AWARENESS OF SYPHILIS INFECTION AND SYPHILIS-RELATED FACTORS AMONG ADULT RESIDENTS IN THE SOUTHERN PROVINCE OF SRI LANKA: GENDER DIFFERENCE AND ITS ASSOCIATED FACTORS

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ABSTRACT

Syphilis is one of common sexually transmitted infections that its prevalence and trend has been increasing globally. Awareness of syphilis infection and its related factors is important for disease prevention and adverse events are more impact on mother-to-child transmission if infection occurred in females. To assess the gender difference in awareness of syphilis infection and syphilis-related factors among adults living in the Southern province of Sri Lanka and explore the associated factors with the awareness. A community-based, cross-sectional study was conducted among adult residents aged 18 years or older from three districts using self-administrated questionnaire. Levels of awareness and the associated factors were analyzed using univariate analysis and multivariable regression model. Among 504 residents, prevalence of high awareness of syphilis infection and syphilis-related factors was 41.4% (60.8% in female vs 39.2% in male, p <0.001) and 34.9% (51.1% in female vs 48.9% in male, p 0.779), respectively. High awareness of syphilis infection was less likely to be in males than females after adjusting with other significant factors. Age, marital status, and occupation were independently associated with awareness of syphilis infection. No significance of gender difference in awareness of syphilis-related factors was found. High knowledge significantly increased odds of high awareness of syphilis infection and related factors. Awareness of syphilis infection, rather than specific risk factors, varied significantly by gender and influenced by age, marital status, occupation and knowledge. These findings identify priority groups for targeted strategies to improve prevention and control and importance of knowledge.

Keywords: Syphilis infection, Syphilis-related factors, Awareness, Adults, Gender differences

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INTRODUCTION

Syphilis remains a major public health concern globally and continues to pose significant challenges despite availability with proper diagnostic methods and effective treatments. As stated by World Health Organization (WHO) estimate, there were nearly 8.0 million new cases of syphilis among adults aged 15–49 years worldwide in 2022, up from about 7.1 million in 2020. The evidence showed that syphilis rates are rising not only among high-risk groups but also within the general population (Do et al., 2025). Awareness of sexually transmitted infections (STIs) remains comparatively low among women, despite increasing trends reported in South Asia (Kaur et al., 2023). Inadequate sexual education and entrenched sociocultural stigma around sexual health discussions contribute to limited STI knowledge, particularly among women in tourist-oriented areas of the Southern Province of Sri Lanka (Bozicevic et al., 2020). Syphilis poses serious risks not only to sexually active adults but also to pregnant women, as untreated infection can lead to congenital syphilis, stillbirth, neonatal death, and long-term morbidity. Improving awareness of syphilis transmission and related risk factors is therefore essential for effective prevention and control. However, changing social behaviors and exposures highlight the need for updated evidence to inform current policies and intervention strategies.

A scoping review published in 2023 reported the need of awareness and knowledge of individuals to adopt safer sexual behaviors, seek timely testing and treatment, and reduce onward transmission to sexual partners and unborn children. However, awareness levels are often influenced by socio-demographic factors such as age, gender, marital status, education, occupation, and migration in Southeast Asia (Balakrishnan et al. 2023). Gender differences in sexual health awareness are particularly important, as men and women may differ in exposure to health information, risky behaviors, access to services, perceived risk, and sociocultural norms related to sexuality and healthcare utilization (Ouahid et al., 2025). Females are biologically more vulnerable to complications of syphilis, largely due to the risk of mother-to-child transmission, while men usually play a key role in sustaining transmission because of delayed care-seeking and lower engagement with preventive care services (Qu et al., 2021). Understanding gender related gaps in awareness is essential for designing targeted and effective public health interventions.

Syphilis rates have been increasing in Sri Lanka, particularly in specific geographic areas with high-risk populations (Madurapperuma et al., 2018). However, existing screening programs mainly target pregnant women and do not routinely include the general adult population. Moreover, evidence on public awareness of syphilis—especially gender-disaggregated data on knowledge of disease trends and associated risk factors—remains limited, particularly in community-based settings (National STD/AIDS Control Programme, 2024). Therefore, current study aimed to evaluate the gender association in awareness of syphilis infection and syphilis-related factors among adults living in the Southern province of Sri Lanka and explore the associated factors with the awareness of both syphilis infection and syphilis-related factors.

LITERATURE REVIEWS

Gender differences in awareness of syphilis infection

Syphilis shows an upward trend globally, as an example in Thailand significantly higher syphilis rates have been observed among pregnant women aged 30-34 years (Luengmettakul et al., 2025). Syphilis has direct impacts on adult, child and pregnant women as well as sexual and reproductive health. There was global variation in the male-to-female ratio of syphilis, with a higher prevalence in males than females. The pooled mean prevalence ratio was one. Higher rate of syphilis infection were reported in males than females in Pakistan and India (Jalbani et al., 2024). In addition, a study in India highlighted an increasing trend with a disproportionately high burden among males. Awareness of the disease and its modes of transmission plays a crucial role in disease prevention and control (Jing et al., 2021). A community survey in rural Bangladesh reported that very low

sexual transmitted infections (STIs) awareness among women, including that only 25% had heard of syphilis. Among those aware, fewer than half could identify transmission mechanisms. Similarly, a large community survey in South China found that female gender was independently associated with lower awareness of syphilis than male gender. In contrast, a study from Tanzania reported high percentage of syphilis awareness among men; however, aware women had nearly twice the odds of testing positive, indicating a complex relationship between awareness and risk (Vasudeva et al., 2022). A study performed among adults in United States revealed that female was more knowledgeable about sexual health than male, although participants of both sexes not as knowledgeable collectively on sexual health. Overall awareness of STIs among women across Asia was low, although the majority of males had heard of syphilis, awareness of its symptoms and complications was generally low (Thapa & Rana, 2023). A study conducted among Myanmar migrants in Thailand showed poor knowledge of STIs including syphilis and highlighted awareness gaps in cross-border Asian populations with different economic and social vulnerabilities (Thant et al., 2024).

Gender differences in awareness of syphilis related factors

A review on the epidemiology reported that syphilis and HIV are usually co-infected and the rise in syphilis are multifactorial which often linked to sexual networks and risk behaviors such as unprotected sex, multiple sex partners, early age of first sexual intercourse, condomless sex, use of illicit drugs, smoking and alcohol drinking, growing use of internet for finding sexual partners, high-risk sex worker population (Ren et al., 2021), and sociodemographic factors such as education, income, marital status, and migration. The study conducted in Pakistan reported that inconsistent condom uses among female sex workers as a key risk factor for sexually transmitted infections (STIs) of which increased the likelihood of acquiring syphilis transmission (Shah et al., 2025). Co-infection rate of HIV and syphilis was overall reported in 63.2% (Javed et al., 2023). Internal migration was also identified as an important risk factor, reported by 85.3% (Kawi et al., 2022). In Bangladesh, only 13.3% of women surveyed were aware of syphilis and its related factors, awareness varied significantly by age, education, and urban/rural residence, older and more educated women showing higher awareness. Although socio-economic factors like education level and income are commonly examined, their influence varies across cultural and regional context. The demographic profiles with women earners, were more likely to have higher awareness compared to lower income participants. In Asia married women may have better awareness of STI (Kaur et al., 2023). Existing evidence consistently demonstrates that inadequate awareness of syphilis infection and its related factors contribute to delayed diagnosis, continued transmission, and adverse health outcomes, highlighting awareness as a critical component of syphilis prevention and control strategies.

RESEARCH METHODOLOGY

Study Design and Setting

A community-based, cross-sectional study was conducted from 25th July 2025 to 15th September 2025 in three districts, Galle, Matara and Hambantota, of Southern province of Sri Lanka where are major tourist destinations in the country.

Study sample and sample size

Adults aged 18 years or older who had resided for at least six months in households located within selected tourist areas of the three study districts were eligible for inclusion. Individuals who were unavailable during the survey period or had communication barriers were excluded. Temporary visitors and tourists were also excluded. Residency of at least six months was verified by authorized local government officers using local administrative records. The required sample size was calculated to identify a difference in awareness of syphilis among males and females, assuming 15% of difference, created on findings from a previous study (Vasudeva et al., 2022).

The estimation was based on a 95% confidence level, 80% power of the test, equal allocation between the two groups with design effect of 1.5 and an anticipated 20% nonresponse or incomplete data rate. Final adjusted sample size was 504 adults, 252 males and 252 females.

Sampling procedure and data collection

The household lists were not available within the selected tourist areas of each study district; therefore, we used the 2012 national census, the most recent publicly available small-area household density dataset, indicating an average of approximately 84 households per kilometer in these areas. Tourist area boundaries were defined using local public health maps. Starting points were randomly selected within predefined geographic blocks surrounding tourist information centers. Systematic sampling was then applied to maintain a fixed interval between households (every fifth household), with subsequent households approached sequentially in a right-hand direction from the initial household. If a selected household was unavailable, the next immediate household would be approached. To recruit 168 households per district, the sampling frame covered approximately 10 kilometers, corresponding to an estimated 850 households per district. Only one eligible participant was selected from each household, with participant selection guided by the gender distribution of previously recruited participants to maintain gender balance. Ethical clearance was approved by the Ethical Review Committee of Department of Ayurveda, Ministry of Health, Sri Lanka and the Human Research Ethics Committee, Faculty of Medicine, Prince of Songkla University (REC.68-333-18-1).

Content validity was assessed by three experts and demonstrated a high content validity index. The questionnaire's reliability was pretested among 30 participants in a similar setting and showed acceptable internal consistency (Cronbach's alpha of 0.7). For data collection, the research team visited the selected household and checked the eligibility. All eligible participants were informed and requested to join in the study. After signing the consent form, the self-administered structured questionnaire was given to the participants to complete, and the research team was nearby in case any clarification of questionnaire was needed. Average time to complete the questionnaire was around 20-30 minutes and it was returned to the research team. Main outcomes were awareness of syphilis infection with six items and syphilis-related factors with eight items of which each item was measured as *"yes", "no", "not sure", and "not know"*. Awareness of syphilis infection was assessed: recognition of syphilis as a sexually transmitted infection; awareness that syphilitic lesions may disappear regardless of treatment; knowledge that both men and women can be affected; awareness of syphilis trends; recognition of sexual transmission through a partner; and awareness of mother-to-child transmission. Awareness of syphilis-related factors was measured, including manual genital sex, condomless sex, oral sex, sex between men, use of dating applications, alcohol consumption, having multiple sexual partners, and contact with commercial sex workers. Main exposure was gender classified as female and male. Covariates measured were age, marital status, religion, occupation, highest education level, monthly personal income, residence, internal migration, and knowledge related to syphilis.

Data Management and analysis

Data collection was obtained using a self-administrated, paper-based, structured, questionnaire and entered in Kobo Toolbox. The data were managed and analyzed by R statistical software version 4.4.0 (R Core Team, 2024). Descriptive statistics of asymmetrically distributed continuous variables were displayed with medians with interquartile ranges (IQR). Group-based variables were summarized using frequencies and percentages.

Responses of "yes" were classified as aware, whereas responses of "no," "not sure," and "do not know" were grouped as unaware, as uncertainty or lack of knowledge was considered functionally equivalent to unawareness from a public health perspective. Each item was coded as 1 for awareness and 0 for unawareness. Total awareness scores were calculated by summing item scores (range 0–6 for awareness of syphilis infection and 0–8 for awareness of syphilis-related factors).

Because no established cut-off values exist to define adequate awareness, median scores were used to categorize awareness levels. Median score of 3 was used to categorize the awareness of syphilis infection into low (score ≤3) or high (score >3). Median score of 4 was used to categorize the awareness of syphilis-related factors into low (score ≤4) or high (score >4).

The gender difference in awareness of syphilis infection and syphilis-related factors was evaluated by the Chi-square of Fisher Exact tests. A univariate analysis was performed to explore the association between individual independent and awareness. Independent variables demonstrated p-value <0.2 in the univariate analysis were involved in the multivariable logistic regression. Backward elimination method was used to identify the predictors influencing low or high awareness level. The odds ratio (OR) and 95% confidence interval (CI) were applied. P-value <0.05 was considered as statistical significance.

RESEARCH RESULTS

All eligible participants from the 504 households agreed to participate, resulting in a response rate of 100%. The socio-demographic characteristics of participants are shown in Table 1. Among 504 participants (252 male and 252 female), median age slightly higher among males (40 years) than females (36 years) were observed, but not significantly different. Marital status, religion, and education level were not different between males and females. Self-employed status and personal monthly income in males were higher reported than in females significantly (p-value <0.001). Overall internal migration was found in 17.3% that was significant difference between males and females (females 12.3% vs males 22.2%, p = 0.005).

Table 1 Socio-demographic characteristics of participants

Variable	Female (N = 252) n (%)	Male (N = 252) n (%)	p value
Age (years)			0.079
Median (IQR)	36 (27,50)	40 (29,51)	
Marital status			0.717
With partner	147 (58.3)	152 (60.3)	
No partner	105 (41.7)	100 (39.7)	
Religion			0.302
Buddhist	195 (77.4)	184 (73.0)	
Non-Buddhist	57 (22.6)	68 (27.0)	
Occupation			<0.001
Unemployed	46 (18.8)	6 (2.4)	
University student	13 (5.3)	19 (7.6)	
Retired	41 (16.7)	35 (13.9)	
Manual/general worker	27 (11.0)	50 (19.9)	
Public sector	56 (22.9)	35 (13.9)	
Private sector	48 (19.6)	67 (26.7)	
Self-employed	14 (5.7)	39 (15.5)	
Highest education level			0.150
Secondary/high school	163 (64.7)	182 (72.3)	
University/ graduate	59 (23.4)	50 (19.8)	
Vocational	30 (11.9)	20 (7.9)	
Monthly personal income (USD)			<0.001
<81	71 (28.2)	29 (11.5)	
81 – 161	113 (44.8)	109 (43.3)	
>161	68 (27.0)	114 (45.2)	

Internal migration			0.005
No	221 (87.7)	196 (77.8)	
Yes	31 (12.3)	56 (22.2)	

Awareness score of syphilis infection showed significant difference between females (median 4, IQR 2,5) and females (median 3, IQR 2,4), with p <0.001. No significant difference of awareness score of syphilis-related factors was shown between females (median 4, IQR 2,5) and males (median 4, IQR 2,5). The prevalences of awareness of syphilis infection between females and males are presented in Figure 1. Higher awareness of mother-to-child transmission and transmission by sexual partner, but lower awareness of syphilis being a sexually transmitted infection were in females than males significantly. Figure 2 shows the awareness of syphilis-related factors between females and males. No significant differences of awareness of syphilis-related factors between females and males were found. Of all participants, 50% or lower were aware the use of dating apps, man to man sex, oral sex, condomless sex, and manual genital sex as syphilis-related factors in both females and males.

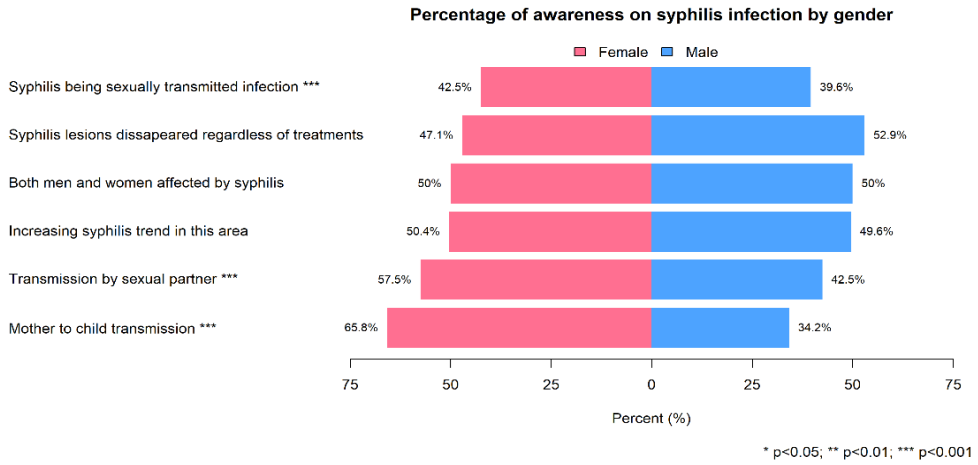

Figure 1 Prevalence of awareness of syphilis infection between females and males

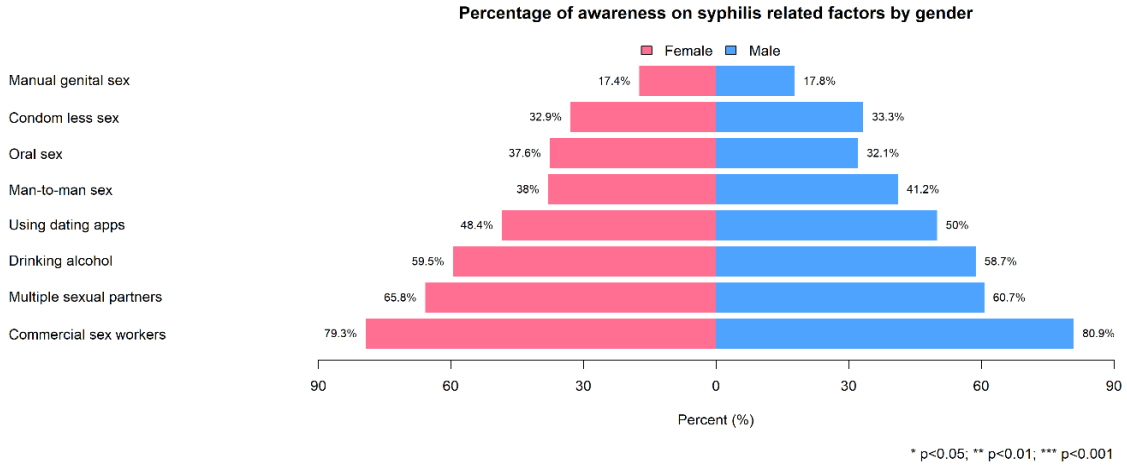

Figure 2 Prevalence of awareness of syphilis-related factors between females and males

Among 504 residents, prevalence of high awareness of syphilis infection and syphilis-related factors was 41.4% (60.8% in female vs 39.2% in male, p <0.001) and 34.9% (51.1% in female vs 48.9% in male, p 0.779). Table 2 shows the multivariable analysis of associated factors with

syphilis infection. Male gender (AOR 0.51; 95% CI: 0.34-0.78), increasing age (AOR 0.98; 95% CI: 0.96 – 1.00), absence of a marital partner (AOR 0.31; 95% CI: 0.19-0.49), and manual/general work (AOR 0.28; 95% CI: 0.11-0.67) were less likely to have high awareness significantly, while participants who had high knowledge had higher odds of high awareness comparing to those had low knowledge (AOR 2.74; 95% CI: 1.84 – 4.10). No significant interaction was observed between knowledge and gender for awareness of syphilis infection or syphilis-related factors.

Table 2 Factors associated with high awareness of syphilis infection in multivariable analysis

Variable	Crude OR (95%CI)	AOR (95%CI)	P (Wald's test)
Gender (Ref: female)			
Male	0.47 (0.33–0.68)	0.51 (0.34–0.78)	0.002
Age	0.99 (0.97–1.00)	0.98 (0.96–1.00)	0.034
Marital status (Ref: with partner)			
No partner	0.46 (0.31–0.67)	0.31 (0.19–0.49)	< 0.001
Occupation (Ref: Unemployed)			
University student	0.82 (0.34–1.97)	1.43 (0.53–3.83)	0.478
Retired /home maker	0.57 (0.28–1.16)	0.97 (0.37–2.55)	0.950
Manual/General worker	0.22 (0.10–0.48)	0.28 (0.11–0.67)	0.005
Public sector	0.73 (0.36–1.44)	0.85 (0.38–1.86)	0.686
Private sector	0.94 (0.49–1.82)	1.09 (0.51–2.35)	0.821
Self-employed	0.56 (0.26–1.22)	0.63 (0.25–1.57)	0.325
Knowledge level* (Ref: low)			
High	2.99 (2.07–4.35)	2.74 (1.84–4.10)	< 0.001

AOR: Adjusted Odd Ratio; *No significant interaction between gender and knowledge (p = 0.957)

In multivariate analysis, gender difference in awareness of syphilis-related factors was not found (Table 3). Only high knowledge level significantly increased odds of high awareness (AOR 1.85; 95% CI: 1.26-2.72) after adjusting with socio-demographic characteristics.

Table 3 Factors associated with high awareness of syphilis-related factors in multivariable analysis

Variable	Crude OR (95%CI)	AOR (95%CI)	P (Wald's test)
Gender: (Ref: female)	0.88 (0.61–1.27)	1.09 (0.72–1.63)	0.692
Occupation (Ref: Unemployed)			
University student	0.98 (0.40–2.38)	0.90 (0.35–2.24)	0.815
Retired /home maker	0.55 (0.26–1.14)	0.57 (0.27–1.21)	0.143
Manual/General worker	0.36 (0.16–0.76)	0.35 (0.16–0.79)	0.012
Public sector	1.03 (0.52–2.06)	1.00 (0.49–2.02)	0.992
Private sector	0.65 (0.33–1.27)	0.60 (0.30–1.21)	0.153
Self-employed	0.65 (0.29–1.42)	0.57 (0.24–1.32)	0.193
Knowledge level* (Ref: low)			
High	1.90 (1.31–2.77)	1.85 (1.26–2.72)	0.002

AOR: Adjusted Odd Ratio; *No significant interaction between gender and knowledge (p = 0.773)

DISCUSSION & CONCLUSION

Awareness of syphilis infection in female adults was higher than in male in the Southern Province of Sri Lanka, especially in mother-to-child transmission and transmission by sexual partner. Overall awareness of syphilis infection was significantly low among both genders in terms of the use of dating apps, man to man sex, oral sex, condomless sex, and manual genital sex. Gender, age, marital status, occupation, and knowledge were significantly associated with awareness of syphilis infection. No gender difference was observed in awareness of syphilis-related factors. Only knowledge and occupation were significantly associated with awareness of syphilis-related factors.

In our study, overall awareness of syphilis infection was lower than half in both female and males which was consistent with findings from previous studies conducted among high-risk population in Bangladesh, Tanzania and Myanmar migrant communities in Thailand (Khan et al., 1997; Thant et al., 2024; Vasudeva et al., 2022) despite our study being conducted in general population. This could be explained by the fact that our study settings were in tourist areas. The findings of our study show more awareness of syphilis infection in females than males which was different from the study in China. Females in our study reported significantly higher awareness of mother-to-child transmission and transmission by sexual partners, unlike findings from Bangladesh where women exhibited substantially lower awareness of syphilis infection and syphilis-related factors. Male gender in our study was independently associated with lower odds of high awareness of syphilis infection after adjusting for socio-demographic factors, suggesting that higher disease burden does not necessarily translate into better awareness.

No gender differences were observed in awareness of syphilis-related factors in our study which we assumed that the target population in tourist areas have been informed of the risk factors of HIV-STI co-infection. Globally and regionally, males tend to have a higher prevalence of syphilis infection than females. Although some studies from the United States and Africa reported higher sexual health knowledge among women compared to men, evidences from Asia remains mixed (Thwala & Shangase, 2025) which is related with the lack of gender differences observed in awareness of syphilis-related factors in our current study. Awareness of syphilis-related factors including condomless sex, man to man sex, and use of dating apps remained low among both sexes, consistent with regional evidence presented in previous studies (Burrell et al., 2019; Thant et al., 2024). Despite higher global syphilis prevalence among males, male gender was independently associated with lower odds of high awareness, highlighting a critical gap between disease burden and knowledge (Jalbani et al., 2024). Findings of our study showed having a marital partner, younger age, non-manual occupations, and higher knowledge levels were independently associated with higher awareness of syphilis infection, whereas awareness of syphilis-related factors was driven primarily by overall knowledge rather than socio-demographic characteristics.

This study provides evidence of gender differences in awareness of syphilis infection and related factors in the general population of tourist areas, with lower awareness among males despite a higher global disease burden. This gap may contribute to hidden transmission and subsequently increase the risk of congenital syphilis. There were several limitations. First, the cross-sectional design limits causal inference. Second, awareness was self-reported and may be subject to recall and social desirability bias; however, the measures demonstrated acceptable validity and reliability. Third, prior exposure to sexual health education or campaigns was not assessed, although syphilis-related knowledge was measured. Finally, as the study was conducted in tourist areas of Southern Province, Sri Lanka, the generalizability of findings is limited. Future studies should expand to other settings and countries and be complemented by strengthened disease surveillance to better capture emerging sexually transmitted infections, including syphilis, at the global level.

In conclusion, low awareness of syphilis infection and syphilis-related factors were observed among adults in the Southern Province of Sri Lanka, with fewer than half of participants demonstrating high awareness. Gender-specific differences were observed for certain transmission routes. However, no significant gender differences were found in awareness of syphilis-related factors. These findings emphasize the need for gender-sensitive educational or awareness programs among general population that strengthen knowledge of both syphilis infection and syphilis-related factors to support effective syphilis prevention and control.

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