

Prevalence and characteristics of *Chlamydia trachomatis* infection among three populations of Tunisian women with different risks of sexually transmitted infections.



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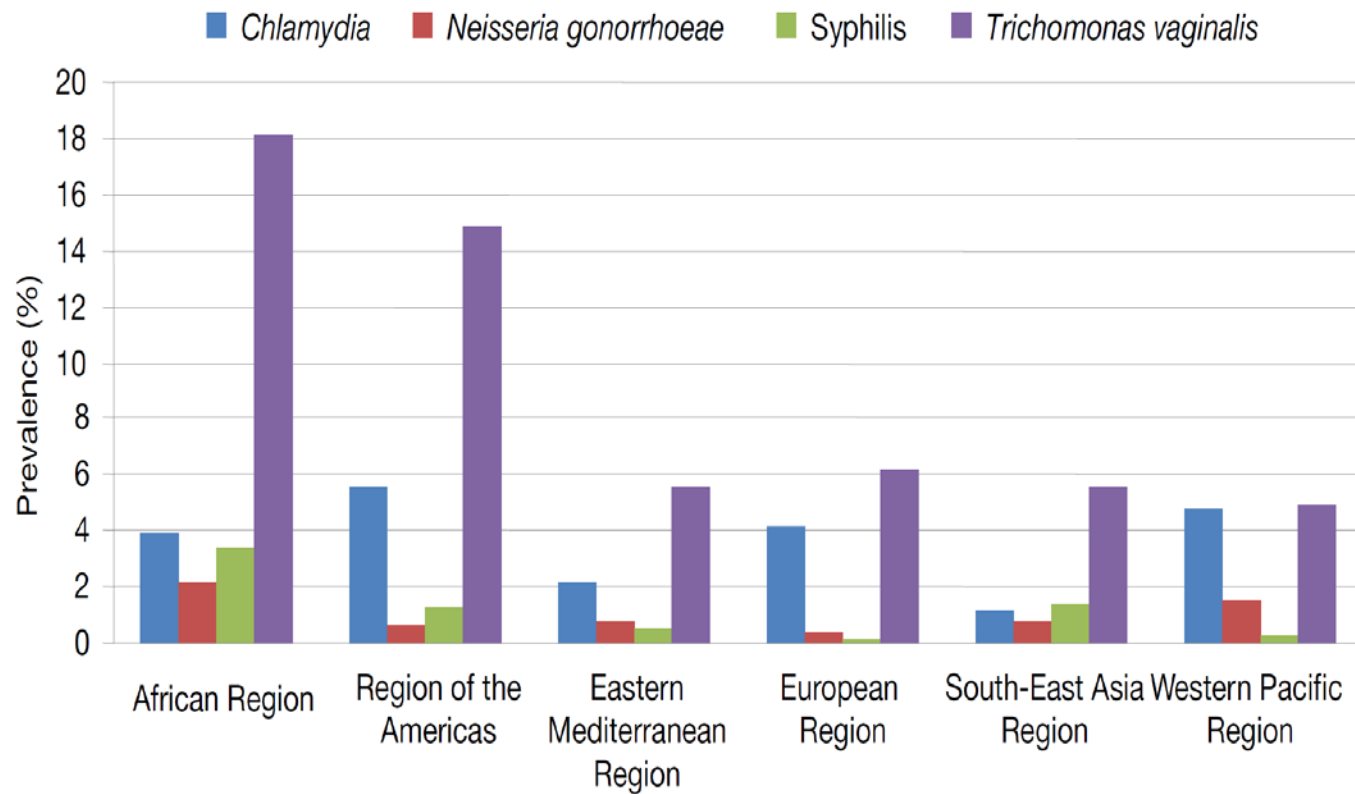
INTRODUCTION



340 million new cases of curable sexually transmitted infections, namely those due to *Treponema pallidum* (*syphilis*), *Neisseria gonorrhoeae*, ***Chlamydia trachomatis*** and *Trichomonas vaginalis*, occur every year throughout the world in men and women aged 15–49 years



Figure 1. Prevalence of STIs in adult females in 2005 in different WHO regions



Tables 18–21 show the breakdown of the four infections by sex and WHO region.

Table 18. Incidence estimates for *Chlamydia trachomatis* in 2005

WHO region	Incidence per 1000		New cases (in millions)		
	Females	Males	Females	Males	Total
African Region	32.79	23.39	5.86	4.16	10.02
Region of the Americas	53.04	44.32	12.15	10.26	22.41
South-East Asia Region	9.20	5.63	4.01	2.60	6.61
Eastern Mediterranean Region	19.35	21.40	2.60	3.06	5.66
European Region	39.89	27.06	9.03	6.17	15.20
Western Pacific Region	43.31	42.70	20.38	21.22	41.60
Global total	32.22	27.32	54.04	47.48	101.52

Chlamydial infection in women

Cervicitis: asymptomatic (70%)



Untreated:

Upper genital tract infection (40%)



Hypofertility (25%):

Complications: salpingitis, PID, perihepatitis

Table 2.
Studies on sexually transmitted infection as risk factor for HIV transmission

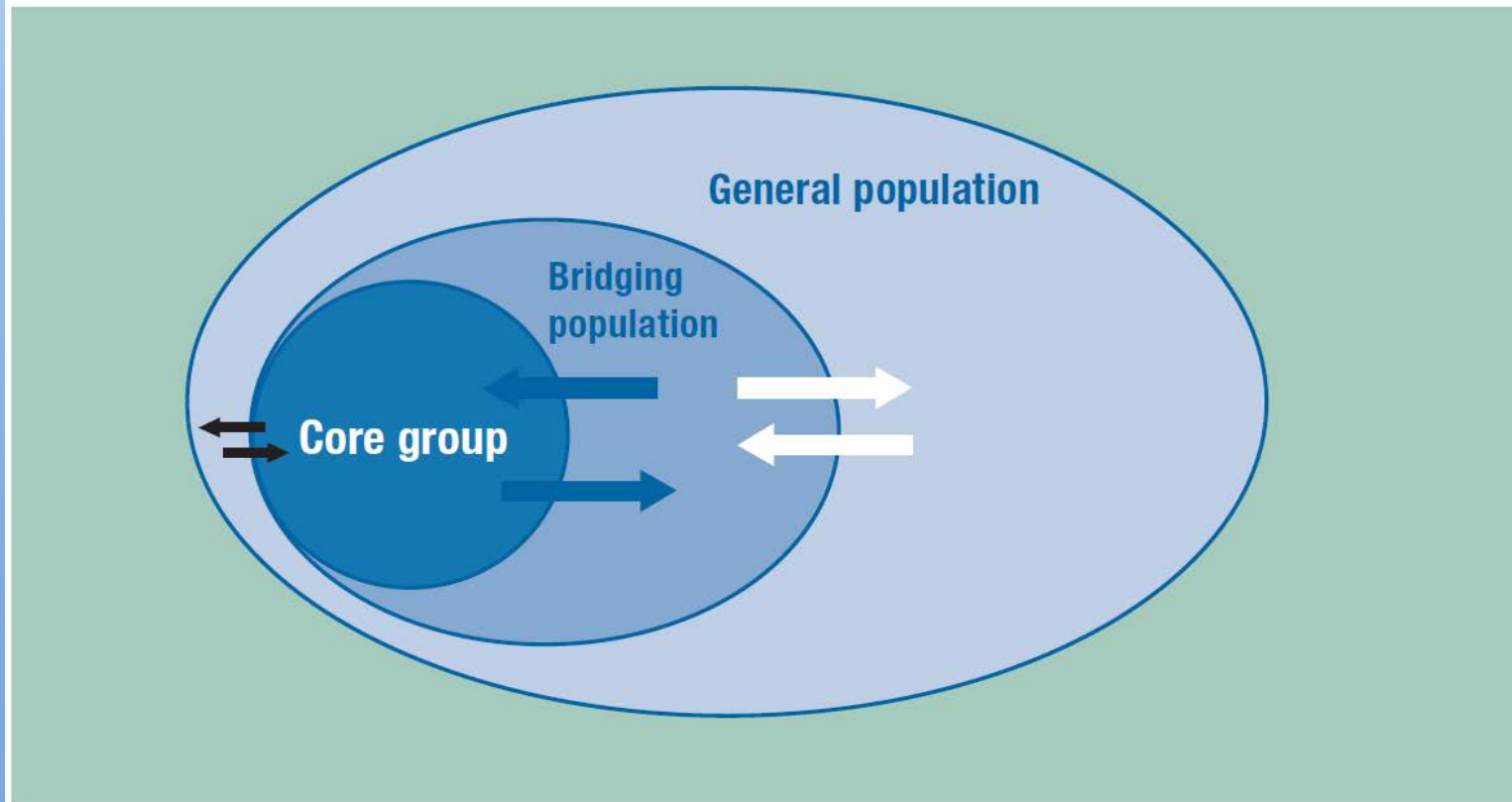
Reference	Study population	Sexually transmitted infection studied	Relative risk	Odds ratio
<i>Plummer, 1991</i>	Female sex workers, Kenya	Chlamydia		3.6
<i>Laga, 1993</i>	Female sex workers, Democratic Republic of the Congo	Chlamydia Gonorrhoea Trichomoniasis		3.6 4.8 1.9
<i>Kassler, 1994</i>	Heterosexual cohort, United States of America	Gonorrhoea		2.5
<i>Craib, 1995</i>	Cohort of MSM, Canada	Rectal gonorrhoea		3.18
<i>Cameron, 1989</i>	Heterosexual men, Kenya	Mainly chancroid	4.7	
<i>Telzak, 1993</i>	Heterosexual men, United States of America	GUD, chancroid	3.0	
<i>Limpakarnjanarat, 1999</i>	Female sex workers, Thailand	Syphilis GUD and herpes		3.7 2.0–2.4
<i>Mbizvo, 1996</i>	Antenatal care women, Zimbabwe	GUD + PID		5.8
<i>Bollinger, 1997</i>	Sexually transmitted infection clinic attendees, India	GUD		4.2
<i>Stamm, 1988</i>	MSM, United States of America	Herpes, syphilis	3.3–8.5	
<i>Holmberg, 1988</i>	MSM, United States of America	Herpes	4.4	
<i>Darrow, 1987</i>	MSM, United States of America	Syphilis	1.5–2.2	

- ▣ Diagnosis: NAAT +++.
- ▣ TTT (doxycycline) : simple et efficient.
 - CT control strategies
 - Specific studies: epidemiologic data+++

Global strategy for the prevention and control of sexually transmitted infections: 2006–2015

Figure 1.

Transmission dynamics of sexually transmitted infection at the population level



Objectives

- Determine the prevalence of CT genital infections in three populations of women at different risk of sexually transmitted infections :
 - Women consulting at family planning clinic (ONFP) of Sfax
 - Female sex workers(FSW)
 - Female partners of infertile couples (F.P.I.C).
- Determine risk factors associated with this infections in each population.

Patients and Methods

- ▣ ONFP: 220 women
- ▣ FSW: 188
- ▣ F.P.I.C.: 120 / 50 pregnant women

Patient:

Information form

Sampling

Vaginal swab



Wet mount+ Gram staining
+ culture

Endocervical swab



Cobs Amplicor Roche CT PCR

Whole blood



CT serology



Endocervical swabs positive for *C. trachomatis* Cobas Amplicor

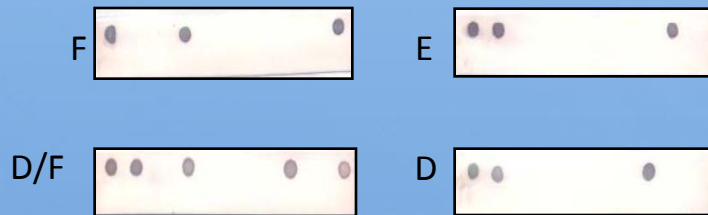
Genotyping:

DNA amplification

A semi nested PCR was performed using the NLO/ C214 and NLO/CT4 Biotinylated

➔ Positive samples were subjected to genotyping (n= 137)

The in house reverse hybridization method



Example of results

A diagram of the membrane layout is shown in a rectangular box. It contains two rows of labels. The first row has labels: Pc, Gb, Gc, Gi, A, B, C, D, E, F. The second row has labels: G, H, I, J, K, L1, L2, L3, Nc. A large green arrow points from this diagram towards the four panels of results shown to the left.

Pc	Gb	Gc	Gi	A	B	C	D	E	F
G	H	I	J	K	L1	L2	L3	Nc	

Layout of the membrane

Pc : positive control; Gb , Gc, Gi : groupes b, c, i respectively

A-L3 : serovars of *C. trachomatis*; Nc : negative control

RESULTS

ONPF: 220

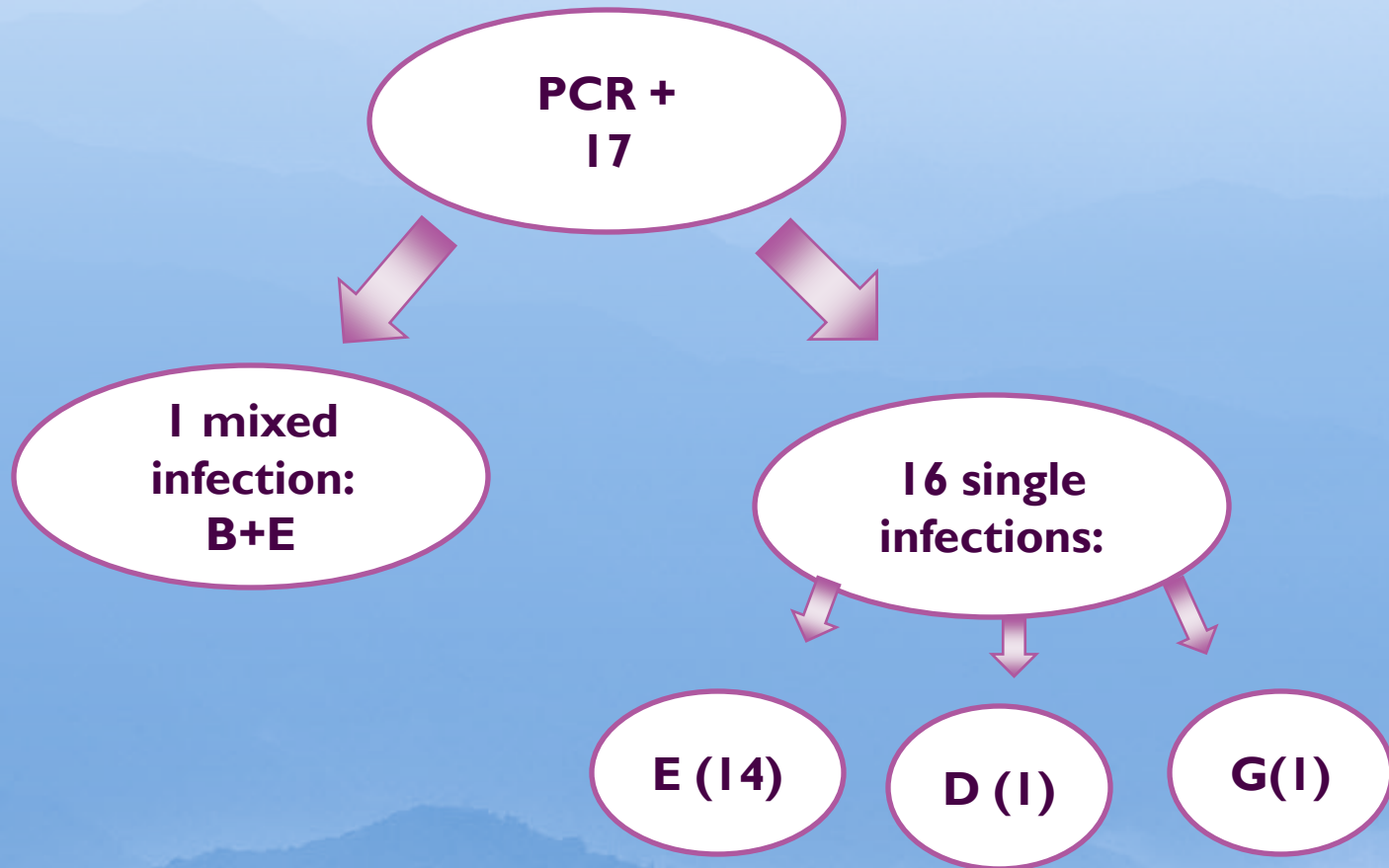
34 (15.4%): any CT marker

CT positive PCR
17 (7.7%)

CT positive serology
30 (13.6%)

CT positive PCR+ serology
13 (5.9%)

Genotyping:



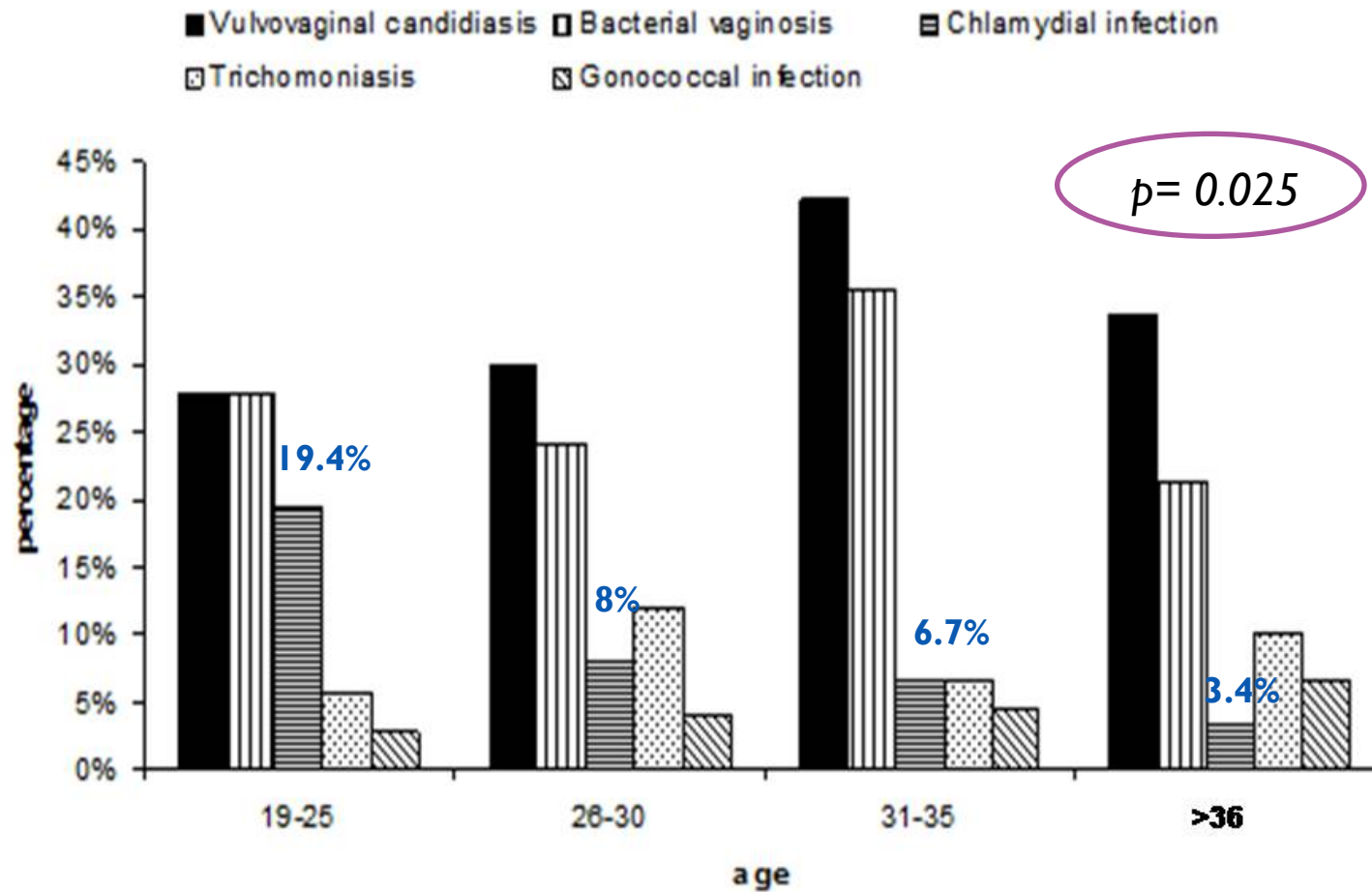


Table 1: Socio-economic, demographic and reproductive health determinants of prevalence of prevalence of CT infections.

	TV n=20	NG n=11	CT n=17	STI n=41
Martial status				
Married	12 (7.2%)	9 (5.4%)	6 (3.6%)	24 (14.4%)
Unmarried	8 (15.1%)	2 (3.8%)	11 (20.5%)	17 (32.1%)
p	p = 0,08	p = 0,638	p <0,001	p = 0,008
Migration from rural region				
No	8 (5.9%)	5 (3.7%)	1 (0.7%)	12 (8.8%)
yes	12 (14.3%)	6 (7.1%)	16 (19%)	29 (34.5%)
p	p = 0,035	p = 0,252	p <0,001	p <0,001
Tabacco consumption				
No	15 (7.7%)	9 (4.6%)	11 (5.7%)	32 (16.5%)
Yes	5 (19.2%)	2 (7.7%)	6 (23.1%)	9 (34.6%)
p	p = 0,055	p = 0,502	p = 0,002	p = 0,034
Alcohol consumption				
No	19 (9%)	11 (5.2%)	14 (6.6%)	38 (18%)
Yes	1 (11.1%)	0	3 (33.3%)	3 (33.3%)
p	p = 0,830	p = 0,482	p = 0,003	p = 0,248

Table 1: Socio-economic, demographic and reproductive health determinants of prevalence of prevalence of CT infections.

	No. of participants (n=220)	TV n=20	NG n=11	CT n=17	STI n=41
Women requesting abortion					
No	189	15 (8%)	11(5.8%)	10 (5.3)	31 (16.4%)
Yes	31	5 (16.1%)	0	7 (22.6)	10 (32.2%)
p		0.25	0.37	0.01	0.23
Number of induced abortion					
0-1	178	16 (9%)	9 (5%)	10 (5.6%)	30 (16.8%)
>1	42	4 (9.5%)	2 (4.8%)	7 (16.7%)	11 (26.2%)
p		0.55	0.92	0,01	0.16
Hormonal contraception use					
Yes	34	6 (17.6%)	3 (8.8%)	6 (17.6%)	11 (32.3%)
No	186	14 (7.5%)	8 (4.3%)	11 (5.9%)	30 (16.1%)

Table 4: Odds ratios including 95% confidence intervals for infections among study group and specified gynaecological symptoms and signs

	Odds ratios and 95% confidence intervals		
	TV	NG	CT
Clinical signs			
Discharge	p = 0,084	p = 0,649	p = 0,815
No*	1	1	1
Yes	1,118 (1,064 to 1,174)	0,980 (0,886 to 1,084)	1,013 (0,913 to 1,125)
Homogenous grey adherent vaginal discharge/ a green, bubbly, bad smell discharge	p = 0,003	p = 0,694	p = 0,093
No*	1	1	1
Yes	1,211 (1,021 to 1,438)	0,969 (0,911 to 1,030)	1,105 (0,965 to 1,265)
Heavy white curd like vaginal discharge	p = 0,013	p = 0,522	p = 0,001
No*	1	1	1
Yes	0,897 (0,835 to 0,965)	1,025 (0,957 to 1,097)	0,881 (0,830 to 0,936)
No specific vaginal discharge	p = 0,319	p = 0,669	p = 0,105
No*	1	1	1
Yes	1,055 (0,957 to 1,163)	0,986 (0,927 to 1,048)	1,079 (0,981 to 1,185)
Cervicitis	p = 0,083	p = 0,414	p = 0,055
No*	1	1	1
Yes	1,224 (0,881 to 1,702)	0,947 (0,917 to 0,978)	1,244 (0,895 to 1,728)

Table 4: Odds ratios including 95% confidence intervals for infections among study group and specified gynaecological symptoms and signs

	Odds ratios and 95% confidence intervals		
	TV	NG	CT
<u>Microbiological findings</u>			
Abundant leucocytes	p = 0.111	p = 0.296	p = 0.571
No*	1	1	1
Yes	1.089 (1.013 to 1.171)	1.049 (0.996 to 1.105)	1.041 (0.966 to 1.123)
Bacterial vaginosis	p = 0.178	p = 0.481	p = 0.017
No*	1	1	1
Yes	1.078 (0.962 to 1.207)	1.029 (0.952 to 1.113)	1.129 (1.004 to 1.270)
Streptococcus B	p = 0.006	p = 0.606	p = 0.669
No*	1	1	1
Yes	1.302 (0.990 to 1.710)	0.945 (0.914 to 0.977)	1.022 (0.885 to 1.181)

Pertinence of criteria used for CT screening among women consulting in ONFP

CT active screening among women :

- ▣ Age: < 25 years
- ▣ Single
- ▣ Requesting abortion

13 / 17 CT+

sensitivity of 76.5%

NPV of 97.2%

FSW: 188

Sexually transmitted infections among female sex workers in Tunisia: high prevalence of *Chlamydia trachomatis*

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Sex Transm Infect 2010;**86**:500–505.

Table 3 Prevalence of different STI in Tunisian FSW

	Total N= 188 (%)	New FSW (<5 years) N=63 (%)	Old FSW (≥5 years) N= 125 (%)	OR (95% CI)	p Value
Any STI marker detected	186 (98.9)	63 (100)	123 (98.4)	–	0.31
Any current STI	163 (86.7)	58 (92.1)	105 (84)	0.45 (0.16 to 1.26)	0.12
One STI detected	70 (37.2)	22 (34.9)	48 (38.4)	1.16 (0.61 to 2.18)	0.64
Two or more STI detected	93 (49.5)	36 (57.1)	57 (45.6)	0.62 (0.34 to 1.15)	0.13
<i>N gonorrhoeae</i>	21 (11.2)	11 (17.5)	10 (8)	2.43 (0.89 to 6.67)	0.05
<i>C trachomatis</i>					
<i>C trachomatis</i> -positive PCR	137 (72.9)	48 (76.2)	89 (71.2)	0.77 (0.38 to 1.55)	0.46
<i>C trachomatis</i> -positive serology	157/183 (85.8)	51/63 (81)	106/120 (88.3)	1.7 (0.76 to 3.87)	0.17
<i>C trachomatis</i> -positive serology with high titres (≥128)	103/183 (56.3)	28/63 (44.4)	75/120 (62.5)	2.08 (1.21 to 3.87)	0.02
Syphilis	5/183 (2.7)	0	5/120 (4.2)	0.64 (0.58 to 0.72)	0.1
HCV	2/183 (1.1)	1/63 (0.8)	1/120 (1.6)	1.91 (0.11 to 31.21)	0.64
Hepatitis B					
Hbs antigen	1/183 (0.5)	0	1/120 (0.8)	0.65 (0.58 to 0.72)	0.46
Hepatitis B core IgG	59/183 (31.4)	7/63 (11.3)	52/120 (43.3)	6 (2.52 to 14.27)	<0.001
HSV-2					
HSV-2 serology	105/183 (55.5)	30/63 (47.6)	71/120 (59.7)	1.62 (0.37 to 3.01)	0.12
HSV-2 PCR	2 (1.1)	2 (3.2)	0	–	0.11
HPV	83 (44.1)	32 (50.8)	51 (40.8)	0.16 (0.36 to 1.22)	0.19
HIV	0 (0)	0	0	–	–

FSW, female sex worker; HPV, human papillomavirus; HSV-2, herpes simplex virus type 2; STI, sexually transmitted infection.

Table 4 Factors associated with any STI and *C trachomatis* infection detected in Tunisian FSW: the univariate analysis.

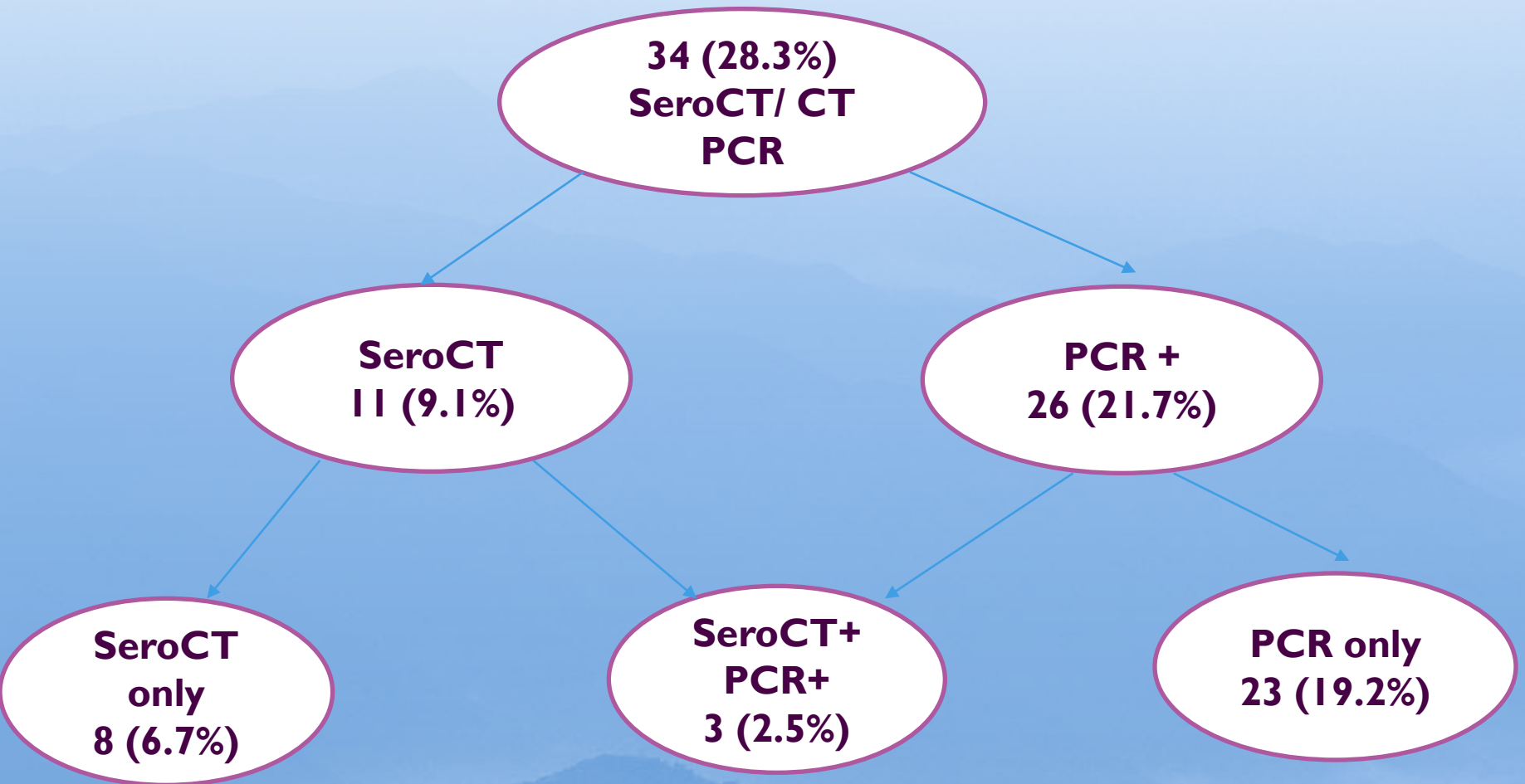
	Any STI				<i>C trachomatis</i> PCR			
	Positive N=163 (%)	Negative N=25 (%)	OR (95% CI)	p Value	Positive N=137 (%)	Negative N=61 (%)	OR (95% CI)	p Value
Demographic data								
Age \geq 34 years	77 (47.2)	12 (48)	0.97 (0.4 to 2.25)	0.94	63 (46)	26 (51)	0.81 (0.43 to 1.55)	0.54
Educational level \leq 6 years	102 (62.6)	17 (68)	1.27 (0.51 to 3.12)	0.6	83 (60.6)	36 (70.6)	1.56 (0.78 to 3.12)	0.2
Immigrant	134 (82.2)	19 (76)	1.45 (0.53 to 3.97)	0.45	112 (81.8)	41 (80.4)	1.09 (0.48 to 2.47)	0.83
Tobacco consumption	133 (81.6)	23 (92)	0.38 (0.08 to 1.72)	0.19	111 (81)	45 (88.2)	0.56 (0.22 to 1.47)	0.24
Alcohol consumption	77 (47.2)	12 (48)	0.97 (0.41 to 2.25)	0.94	64 (46.7)	25 (49)	0.91 (0.47 to 1.73)	0.77
Sexual behaviour								
Duration in sex work \geq 5 years	105 (64.4)	20 (80)	0.45 (0.16 to 1.26)	0.12	89 (65)	36 (70.6)	0.77 (0.38 to 1.55)	0.46
No of client per day \geq 25	83 (50.9)	13 (52)	0.95 (0.41 to 2.22)	0.92	70 (51.1)	26 (51)	1 (0.52 to 1.91)	0.98
Sometimes condom use	63 (38.7)	11 (44)	0.8 (0.34 to 1.87)	0.61	51 (37.2)	23 (54.7)	0.72 (0.37 to 1.38)	0.32
Clinical data								
History of lower genital tract infection	51 (31.3)	12 (48)	0.49 (0.21 to 1.15)	0.09	42 (30.7)	21 (41.2)	0.63 (0.32 to 1.22)	0.17
History of upper genital tract infection	12 (7.4)	4 (16)	0.41 (0.12 to 1.41)	0.15	10 (7.3)	6 (11.8)	0.59 (0.2 to 1.71)	0.32
History of gynaecological surgery	61 (37.4)	10 (40)	0.89 (0.37 to 2.12)	0.8	50 (36.5)	21 (41.2)	0.82 (0.42 to 1.58)	0.55
Treated for genital infection in past week	6 (3.7)	0	0.86 (0.81 to 0.91)	0.33	5 (3.6)	1 (2)	1.89 (0.21 to 16.61)	0.55
Leucorrhoea	8 (4.9)	1 (4)	1.23 (0.14 to 10.34)	0.84	6 (4.4)	3 (5.9)	0.73 (0.17 to 3.04)	0.66
Exocervicitis	8 (4.9)	1 (4)	1.23 (0.14 to 10.34)	0.84	7 (5.1)	2 (3.9)	1.31 (0.26 to 6.5)	0.73
Gram staining								
Abundant leucocytes	91 (56.5)	15 (62.5)	0.78 (0.32 to 1.88)	0.58	79 (58.1)	27 (55.1)	1.12 (0.58 to 2.18)	0.71
Nugent score $<$ 3	28 (17.2)	8 (32)	2.27 (0.8 to 6.29)	0.07	20 (14.6)	17 (33.3)	2.92 (1.29 to 6.62)	0.004
Nugent score intermediate	78 (47.8)	10 (40)	0.73 (0.28 to 1.84)	0.46	70 (51)	19 (37.2)	0.57 (0.28 to 1.15)	0.09
Bacterial vaginosis	57 (35)	7 (28)	0.72 (0.26 to 1.98)	0.49	47 (34.3)	15 (29.5)	0.8 (0.37 to 1.69)	0.52

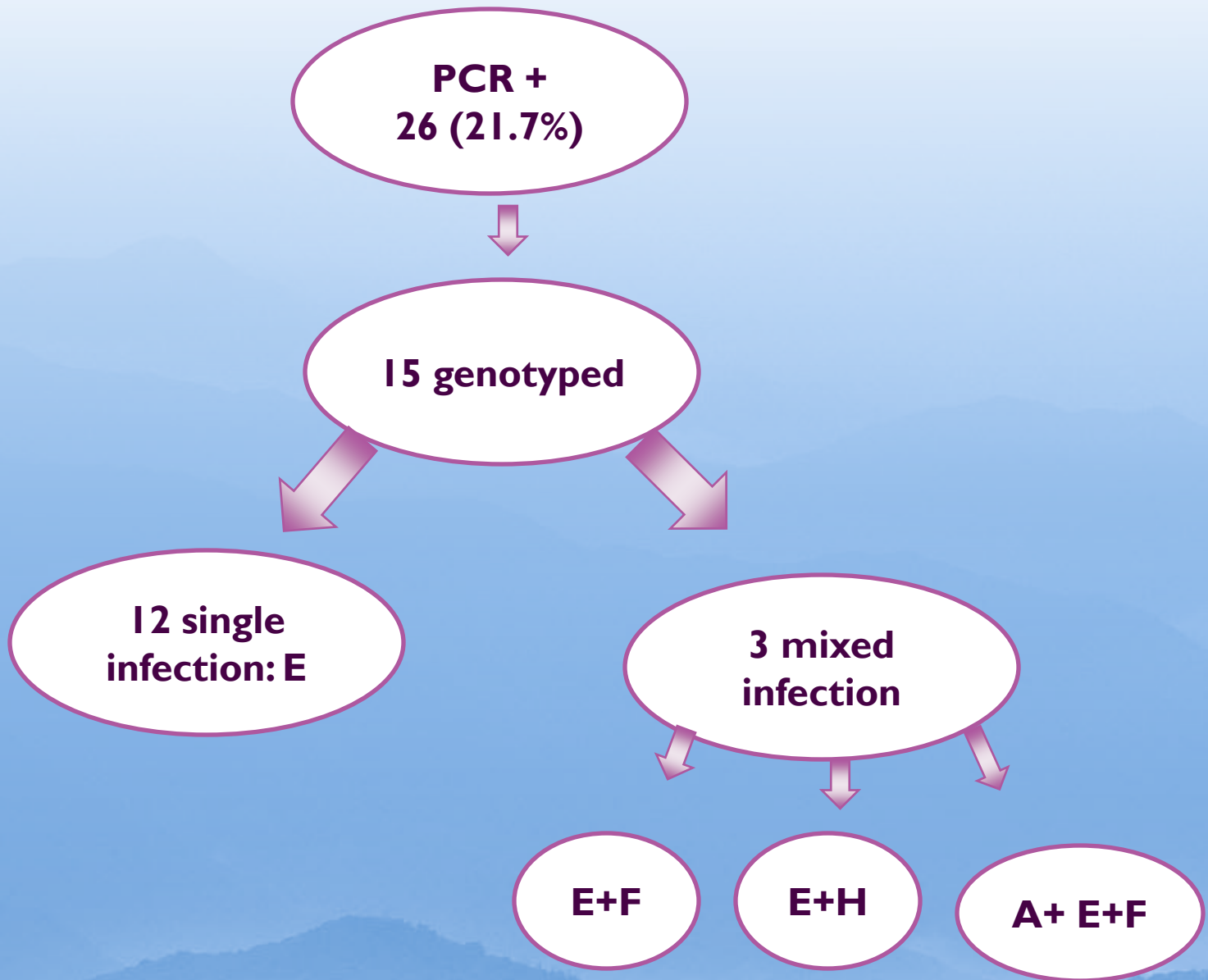
FSW, female sex worker; STI, sexually transmitted infection.

Table. *C. trachomatis* genotype distribution

Genotypes N= 129 (%)			
Single infection 93 (72.1%)	Mixed infections 36 (27.9%)		
	2 Genotypes 25 (19.4%)	3 Genotypes 6 (4.6%)	4 Genotypes 5 (3.9%)
E 92 (71.3%)	B+E 3 (2.3%)	D+E+F 1 (0.8%)	B+D+E+F 1 (0.8%)
F 1 (0.8%)	D+E 2 (1.6%)	E+F+H 2 (1.6%)	D+E+G+H 1 (0.8%)
	E+F 14 (10.9%)	E+G+H 2 (1.6%)	D+E+I+K 1 (0.8%)
	E+G 4 (3.1%)	E+J+K 1 (0.8%)	E+F+J+K 1 (0.8%)
	E+H 1 (0.8%)		E+G+H+K 1 (0.8%)
	H+K 1 (0.8%)		

F.P.I.C: I20





C. trachomatis infection markers in study and control groups

	CT PCR			CT serology		
	+	-	p	+	-	p
FPIC (N =120)	26 (21.7%)	94 (78.3%)	0.01	11 (9.2%)	109 (90.8%)	0.08
Pregnant women (N= 50)	3 (6%)	47 (94%)		1 (2%)	49 (98%)	
Tubal infertility (N=29)	7 (24.1%)	22 (75.9%)	0.02	8 (27.6%)	21 (72.4%)	0.001
Pregnant women (N= 50)	3 (6%)	47 (94%)		1 (2%)	49 (98%)	

Conclusions

- CT infection prevalence : ↑↑

- FSW
- F.P.I.C.

Systematic screening

- Women consulting at ONFP:

- Age < 25 years
- Single
- Abortion

Selective screening

- Genotype E: predominant (vaccine development)



Sexual education: best way to avoid exposition to these infections.