Par exemple, moins de 1 % des femmes étaient porteuses d'une infection du col de l'utérus. Aucun cas d'infection par le virus de l'immunodéficience humaine (VIH) n'a été trouvé. On a cependant rapporté chez les hommes un niveau élevé de comportement à risque et un faible niveau de protection contre les infections.

**Conclusion** Une faible prévalence des infections de l'appareil reproducteur associée à un taux élevé de comportement à risque montre la nécessité de programmes de prévention primaire destinés à empêcher une augmentation de l'incidence des infections de l'appareil reproducteur, des infections sexuellement transmissibles et de l'infection par le VIH.

## Resumen

### Infecciones del aparato reproductor: prevalencia y factores de riesgo en el Bangladesh rural

**Objetivo** Determinar la prevalencia y los factores de riesgo de infecciones del aparato reproductor entre los hombres y mujeres de una comunidad rural de Bangladesh.

**Métodos** En la zona de Matlab, a partir de un sistema completo de registro de hogares de mujeres casadas se obtuvo una muestra sistemática de mujeres no embarazadas de 15-50 años. Se obtuvo además una muestra sistemática de hombres casados y solteros del mismo grupo de edad tomando como base una lista de vigilancia demográfica elaborada con información censal. Se realizaron entrevistas privadas con 804 mujeres en un dispensario, y se obtuvieron muestras cervicouterinas, vaginales, urinarias y serológicas. Se tomaron también muestras de orina y sangre de 969 hombres a los que se entrevistó en su domicilio.

**Resultados** La prevalencia de infecciones bacterianas y víricas del aparato reproductor era entre moderada y baja. Por ejemplo, menos del 1% de las mujeres presentaban infección del cuello del útero. No se halló ningún caso de infección por el virus de la inmunodeficiencia humana (VIH). Sin embargo, entre los hombres se detectó una alta frecuencia de comportamientos de riesgo declarados y un bajo nivel de protección contra las infecciones.

**Conclusión** La baja prevalencia de infecciones del aparato reproductor, unida al alto nivel de comportamientos de riesgo declarados, muestra la necesidad de establecer programas de atención primaria que prevengan un aumento de la incidencia de infecciones genitales, de infecciones de transmisión sexual y del VIH.

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