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Detection of *Treponema pallidum* DNA among men who have sex with men who presented with early syphilis

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Background

1. Early diagnosis of syphilis and measurement of disease activity remain challenging with the use of serologic tests and clinical assessment.
2. The study aimed to investigate the presence of *Treponema pallidum* DNA (TP-DNA) in various sample types and syphilis stages among men who have sex with men (MSM).

Materials and Methods

1. Design: prospective cohort study, September 2021 to September 2022.
2. Study site: National Taiwan University Hospital
3. Included participants: adult MSM seeking care for sexually transmitted infections
4. Serologic tests: rapid plasma regain (RPR) and *Treponema pallidum* particle agglutination (TPPA) for syphilis diagnosis
5. TP-DNA (samples from oral rinse, rectal swab, and urethral swab)
   - PCR assay targeting the 47 kDa gene
   - Considered positive with a cycle threshold (Ct) value of <38

Results

1. 449 MSM were included in analysis (Figure 1 and Table 1):
   - 205 participants with early syphilis.
   - 145 participants with treated syphilis.
   - 99 participants with no serologic and clinical diagnosis of syphilis.
2. TP-DNA was detected in at least 1 study sample in 46.3% (95/205) of the participants with early syphilis and 2.0% (2/99) the participants without syphilis (p<0.001), resulting in a specificity of 95.9% and sensitivity 46.3%.
3. TP-DNA was most frequently detected in the participants with secondary syphilis (72%), followed by those with primary and early latent stage (59% and 27%, respectively) (Figure 2).
4. Of the clinical samples in participants with early syphilis, the detection rate of TP-DNA was highest in oral rinse samples (40%), compared with rectal swab (24%) and urethral swab samples(16%) (Table 2).
5. The detection rate of TP-DNA was higher in participants with RPR titers ≥1:32 compared with those with lower titers (53% vs 20%, p<0.001) (Table 3 and Figure 3).

Figure 1. Study flow diagram

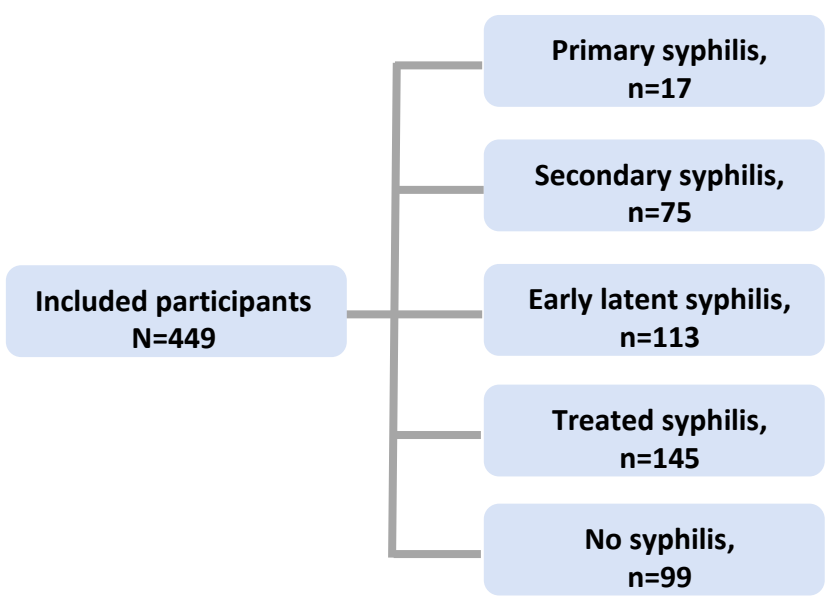


Figure 2. Detection of TP-DNA in any sampling site by syphilis stage

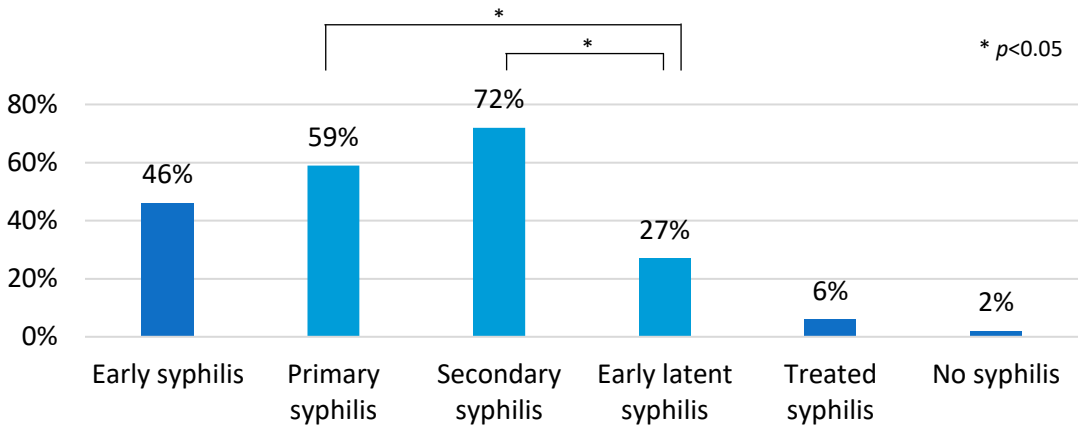


Table 1. Comparisons of characteristics between participants with early syphilis and those with no syphilis

	Early syphilis (n=205)	No syphilis (n=99)	*p*
Age, mean [IQR], years	36 [32-43]	33 [30-38]	<0.001
University or higher, n (%)	173 (84)	87 (88)	0.418
Anal-penile sex in the past 3 months, n (%)	165 (80)	71 (72)	0.085
>5 sex partners in the past 3 months, n (%)	30 (15)	13 (13)	0.725
Chemsex in the past 3 months, n (%)	32 (19)	11 (17)	0.700
HBsAg positivity, n (%)	16 (7.8)	6 (6.1)	0.720
Anti-HCV positivity, n (%)	54 (28)	7 (7.1)	0.024
HIV infection, n (%)	187 (91)	61 (62)	<0.001

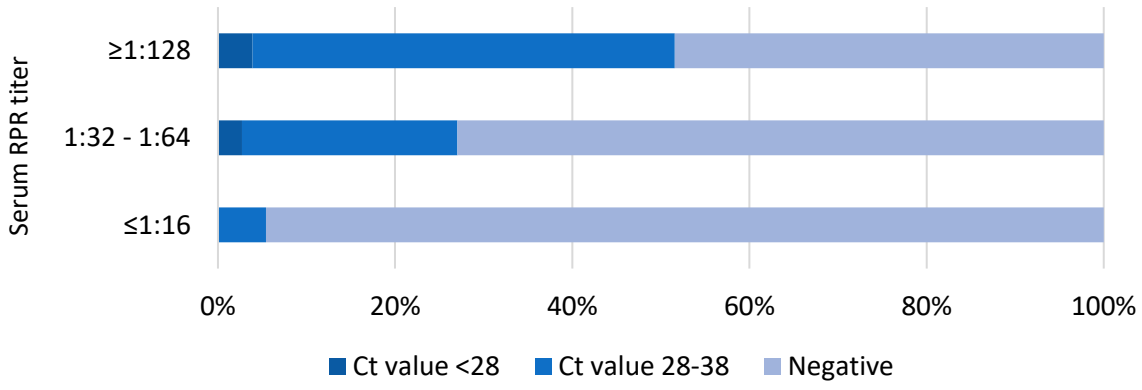
Table 2. Serum RPR titers and detection of TP-DNA by syphilis stage

	Early syphilis (n=205)	Primary syphilis (n=17)	Secondary syphilis (n=75)	Early latent syphilis (n=113)	Treated syphilis (n=145)	No syphilis (n=99)
RPR [IQR]	128 [32-512]	128 [64-256]	256 [128-512]	128 [16-256]	16 [4-64]	0 [0-0]
TP-DNA positivity in different sampling sites						
Oral rinse	40%	47%	66%	21%	3%	3%
Rectal swab	24%	29%	40%	13%	2%	1%
Urethral swab	16%	24%	27%	6%	2%	0%

Table 3. Detection of TP-DNA by serum RPR titer

	RPR negative or ≤1:16	RPR ≥1:32	*p*
At least 1 site	8 (20%)	87 (53%)	<0.001
Oral rinse	2 (6%)	76 (47%)	<0.001
Rectal swab	5 (14%)	42 (25%)	0.137
Urethral swab	3 (8%)	29 (18%)	0.162

Figure 3. Distribution of Ct values of *T. pallidum* PCR detected from oral rinse by serum RPR titer among participants with early syphilis



Conclusions

Detectability of *T. pallidum* DNA in the mouth and anus among MSM correlated with the stage of early syphilis. The higher detection rate and lower Ct value of TP-DNA in those with secondary syphilis and higher RPR titers imply that TP-DNA load may predict transmissibility.