Sex Transm Inf 1998;74(Suppl 1):S132–S138

Evaluation of sexually transmitted diseases diagnostic algorithms among family planning clients in Dar es Salaam, Tanzania

S H Kapiga, B Vuylsteke, E F Lyamuya, G Dallabetta, M Laga

Objectives: To determine the prevalence of sexually transmitted diseases (STDs) and to assess the validity of STD screening approaches among family planning clients in Dar es Salaam, Tanzania.
Methods: Between March and September 1995, information about sociodemographic characteristics, contraceptive use, sexual behaviour, and medical history was obtained from consenting women (n=908). After interview, blood and genital specimens were collected for diagnosis of STDs and HIV. Based on the information obtained at interview and clinical examination, STD diagnostic algorithms were developed and validated.
Results: The prevalence of STDs was HIV (16.9%), gonococcal and/or chlamydial cervicitis (8.2%), and *Trichomonas vaginalis* and/or *Candida albicans* (27.2%). The risk of cervicitis was increased among unmarried women and among women with a husband ≤25 years of age and women having more than one sex partners in the past 3 months or a new sex partner during the past month. Most women with cervicitis (62.2%) and vaginitis (67.6%) were asymptomatic. A screening strategy for cervicitis based on symptoms had a sensitivity of 29.7%, a specificity of 84.1%, and a positive predictive value (PPV) of 15.9%. The corresponding figures for an algorithm based on clinical signs were 20.3%, 90.2%, and 15.6%. The sensitivity of a simple risk assessment algorithm ranged from 20.3% to 73%. An approach based on both risk assessment (risk score ≥1) and clinical signs (cervical mucopus and friability) had a sensitivity of 37.8%, a specificity of 87.5%, and a PPV of 21.4%. A syndromic approach for vaginitis resulted in a higher sensitivity than the approach based on the type of vaginal discharge.
Conclusion: Although there is no single screening strategy for cervicitis which can be advocated for large scale application, risk assessment might be the only cost effective strategy for identifying women with cervicitis in family planning clinics in Tanzania.
(*Sex Transm Inf* 1998;74(Suppl 1):S132–S138)

Keywords: STDs; women; screening; algorithms; family planning; Tanzania

Introduction

Sexually transmitted diseases (STDs) are highly prevalent in many developing countries. Although untreated STDs are associated with serious complications in both men and women, most severe complications such as pelvic inflammatory diseases (PID), ectopic pregnancy, and infertility are experienced by women.[1–3] In addition, bacterial STDs are known to facilitate heterosexual transmission of HIV.[4,5] Tanzania is experiencing a rapidly spreading HIV epidemic, with over one million people estimated to be infected with HIV.[6]

STD case management has been recognised as an essential component of interventions aimed at reducing further spread of HIV. In a community based study in Mwanza, Tanzania,[7] improved case management of STDs was associated with a 42% reduction of HIV incidence. However, STD case management in women is associated with a number of problems. Compared with men, women with STDs are more likely to be asymptomatic, and therefore do not seek medical care. Even when women are symptomatic and perceive their symptoms as a problem, traditional STD services may be inaccessible and/or stigmatising. Hence, integration of STD services into maternal and child health/family planning services may be a logical choice since maternal and child health/family planning clinics are often women's primary contact with the healthcare delivery system.

A standardised and feasible approach for STD screening or case finding in maternal and child health/family planning clinics is lacking. Identification of aetiological agents of various STDs requires sophisticated laboratory tests, which are not readily available in most developing countries. In addition, a simple screening test for the detection of gonococcal and chlamydial infections does not currently exist. Moreover, because many women with STDs are asymptomatic, screening methods based on symptoms and clinical signs tend to miss the majority of infected women. Some studies, however, have shown that risk factors rather than clinical signs are predictive of gonococcal and chlamydial cervicitis.[8] As a result, the World Health Organisation (WHO) has proposed diagnostic flow charts based on risk assessment for case management of symptomatic women.[9] However, it is not known whether these approaches are suitable for screening STDs in low risk populations such as maternal and child health/family planning

Departments of Epidemiology/ Biostatistics and Microbiology/ Immunology, Muhimbili University College of Health Sciences, Dar es Salaam, Tanzania
S H Kapiga
E F Lyamuya

Institute of Tropical Medicine, Antwerp, Belgium
B Vuylsteke
M Laga

FHI/AIDSCAP, Arlington, USA
G Dallabetta

Correspondence to:
Dr Saidi H Kapiga, Harvard School of Public Health, 665 Huntington Avenue, Building 1-1111, Boston, MA 02115, USA.

attenders. Although evaluation of screening strategies in antenatal clinics has been done in some developing countries,[10 11] there are limited data from family planning clinic attenders.

The objectives of this study were to determine the prevalence of STDs among family planning clinic attenders in Dar es Salaam and to assess the validity of various STD screening strategies in this population.

Methodology

STUDY DESIGN

Between March and September 1995, we conducted a cross sectional study at three family planning clinics (Ilala, Temeke, and Mwananyamala) in Dar es Salaam, Tanzania. We approached all new clients and consecutive regular contraceptive users so that about 12 women were enrolled each day. Women reported to be menstruating were excluded from participating in the study. All eligible women were requested to participate in the study after receiving a brief description of the purpose and procedures of the study. Consenting women were interviewed in a private room by trained nurses to obtain information about sociodemographic characteristics, obstetric history, contraceptive practice, sexual behaviour, and detailed medical history. After the interview, pretest counselling was done before blood was taken for syphilis and HIV testing. Later a gynaecological examination, including speculum examination, was performed by a physician, and vaginal and endocervical specimens were collected for laboratory diagnosis of STDs. All women were requested to come back to the clinic after one week for STD results and post-test counselling. During the counselling sessions, individual results were given and strategies for prevention of STDs were discussed. Women with STDs received free treatment and were encouraged to bring their partners for STD counselling and testing.

LABORATORY METHODS

At the study clinics, a leucocyte esterase dipstick (LED: Nephur test; Boehringer Mannheim, Mannheim, Germany) was read for colour change after immersion in midstream urine. Vaginal fluid was collected and a wet mount was prepared and examined microscopically by an experienced technician for the presence of motile *Trichomonas vaginalis* organisms. Swabs from the posterior fornix and endocervix were collected and placed in transport media for processing in the microbiology and immunology laboratory at Muhimbili University College of Health Sciences. Direct microscopy was done on a Gram stained vaginal smear for the detection of *Candida* species, *T vaginalis*, and leucocytes. Isolation of *Neisseria gonorrhoeae* was done by inoculation of the specimens on modified Thayer–Martin medium followed by incubation in a candle extinction jar at 35°C for 24–48 hours. Isolates were identified on the basis of typical colonial morphology, visualisation of Gram negative intracellular diplococci, and positive oxidase reaction and sugar fermentation tests. Endocervical swabs for detection of *C trachomatis* antigen were collected and placed in the transport medium supplied by the manufacturer for processing at the African Medical Research Foundation (AMREF) laboratory. *C trachomatis* antigens were detected using an antigen detection enzyme immunoassay (IDEIA Chlamydia, Dako Diagnostics Ltd, Cambridgeshire). Positive samples were confirmed by a blocking assay from the same manufacturer. Syphilis antibodies were detected using a Venereal Disease Research Laboratory test (VDRL, Murex Diagnostics, Dartford). HIV-1 infection was diagnosed by enzyme linked immunosorbent assay (ELISA, Wellcozyme Recombinant HIV-1, Wellcome Diagnostics, Research Triangle Park, NC, USA) and confirmed by western blot (Dupont de Nemours, Wilmington, DE, USA). Cervicitis was defined as the presence of *N gonorrhoeae* and/or *C trachomatis* antigen. Vaginitis was defined as presence of *T vaginalis* and/or *C albicans*.

VALIDATION OF DIAGNOSTIC STRATEGIES

Different diagnostic strategies were applied to the study population in a simulation based on personal data from the interview and physical examination. The results of this simulation were compared with the results obtained from laboratory tests to determine the validity of algorithms in the study population. For each algorithm, we used the laboratory test results as a "gold standard" to determine the proportion of diagnoses identified by the strategy (sensitivity), the proportion of true non-infected cases identified by the strategy (specificity), and the proportion of truly infected women among women considered positive by the diagnostic strategy (positive predictive value, PPV). The proportion of women treated was obtained from the number of women considered positive by the algorithms. After the validity of some clinical algorithms, including guidelines recommended by the WHO (figs 1 and 2) had been determined, alternative score driven methods were constructed (see below) and validated using the same method.

STATISTICAL ANALYSIS AND DEVELOPMENT OF SCORES

Data were analysed using SPSS/PC statistical software.[12] We summarised the association between cervicitis and vaginitis (dependent variable) with sociodemographic characteristics, symptoms and signs suggestive of STDs, and simple laboratory tests (independent variables) with odds ratios and 95% confidence limits. To adjust for multiple risk factors simultaneously, multivariate analysis was done by using a logistic regression model. We included variables in the model if they were associated with cervicitis in the univariate analyses. Age was included in the model because of its strong association with cervicitis in other studies.[13] All variables found to be associated with gonococcal and chlamydial infection in the logistic

Table 1 Prevalence of STDs among women attending family planning clinics in Dar es Salaam, Tanzania, 1995 (n=897)

Finding	No	(%)
N gonorrhoeae	14	(1.6)
C trachomatis	60	(6.7)
N gonorrhoeae and/or *C trachomatis*	74	(8.2)
T vaginalis	194	(21.6)
C albicans	67	(7.5)
T vaginalis and/or *C albicans*	244	(27.2)
Syphilis antibodies*	35	(3.9)
Antibody to HIV	152	(16.9)

* VDRL positive.

model were used to develop a non-hierarchical quantitative decision system based on scores. The scores were constructed by using the adjusted odds ratio obtained from the logistic regression model and rounded up to the nearest whole number. For each woman, the total score was the sum of points for each factor or symptom present. The score based algorithm was later applied to the study population using different cut off points and compared with the laboratory results to determine its validity. The validity of the score based algorithm was compared with the clinical algorithms described above.

Results

Out of 960 women approached, 908 (94.6%) agreed to participate in the study. Eleven women had substantial missing data and were excluded from the analyses. The age of the

Table 2 Predictors of cervicitis and vaginitis among women attending family planning clinics in Dar es Salaam, Tanzania, 1995 (n=897)

		Cervicitis		Vaginitis	
	No	% positive	OR (95% CI)*	% positive	OR (95% CI)*
Sociodemographic characteristics:					
Age (years)					
16–20	126	11.1	1.66 (0.76–3.61)	35.7	1.67 (1.03–2.71)
21–25	312	8.3	1.21 (0.61–2.37)	27.9	1.16 (0.77–1.74)
26–30	259	7.7	1.11 (0.55–2.26)	23.9	0.94 (0.61–1.45)
31+	200	7.0	1.00	25.0	1.00
Marital status					
Married (mono/polygamous)	671	6.7	1.00	23.8	1.00
Cohabiting	173	11.6	1.77 (1.01–3.10)	39.3	2.00 (1.40–2.86)
Single/separated/divorced	53	17.0	2.81 (1.28–6.15)	30.2	1.33 (0.72–2.47)
Education					
No education	72	12.5	2.37 (0.68–8.33)	38.9	2.53 (1.16–5.51)
Primary education (1–4 years)	73	6.8	1.23 (0.31–4.87)	27.4	1.49 (0.67–3.32)
Primary education (5–7 years)	689	8.1	1.35 (0.47–3.87)	26.4	1.31 (0.71–2.45)
Secondary education	63	6.3	1.00	22.2	1.00
Husband's age (years)†					
18–25	93	15.1	3.25 (1.25–8.43)	31.2	1.05 (0.56–1.95)
26–30	206	6.8	1.35 (0.56–3.25)	31.6	1.21 (0.75–1.96)
31–35	210	9.0	1.79 (0.84–3.82)	21.9	0.79 (0.50–1.25)
36+	292	5.5	1.00	25.3	1.00
Don't know	43	4.7	0.88 (0.19–4.12)	32.6	1.29 (0.56–2.37)
Husband's education†					
No education	51	7.8	1.00	37.3	1.00
Primary education (1–7 years)	602	7.8	0.92 (0.31–2.69)	27.2	0.58 (0.32–1.07)
Secondary and above	191	7.3	0.84 (0.26–2.72)	23.6	0.47 (0.24–0.92)
Occupation					
Housework	532	6.8	1.00	26.5	1.00
Hotel worker	14	7.1	1.14 (0.15–9.06)	28.6	1.21 (0.37–3.94)
Small scale trader	291	9.6	1.59 (0.94–2.71)	27.5	1.13 (0.81–1.57)
Others	60	15.0	2.56 (1.16–5.65)	31.7	1.35 (0.75–2.41)
Contraceptive methods used at recruitment					
None	236	7.2	1.00	27.1	1.00
OCs	197	7.1	1.03 (0.49–2.15)	33.0	1.39 (0.91–2.11)
Injectables	402	9.2	1.45 (0.78–2.69)	24.9	0.96 (0.66–1.40)
IUD	59	10.2	1.66 (0.61–4.48)	25.4	1.03 (0.53–2.00)
Sexual behaviour:					
Had >1 sex partner past 3 months	96	15.6	2.43 (1.31–4.50)	32.3	1.37 (0.86–2.16)
Had extramarital sex past 3 months†	70	11.4	1.75 (0.79–3.88)	32.9	1.45 (0.85–2.46)
Had new sex partner past month	38	31.6	6.01 (2.87–12.58)	39.5	1.76 (0.90–3.45)
Used condom during last sex	55	9.1	1.09 (0.42–2.83)	21.8	0.71 (0.37–1.33)
Symptoms and signs suggestive of STD:					
Ever had abnormal vag discharge	116	15.5	2.42 (1.36–4.29)	31.9	1.33 (0.87–2.03)
Ever had genital ulcer	42	9.5	1.14 (0.39–3.32)	40.5	1.84 (0.97–3.49)
Had the following symptoms at interview					
(a) Lower abdominal pain	216	7.9	0.93 (0.53–1.64)	33.3	1.45 (1.04–2.02)
(b) Dysuria	77	15.6	2.33 (1.19–4.56)	42.9	2.23 (1.38–3.61)
(c) Dyspareunia	102	6.9	0.81 (0.36–1.18)	32.4	1.33 (0.85–2.09)
(d) Genital irritation	137	11.7	1.68 (0.93–3.02)	40.1	2.07 (1.41–3.03)
(e) Abnormal vaginal discharge	87	17.2	2.73 (1.47–5.08)	33.3	1.41 (0.88–2.27)
(f) Abnormal genital smell	56	12.5	1.67 (0.73–3.85)	30.4	1.18 (0.68–2.13)
Had the following signs at examination					
(a) Abnormal vulval discharge	33	12.1	1.55 (0.53–4.56)	57.6	3.94 (1.93–8.04)
(b) Purulent vaginal discharge	51	9.8	1.23 (0.47–3.21)	52.9	3.36 (1.89–5.99)
(c) Cervical ectropion	99	11.1	1.43 (0.73–2.82)	30.3	1.17 (0.74–1.84)
(d) Cervical mucopurulent discharge	69	17.4	2.65 (1.34–5.24)	53.6	3.57 (2.15–5.91)
(e) Cervical friability	45	17.8	2.54 (1.13–5.69)	46.7	2.44 (1.33–4.47)
(f) Cervical tenderness on movements	47	17.0	2.39 (1.07–5.34)	61.7	4.70 (2.55–8.67)
Results of urine LED test‡					
<10 PMNs/μl	392	8.1	1.00	23.0	1.00
~25 PMNs/μl	312	6.1	0.68 (0.38–1.66)	21.5	0.92 (0.64–1.31)
~75 PMNs/μl	112	10.7	1.26 (0.63–2.53)	37.5	2.01 (1.28–3.17)
~500 PMNs/μl	81	11.1	1.32 (0.60–2.87)	55.6	4.19 (2.50–7.04)

* Age adjusted odds ratio.
† This information was collected from women who were married or cohabiting.
‡ Polymorphonuclear cells/μl of urine.

Table 3 Validity of selected clinical diagnostic algorithms for cervicitis, family planning clients, Dar es Salaam, Tanzania, 1995

Diagnostic strategy	% Of women examined with speculum	% Of women treated	Sensitivity (%)	Specificity (%)	PPV (%)
Treating all women who have symptoms of vaginal discharge and/or dysuria	0	17.1	29.7	84.1	15.9
Examine all women and consider positive if have cervical mucopus and/or friability	100	10.7	20.3	90.2	15.6
WHO algorithms	25	7.4	13.5	93.2	15.1

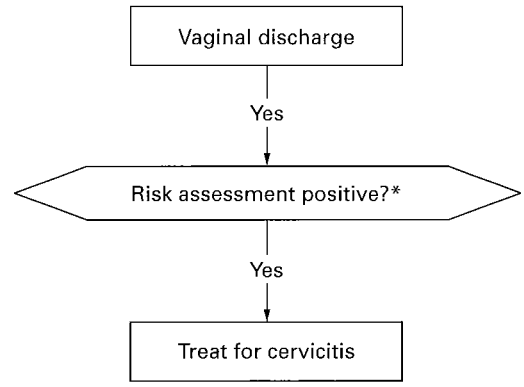

*Figure 1 Vaginal discharge. * Positive = partner symptomatic, or any two of the following: age <21 years; single; >1 partner; new partner in past 3 months.*

women ranged from 16 to 47 years (mean 26.4 years; median 26 years), and about 75% of the women were married. The majority of women (83.8%) reported having completed at least 5–7 years of primary education and 59% gave housework as their main occupation. At the time of interview, 661 (73.7%) women were using contraceptive methods, of which 402/661 (60.8%) were using injectable contraceptives.

PREVALENCE OF STDS AND ASSOCIATED FACTORS

The prevalence of STDs is shown in table 1. *T vaginalis* was the most prevalent STD found in 21.6% of the women, followed by HIV (16.9%). Overall, 74 (8.2%) women had gonococcal or chlamydial cervicitis while 244 (27.2%) had trichomoniasis or candida vaginitis.

In table 2 we show the association between cervicitis and vaginitis with sociodemographic characteristics, sexual behaviour, symptoms, and clinical signs. Prevalence of both cervicitis and vaginitis was highest among women aged 16–20 years. The risk of cervicitis was significantly increased among women reported to be cohabiting (odds ratio (OR) 1.77, 95% CI (1.01–3.10)), single or separated or divorced (OR 2.81 (1.28–6.15)), and women whose husband's age was under 26 years (OR 3.25 (1.25–8.43)). Women who were cohabiting and those with no formal education had a significantly increased risk of vaginitis. Contraceptive use, occupation, and husband's education were not significantly associated with STDs.

About 11% of women reported having more than one sex partner during the past 3 months, while 70 (8.3%) reported having extramarital sexual contact. The risk of cervicitis was significantly increased among women reporting multiple sex partners in the past 3 months and among those reporting a new sex partner during the previous month. However, there was no significant association between reported sexual behaviour and vaginitis. Reported condom use was not associated with either cervicitis or vaginitis.

The majority of women with cervicitis (46/74 (62.2%)) and vaginitis (165/244 (67.6%)) were asymptomatic. Among women with symptoms, lower abdominal pain, genital irritation, and dyspareunia were the most common symptoms. Dysuria and abnormal vaginal discharge were significantly associated with cervicitis; while lower abdominal pain, dysuria, and genital irritation were significantly associated with vaginitis. Abnormal clinical signs during examination were rare in this population. Clinical signs associated with both cervicitis and vaginitis were cervical mucopurulent discharge, cervical friability, and cervical motion tenderness. Abnormal vulval and vaginal discharge was associated with vaginitis. The presence of ≥ 75 leucocytes per μl of urine, as measured by the LED test, was significantly associated with vaginitis. After adjusting for other risk factors and symptoms in multivariate analyses, the following factors were significantly associated with cervicitis: husband's age ≤ 25 years (OR 2.22 (1.09–4.55)), having a new sex partner during the past 3 months (OR 3.80 (1.58–9.12)), and abnormal vaginal discharge symptom (OR 2.00 (1.00–3.97)).

VALIDATION OF DIAGNOSTIC APPROACHES FOR CERVICITIS

In table 3 we present the results of the simulation of clinical algorithms for the diagnosis of cervicitis. The clinical strategy based on symptoms (abnormal vaginal discharge and/or dysuria) alone had a sensitivity of 29.7%, specificity of 84.1%, and a PPV of 15.9%. The corresponding figures for a strategy based on clinical signs (cervical mucopus and/or friability) were 20.3%, 90.2%, and 15.6% respectively. In order to apply this algorithm, a speculum examination is required in all women. The symptoms of vaginal discharge and lower abdominal pain are the entry points of the WHO algorithms (figs 1 and 2). Applying these algorithms for the diagnosis of cervicitis in our study population resulted in a sensitivity of 13.5%, a specificity of 93.2%, and a PPV of 15.1%.

In an attempt to find alternative diagnostic approaches, we developed diagnostic algorithms using a scoring system. Risk factors and symptoms from our final logistic regression model were assigned scores proportional to the strength of the association with cervicitis (see table 4). The total score for each woman was calculated by adding the points for each factor or symptom present. Later, algorithms using different cut off points were validated. By in-

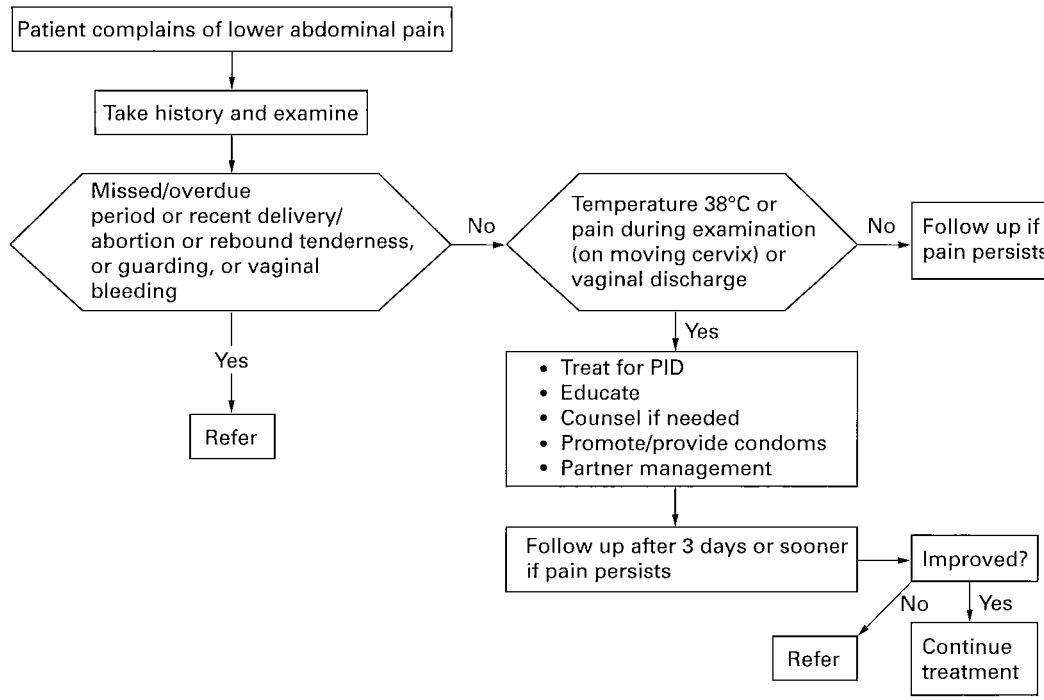

Figure 2 Lower abdominal pain.

Table 4 Variables used in constructing risk assessment scores, family planning clients, Dar es Salaam, Tanzania, 1995

Risk factor	*OR (95% CI) from logistic regression model*	*Scores used in risk assessment diagnostic algorithms*
Respondent's age 16–20 years	1.05 (0.51–2.13)	1
Husband's age 18–25 years	2.22 (1.09–4.55)	2
Cohabiting	1.41 (0.78–2.56)	1
Single/divorced/widow	2.27 (0.97–5.30)	2
Had new sex partner last month	3.80 (1.58–9.12)	4
Had >1 sex partner last 3 months	1.32 (0.63–2.79)	1
Had abnormal vaginal discharge symptom	2.00 (1.00–3.97)	2
Had dysuria	1.74 (0.83–3.65)	2

creasing the cut off point of the score, the sensitivity decreased from 73% (cut off 1) to 20.3% (cut off 5) while the PPV increased from 11.6% to 27.8% (table 5).

Further testing of simulations based on a combined approach was done. Algorithms based on the scoring system shown above and speculum examination findings were used to identify women with cervicitis. Two types of combination flow charts were validated. Firstly, women with a risk score ≥ 1 and cervical mucopus or friability were classified as having cervicitis. This approach had a sensitivity of 17.6%, specificity of 94.4%, and PPV of 22.0% (table 5). In a second approach, women were identified as having cervicitis if they had a risk score ≥ 4, or if they had a risk score of 1–3 with cervical mucopus or friability. This approach had a sensitivity of 37.8%, specificity of 87.5%, and a PPV of 21.4% (table 5). Various other approaches were validated (results not shown), but none of these resulted in a higher sensitivity than those presented in table 5.

DIAGNOSTIC APPROACHES FOR VAGINITIS

The sensitivity and PPV of clinical approaches for the diagnosis of candidiasis and trichomoniasis are presented in table 6. An algorithm based on symptoms or visible vaginal discharge had a sensitivity of 62.7% for candidiasis and 43.3% for trichomoniasis. A diagnostic approach based on white vaginal discharge on examination had a sensitivity of

Table 5 Validity of cervicitis diagnostic algorithms based on risk assessment scores, family planning clients, Dar es Salaam, Tanzania, 1995

Diagnostic strategy	*% Of women examined with speculum*	*% Of women treated*	*Sensitivity (%)*	*Specificity (%)*	*PPV (%)*
Risk score based algorithm					
Consider positive if:					
risk score ≥ 1	0	51.9	73.0	50.0	11.6
risk score ≥ 2	0	34.0	58.1	68.2	14.1
risk score ≥ 3	0	19.1	40.5	82.9	17.5
risk score ≥ 4	0	10.0	29.7	91.7	24.4
risk score ≥ 5	0	6.0	20.3	95.3	27.8
Combined approach:					
Examine if score ≥ 1 and consider positive if cervical mucopus and/or friability present	51.9	6.6	17.6	94.4	22.0
Combined approach:					
If score ≥ 4 consider positive; if score 1–3 examine and consider positive if cervical mucopus and/or friability present	42.0	14.6	37.8	87.5	21.4

Table 6 Sensitivity (S) and positive predictive value (PPV) of diagnostic approaches for vaginitis (candidiasis and trichomoniasis), family planning clients, Dar es Salaam, Tanzania, 1995

	Candidiasis (n=67)		*Trichomoniasis (n=194)*	
Diagnostic strategy	*S (%)*	*PPV (%)*	*S (%)*	*PPV (%)*
Any symptom* or visible abnormal vaginal discharge†	62.7	12.2	43.3	24.4
White vaginal discharge on clinical examination	22.4	34.1	7.7	34.1
Purulent or other vaginal discharge on clinical examination	19.4	11.5	33.0	56.6

* Any of the following symptoms: vaginal irritation, genital discharge, dysuria, or lower abdominal pain.
† Vaginal discharge visible on inspection without speculum examination.

22.4% for candidiasis while that based on purulent or other vaginal discharge had a sensitivity of 33.0% for trichomoniasis. These results were not materially altered when we limited this analysis to symptomatic women (n=328) (data not shown).

Discussion

Our findings indicate that HIV and STDs are a major public health problem in the study population. *T vaginalis* was found to be the most common STD. A striking feature of trichomoniasis is its consistently high prevalence among low risk women in many developing countries.[8 11 14 15] The prevalence of gonorrhoea and chlamydial infections observed in our study was similar to that reported by other studies involving pregnant women.[8 11]

Younger and unmarried women were at highest risk of cervicitis and vaginitis. Similar findings have been reported in both developing countries[8 11] and industrialised countries.[16 17] In the United States, prevalence of gonorrhoea and syphilis among adolescents is three times higher than that of the general population.[15] Increased risk of STDs among young women is related to both sexual behaviour and biological factors.[18] Biological factors that might account for the increased risk of STDs among young women include a large area of cervical ectopy, and trauma on a less mature vaginal epithelium.[19 20]

Although the prevalence of HIV/STD was high in the study population, the majority of women did not report any high risk sexual behaviour. Most women were married and had only one sex partner in the 3 months preceding the survey. Similar findings were observed among family planning clinic clients in Nairobi[21] and Dar es Salaam.[22] In these studies, the risk of STD and HIV among women not reporting high risk sexual behaviour was determined by the sexual behaviour of their male partners. In our study, the risk of cervicitis was significantly increased among women whose husband were less than 26 years of age.

As observed elsewhere,[8 23] more than a half the women with vaginitis and cervicitis were asymptomatic. The lack of symptoms among women with STDs is a major constraint in using syndromic algorithms for the screening of gonococcal and/or chlamydial cervicitis in maternal and child health/family planning attenders.[8 10 11] Owing to the low sensitivity and specificity of syndromic algorithms, only a small proportion of women with STDs can be detected. As a result, WHO flow charts based on the symptoms of vaginal discharge and lower abdominal pain performed poorly in this population. Diagnostic approaches based on clinical signs were less sensitive than those based on symptoms (20.3% *v* 29.7%). Hence, algorithms based on clinical signs alone were not helpful in identifying infected women. In addition, the need for speculum examination on every woman makes screening strategies based on clinical signs unworkable in many settings.

In order to circumvent some of these limitations, alternative flow charts, including risk markers, for gonococcal and chlamydial cervicitis screening have been designed.[8–11] Our non-hierarchical score based approach showed significant improvement in sensitivity (73%). Similar findings were obtained in a score driven system developed among antenatal clinic attenders in Zaire.[8] Owing to low prevalence of gonococcal and/or chlamydial infection in maternal and child health/family planning clinic attenders, the PPV of these new algorithms remained low. Diagnostic approaches with low PPV are associated with relatively large number of false positives resulting in a large number of women receiving unnecessary treatments and a high cost for each STD case treated. In an attempt to improve the PPV without losing too much sensitivity, we developed combined algorithms based on risk scores and clinical examination findings. Our best combined screening flow chart had a sensitivity of 37.8% and a PPV of 21.4%. In Mwanza Tanzania, a flow chart based on risk assessment and clinical examination findings performed less well than a syndromic approach in antenatal clinic attenders.[11]

Because of the serious potential complications resulting from untreated gonococcal and/or chlamydial infections, cervicitis is more important, from a public health point of view, than vaginitis. However, trichomoniasis, bacterial vaginosis, and candidiasis are the major causes of the vaginal discharge complaints.[10 24] Hence, it is important to include treatment of vaginitis in the case management of symptomatic women in family planning clinics. In our study, white vaginal discharge, identified by a physician on speculum examination, was as predictive for candida infection as for trichomoniasis (PPV of 34.1%). In view of these findings, clinical flow charts based on types of vaginal discharge are less desirable for healthcare workers in family planning clinics in Tanzania. In the absence of laboratory facilities, a syndromic approach may be the most ap-

propriate strategy in the management of vaginitis.

As already observed in pregnant women,[8 11] STD control in family planning clients is complicated. Algorithms based on clinical signs and symptoms are associated with low sensitivity and PPV, while those based on risk scores with the lowest cut off point have higher sensitivity but low PPV. Combined flow charts based on scoring system and clinical signs and symptoms show improved specificity and PPV, but low sensitivity which would result in a large number of infected women not receiving treatment. As a result, selecting a screening strategy to be used in family planning clinics in Tanzania will involve a trade off between sensitivity and PPV. The practical implications of these findings is that there is no single approach which can be advocated for large scale application in family planning clinic clients in Tanzania. In the absence of an inexpensive and reliable rapid test for gonorrhoea or chlamydial infection, diagnostic algorithms based on risk assessment remain the best option for detection of women with cervicitis in family planning clinics. To reduce costs associated with low PPV, different strategies can be applied to different groups of family planning clinic clients. For example, algorithms with high sensitivity can be used for screening women making their first family planning clinic visit while those with high PPV can be applied for women making follow up visits.

In conclusion, the high prevalence of STDs in this population is a strong justification for integration of STD control in family planning services. In the absence of laboratory tests, a syndromic approach is probably the best tool to use in the management of vaginitis. Because of the large proportion of women with asymptomatic infections, algorithms based on a syndromic approach had low sensitivity and were therefore less suitable for screening women with cervicitis. Algorithms based on risk assessment showed improved sensitivity, although the PPV remained low. Until a simple, rapid, inexpensive, and valid screening test for gonococcal and chlamydial infection is available, risk assessment might be the only option for identifying women with cervicitis in resource poor settings. Further field testing of the selected approaches to determine feasibility and acceptability is required.

This study was funded by the United States Agency for International Development (USAID) as part of Family Health International's AIDS Control and Prevention (AIDSCAP) Project (contract HRN-5972-C-00-4001-00) and The Rockefeller Foundation. The views presented in this paper do not necessarily reflect the views or policies of USAID or The Rockefeller Foundation. During the data analyses phase, Dr Saidi H Kapiga was supported by a training grant from the Fogarty International Center, National Institutes of Health (D43 TW 00002), to the Harvard AIDS Institute.

We are grateful to Dr P Ochola, Dr D Mtasiwa, and Dr C Hamelmann for their cooperation and support during data collection; C Chuma, A Kavugha, L Rutaguza, C Kagoma, DM Ocheng, and M Kazaura for their participation in data collection, laboratory analyses, and computer data entry; and A Buve, Dr U Larsen, and Dr D Hunter for their valuable comments on an earlier draft of this paper.

1 Wasserheit JN. The significance and scope of reproductive tract infections among Third World women. *Int J Gynaecol Obstet* 1989;**3**:145–68.
2 Cates W, Wasserheit JN. Genital chlamydial infections: epidemiology and reproductive sequelae. *Am J Obstet Gynecol* 1991;**6**:1771–81.
3 Temmerman M. Vulvovaginitis, cervicitis, pelvic inflammatory disease and obstetrical infections. *Curr Opin Infect Dis* 1994;7:20–4.
4 Laga M, Manoka A, Kivuvu M, *et al.* Non-ulcerative sexually transmitted diseases as risk factors for HIV-1 transmission in women: results from a cohort study. *AIDS* 1993;**1**: 95–102.
5 Plourde PJ, Pepin J, Agoki A, *et al.* Human immunodeficiency virus type I seroconversion in women with genital ulcers. *Sex Transm Dis* 1994;**170**:313–7.
6 United Republic of Tanzania, National AIDS Control Programme. HIV/AIDS/STD Surveillance report No 10, December 1995.
7 Grosskurth H, Mosha F, Todd J, *et al.* Impact of improved treatment of sexually transmitted diseases on HIV infection in rural Tanzania: randomised controlled trial. *Lancet* 1995;**346**:530–6.
8 Vuylsteke B, Laga M, Alary M, *et al.* Clinical algorithms for the screening of women for gonococcal and chlamydial infection: evaluation of pregnant women and prostitutes in Zaire. *Clin Infect Dis* 1993;**17**:82–8.
9 World Health Organisation. Recommendations for the management of sexually transmitted diseases. Geneva: WHO/GPA/STD/93.1.
10 Behets F, Williams Y, Brathwaite A, *et al.* Management of vaginal discharge in women treated at a Jamaican sexually transmitted disease clinic: use of diagnostic algorithms versus laboratory testing. *Clin Infect Dis* 1995;**21**:1450–5.
11 Mayaud P, Grosskurth H, Changalucha J, *et al.* Risk assessment and other screening options for gonorrhoea and chlamydial infections in women attending rural Tanzanian antenatal clinics. *Bull World Health Organ* 1995;**5**:621–30.
12 SPSS/PC+Version 5.0. Chicago: SPSS Inc.
13 Arno JN, Katz BP, McBride R, *et al.* Age and clinical immunity to infections with Chlamydia trachomatis. *Sex Transm Dis* 1994;**1**:47–52.
14 Vuylsteke B, Bastos R, Barreto J, *et al.* High prevalence of sexually transmitted diseases in a rural area in Mozambique. *Genitourin Med* 1993;**69**:427–30.
15 Fox LJ, Williamson NE, Cates W, Dallabetta G. Improving reproductive health: integrating STD and contraceptive services. *JAMWA* 1995;**50**:129–36.
16 van Duynhoven YTHP, van de Laar MJW, Fennema JSA, *et al.* Development and evaluation of screening strategies for Chlamydia trachomatis infections in an STD clinic. *Genitourin Med* 1995;**71**:375–81.
17 Thejls H, Rahm V, Gnarpe J, Gnarpe H. Diagnostic efficacy of chlamydial antibodies in cervical secretions from pregnant women and adolescent girls. *Genitourin Med* 1995; **71**:370–4.
18 Vuylsteke B, Sunkutu R, Laga M. Epidemiology of HIV/STI in women. In: Mann J, Tarantola D, eds. *Global AIDS policy coalition. AIDS in the world.* Vol II. London: Oxford University Press, 1996.
19 Brabin L, Kemp J, Obunge OK, *et al.* Reproductive tract infections and abortion among adolescent girls in rural Nigeria. *Lancet* 1994;**344**:300–3.
20 Bulterys M, Chao A, Habimana P, *et al.* Incident HIV-1 infection in a cohort of young women in Butare, Rwanda. *AIDS* 1994;**8**:1585–91.
21 Costello Daly C, Maggwa N, Mati JK, *et al.* Risk factors for gonorrhoea, syphilis, and trichomonas infections among women attending family planning clinics in Nairobi, Kenya. *Genitourin Med* 1994;**70**:155–61.
22 Kapiga SH, Lwihula GK, Shao J, *et al.* Predictors of AIDS knowledge, condom use and high-risk sexual behaviour among women in Dar es Salaam, Tanzania. *Int J STD AIDS* 1995;**6**:175–83.
23 Cates W Jr, Stone KM. Family planning, sexually transmitted diseases and contraceptive choice: a literature update. Part I. *Int Fam Plann Perspect* 1992;**24**:75–84.
24 Le Bacq F, Mason PR, Gwanzura L, *et al.* HIV and other sexually transmitted diseases at a rural hospital in Zimbabwe. *Genitourin Med* 1993;**69**:352–6.