


Article

Knowledge, Attitudes, and Practices Associated with Syphilis Infection Among Physicians in Armenia

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Abstract: Background/Objectives: Syphilis diagnosis in Armenia is unreliable due to inconsistent testing methods, limited access to confirmatory tests, and the underutilization of healthcare services due to stigma and lack of awareness. In 2022, 29% of cases were latent, 8.1% were late latent, 21% were secondary, and 1% were congenital. We assessed primary care physicians' (PCPs) knowledge, attitudes, and practices regarding syphilis diagnosis and prevention to improve early detection. **Methods:** Between December 2023 and February 2024, we conducted a cross-sectional survey among outpatient physicians. We randomly selected 24 clinics in six regions. In each clinic, we randomly selected respondents from employee registries. We assigned one or two points to correct answers and zero points to incorrect or unknown answers; scores were categorized as Poor (0–<30%), Moderate (30–<70%), and Good (>70%). We used non-parametric tests to compare groups. **Results:** Of the 413 physicians contacted, 345 (83%) responded; 74% were female; the median age was 46 years; 54% had > 16 years work experience; and 47% worked as general practitioners. The respondents had moderate knowledge of risk groups (56%) and symptoms (49%) and poor knowledge of disease transmission (8%). As for practices, the respondents expressed difficulty in prescribing additional laboratory tests based on clinical symptoms (51%) and struggled with reporting diagnosed syphilis cases (66%); moderate opinions on pregnancy termination decisions (65%) were conveyed. The respondents' knowledge did not correlate with their practice ($r = 0.23$) and attitude ($r = 0.25$) scores. **Conclusions:** PCPs' knowledge was not positively associated with improved practices and attitudes regarding syphilis diagnosis and prevention. This highlights the need to improve healthcare workers' post-graduate education and implement an efficient screening program to detect and treat asymptomatic, late latent, and congenital infections, as well as to prevent complications, transmission, and reinfection.

Keywords: knowledge; practices; attitudes; syphilis



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1. Introduction

Syphilis is a chronic infectious disease and a major public health concern [1]. It can be transmitted through sexual contact, blood transfusion, or from mother to child (vertical transmission). Its signs and symptoms vary depending on the following disease stages: primary, secondary, latent, or tertiary [2]. Early detection allows for simple and effective

treatment, whereas delayed diagnosis and treatment increase the risk of developing potentially fatal tertiary syphilis from 10 to 30 years after the initial infection [3,4]. If left untreated, syphilis can cause severe health complications, including neurological and cardiovascular disorders. However, the disease is both preventable and curable. Early detection and treatment are essential to avoid long-term health consequences. Additionally, frequent atypical manifestations pose challenges in clinical practice [5]. The World Health Organization (WHO) underscores the importance of regular screening, particularly for pregnant women, to prevent mother-to-child transmission of bloodborne pathogens, including syphilis [6–8]. Congenital syphilis can lead to premature birth, miscarriage, and severe health complications in infants. Despite ongoing efforts, syphilis remains a significant global health concern, with its burden increasing over recent decades [9,10]. In Armenia, from 2013 to 2022, a total of 1499 syphilis cases were diagnosed by the National Center for Disease Control and Sexually transmitted infections (NCD&STI), 15 (1%) of which were categorized as congenital syphilis. In total, 537 confirmed syphilis cases were reported in 2022, with a rate of 18 cases per 100,000 people. Of these, 188 (35%) were diagnosed as primary, 114 (21%) as secondary, 75 (14%) as early latent syphilis, 156 (29%) late latent syphilis, and 4 (1%) were diagnosed among pregnant women. Among the noted syphilis cases, 66 had co-infections with HIV, 14 with hepatitis B, and 7 with hepatitis C. Distribution by age group was available only for 2022, as follows: 18 (3.3%) cases among 12–17-year-olds, 127 (23.6%) cases among 18–24-year-olds, 206 (38.3%) cases among 25–49-year-olds, and 177 (34.8%) cases among 50-year-olds and over. The median age was 34 (range 17–76) years; 392 (73%) were male, 145 (37%) were men having sex with men (MSM), and 389 (72%) lived in urban areas. During 2013–2022, the incidence rate rose from 1.8 to 18 per 100,000 people [11].

The World Health Organization (WHO) provides comprehensive guidelines for syphilis screening and treatment in pregnant women, emphasizing the importance of early detection and treatment to prevent adverse pregnancy outcomes and mother-to-child transmission [6]. However, Armenia lacks specific national guidelines for the early diagnosis, detection, and treatment of syphilis in pregnant women, leaving healthcare providers without a standardized reference for managing such cases. However, the Ministry of Health, in collaboration with the Yerevan Municipality, launched the “Do Not Guess, Get Tested” campaign in 2020. This initiative offers free, anonymous, and rapid testing for HIV, syphilis, hepatitis B, and hepatitis C in all outpatient clinics across Yerevan, aimed to raise awareness and promote the early detection of these infections. Additionally, European guidelines on syphilis management provide recommendations for the diagnosis and treatment of syphilis across Europe, which could serve as a reference for improving national protocols [12,13]. In 2017, specialists from the NCD&STI published the Guideline for the Management of Sexually Transmitted Infections, which provides recommendations for diagnosing syphilis cases, including treatment, follow-up, and strategies for effective disease control and prevention. Currently, in 2025, the guideline is undergoing revision by NCD&STI specialists, and a draft version is available on the NHI website [14].

Previous research in Armenia has primarily focused on the epidemiology of syphilis, with studies indicating an increase in cases until the 2010s [15].

Syphilis remains a significant public health concern in Armenia; however, there is limited information on healthcare workers’ knowledge, attitudes, and practices (KAPs) regarding the disease. To date, no similar studies have been conducted in Armenia, making it difficult to develop effective health policies and improve treatment guidelines.

The current STI surveillance system in Armenia has shown that syphilis cases are often not referred to primary care physicians in a timely manner. These delays impact treatment, the prevention of further transmission, and increase the risk of adverse pregnancy outcomes,

including congenital syphilis. International evidence highlights that healthcare workers' awareness of and adherence to best practices play a crucial role in the early detection, prevention, and treatment of syphilis.

Unfortunately, there are several gaps in Armenia's approach to syphilis management, including the lack of a clear case definition and standardized laboratory diagnostic algorithm. Furthermore, there is no mandatory screening program for pregnant women, and standardized treatment guidelines, especially for managing syphilis during pregnancy, are absent. Additionally, training and continued education programs on syphilis for healthcare workers remain very limited.

Therefore, we aimed to assess the knowledge, attitudes, and practices of Armenian general practitioners regarding syphilis diagnosis and prevention, with the goal of identifying areas for improvement. This research can guide the development of effective public health policies and improve syphilis management in Armenia.

2. Materials and Methods

2.1. Study Design

Between December 2023 and February 2024, we surveyed general practitioners working in randomly selected healthcare facilities to assess their knowledge, attitudes, and practices regarding syphilis diagnosis and prevention.

2.2. Setting and Participants

We first selected the following 6 regions out of all 11 administrative regions of Armenia: Tavush, Armavir, Lori, Vayots Dzor, Shirak, and Yerevan (Appendix B, Map of Armenia). From the list of clinics operating in these regions, we randomly selected 24 outpatient clinics. Finally, we sent an online questionnaire (Appendix A) to physicians who were randomly selected from the employee registries of each clinic. Based on the sample size estimation, we aimed to recruit at least 386 physicians.

We included physicians employed at the selected outpatient clinics, actively consulting patients at the time of the study, who gave informed consent for the interview. We excluded respondents who did not sign the informed consent form and those who returned incomplete questionnaires.

2.3. Variables and Data Sources

The primary outcomes of the study included participants' knowledge, attitude, and practice (KAP) scores regarding syphilis. To assess these, we developed a questionnaire.

The questionnaire consisted of four parts. In the first part, the participants were asked to provide information about demographic variables (5 items), such as gender, age, work experience, region, and education. The second, third, and fourth parts assessed the following:

- Respondents' knowledge about the clinical picture of syphilis, including its definition, modes of transmission, risk groups, symptoms, potential complications if untreated, diagnostic practices (such as differential diagnosis), and reporting requirements (7 items).
- Respondents' attitudes toward syphilis prevention, diagnosis, and treatment, including their confidence in early diagnosis to prevent disease spread, the necessity of testing pregnant women, treatment options during pregnancy, ethical considerations regarding pregnancy termination, and the importance of treating sexual partners (5 items).
- Respondents' practices related to the diagnosis, management, and reporting of syphilis, including their familiarity with the diagnostic methods available at their medical insti-

tution, ability to interpret laboratory results, ordering additional tests based on rapid test outcomes, using clinical symptoms and disease stage to guide testing, consulting the Sexually Transmitted Disease Management Guide, and reporting diagnosed syphilis cases to the appropriate authorities (7 items).

Some of these questions were closed-ended, offering responses such as “Yes”, “No”, “I don’t want to answer”, and “Do not know”, while others were multiple choice, allowing the participants to select more than one option from the provided list [16].

2.4. Addressing Bias

Several efforts were made to minimize potential sources of bias. To ensure a representative sample of healthcare workers, we tried to randomly select eligible respondents. Participants’ responses were collected anonymously to reduce social desirability bias and encourage honest answers. Clear and simple instructions were provided with the questionnaire to reduce misinterpretation or misunderstanding, addressing potential information bias.

The same online questionnaire was used for all participants, ensuring consistency in data collection. Additionally, the phrasing of questions accounted for the limited or lack of prior postgraduate training of respondents. We designed the questionnaire to assess fundamental knowledge, attitudes, and practices that were relevant, regardless of prior training.

2.5. Quantitative Variables

Quantitative variables such as age, professional experience, and KAP scores were used in the analysis. Age was grouped into the following categories: <30, 30–39, 40–49, 50–59, and >60 years. Professional experience was categorized into <1 year, 1–5 years, 6–10 years, 11–15 years, and >16 years. For categorical variables, we considered factors such as sex, work department, and region. These were used to assess demographic differences in knowledge, attitudes, and practices. KAP scores were treated as continuous measures, but were also categorized as Poor, Moderate, or Good for comparative purposes.

2.6. Data Collection

At the start of the survey, physicians were informed about the survey’s primary objectives. They were assured that their participation was entirely anonymous and voluntary, that their responses would remain confidential, and that they could withdraw at any point without consequences. It was also clarified that no financial compensation would be provided, the data would only be used for the survey’s intended purposes, and submitting the completed questionnaire implied their informed consent. The survey took approximately 20 min to complete.

2.7. Data Analysis

We used MS Excel for data management (Microsoft Corporation, Redmond, WA, USA) and R software version 4.2.3 for analysis (R Foundation for Statistical Computing, Vienna, Austria). Continuous variables are summarized using mean and standard deviation, while categorical variables are presented as frequency and proportion. Knowledge, attitude, and practice scores were calculated by assigning 1 or 2 points for correct answers and 0 points for incorrect or unknown answers. Participants with missing data for the primary outcomes (knowledge, attitudes, and practice scores) were excluded from the corresponding analyses. This approach ensured that the main analyses were based on complete data for each outcome. The responses contributing to specific scores are summarized in Table 1.

Table 1. Domains for knowledge, attitudes, and practices with corresponding items, survey of general practitioners on syphilis prevention and diagnosis, Armenia, December 2023–February 2024.

Questionnaire Items by Domain	Possible Values for Score
Questions on knowledge on:	0–10
Type of disease	0, 1
Transmission	0, 1, 2
Symptoms	0, 1, 2
Risk factors	0, 1, 2
Prevention and treatment	0, 1
Diagnosis	0, 1
Complications	0, 1
Questions on attitudes towards prevention	0–5
Early diagnosis can prevent the spread of the disease	0, 1
Importance of testing of pregnant women	0, 1
Importance of treating syphilis during pregnancy	0, 1
Woman with syphilis should have pregnancy terminated	0, 1
Importance of treating the partner	0, 1
Questions on practices of diagnosis and management	0–10
List of diagnostic methods	0, 1, 2
Interpretation of syphilis laboratory results	0, 1, 2
Order additional laboratory tests based on the result of the rapid test	0, 1
Consultation on a suspected case of syphilis	0, 1
Order laboratory tests based on clinical symptoms and disease stage	0, 1
Use of the Sexually Transmitted Disease Management Guide	0, 1
Reporting of diagnosed syphilis	0, 1, 2

We interpreted the scores based on cut-off values of 0–<30% (Poor), 30–<70% (Moderate), and >70% (Good) (Table 2).

Table 2. Interpretation of scores on knowledge, attitudes, and practices, survey of general practitioners on syphilis prevention and diagnosis, Armenia, December 2023–February 2024.

Score Value Cut-Offs			Interpretation
For Knowledge	For Attitudes	For Practices	
0–2	0–1	0–2	Poor
3–6	2–3	3–6	Moderate
7–10	4–5	7–10	Good

To assess the differences in KAP scores across multiple independent groups (e.g., different medical specialties and years of experience) we used the Kruskal–Wallis test. To examine the relationship between practice and knowledge scores, we applied the Spearman correlation test [17]. At a 95% Confidence Interval, p -value < 0.05 was considered to be statistically significant.

3. Results

Of the 1413 PCPs contacted, 345 (83%) responded. Most participants (74%) worked in Yerevan. Their ages ranged from 19 to 75 years, with a median (IQR) of 46 years. In total, 256 (74%) were females. Most respondents (188; 54%) had >16 years of work experience. Most respondents, 163 (47%), were family doctors. The demographic characteristics of the respondents are summarized in Table 3.

Table 3. Characteristics of survey respondents, survey of general practitioners on syphilis prevention and diagnosis, Armenia, December 2023–February 2024.

Characteristic	Categories	N (%)
Gender	Female	256 (74)
	Male	89 (26)
Age group (years)	<30	51 (15)
	30–39	76 (22)
	40–49	86 (25)
	50–59	77 (22)
	>60	55 (16)
Work experience	<1 year	10 (2.9)
	1–5 years	69 (20)
	6–10 years	44 (13)
	11–15 years	34 (9.9)
	>16 years	188 (54)
Work department	Gynecological	59 (17)
	Therapeutic (family doctors)	163 (47)
	Surgical	47 (14)
	ICU	18 (5.2)
	Laboratory	44 (13)
	Other	7 (2.0)
	I don't want to answer	7 (2.0)
Work region	Armavir	19 (2.4)
	Lori	29 (8.4)
	Shirak	19 (5.5)
	Tavush	3 (0.9)
	Vayoc Dzor	21 (6.1)
	Yerevan	254 (74)

Table 4 presents the responses to the questions used to assess the participants' knowledge, attitudes, and practices regarding syphilis. While most respondents demonstrated a strong understanding of the clinical characteristics and complications of syphilis, significant knowledge gaps were observed in transmission modes, symptoms, and risk group identification. The respondents generally displayed a positive attitude toward syphilis prevention and management, particularly early diagnosis and partner treatment, though opinions on pregnancy-related decisions varied. While they were generally familiar with diagnostic methods and test interpretation, challenges remained in clinical management and adherence to guidelines (Table 4).

Answers to the questions with all possible responses are detailed in Appendix C.

Table 5 provides an analysis of the knowledge, attitude, and practice scores related to syphilis based on demographic and professional variables. No significant differences were observed in knowledge or attitude scores, except that male participants scored slightly higher for practices of syphilis diagnosis and management. Knowledge and attitude scores remained consistent across age groups, whereas practice scores improved significantly with age. While longer professional experience had no notable impact on knowledge or attitudes, it was associated with a slight improvement in practice scores. Additionally, gynecologists and family doctors demonstrated higher attitude and practice scores compared to other specialties. Significant regional differences were observed across all three domains, with Tavush and Vayots Dzor showing higher practice scores.

Table 4. Answers to individual questions on knowledge, attitudes, and practices associated with syphilis among primary care physicians. Survey of general practitioners on syphilis prevention and diagnosis, Armenia, December 2023–February 2024.

	Questions (N = 18)	No. (%) of Fully Correct Answers
Knowledge	What is syphilis?	341 (99)
	How is the disease transmitted?	29 (8.4)
	Who are the risk groups for the disease?	194 (56)
	What are the symptoms of the disease?	169 (49)
	If syphilis is not treated, can it cause complications?	341 (99)
	Is differential diagnosis performed in the diagnosis of syphilis?	256 (74)
	Is a diagnosis of syphilis a reason to complete an emergency reporting form?	240 (70)
Attitudes	How confident are you that early diagnosis of syphilis can prevent the spread of the disease?	334 (97)
	Do you think it is necessary to test pregnant women for syphilis?	323 (94)
	Do you think a patient can be treated for syphilis during pregnancy?	251 (73)
	Do you think that a pregnant woman with syphilis should have her pregnancy terminated?	225 (65)
	Do you think it is necessary to treat the partner as well?	336 (97)
Practices	Are you familiar with which diagnostic methods are used in your medical institution?	296 (86)
	Could you interpret syphilis laboratory results?	296 (86)
	Can you order additional laboratory tests for the patient based on the result of the rapid test?	253 (73)
	Have you ever consulted on a suspected case of syphilis?	149 (43.2)
	Do you order laboratory tests based on clinical symptoms and disease stage?	176 (51)
	For diagnosis, treatment, and any questions you may have, use the Sexually Transmitted Disease Management Guide.	187 (54)
	To whom do you report diagnosed syphilis at your healthcare facility?	229 (66)

Table 5. Mean scores of knowledge, attitudes, and practices (KAPs) associated with syphilis prevention and diagnosis by respondent characteristics. Survey of general practitioners on syphilis prevention and diagnosis, Armenia, December 2023–February 2024.

Variable	N	Knowledge Mean (SD)	<i>p</i> -Value	Attitudes Mean (SD)	<i>p</i> -Value	Practices Mean (SD)	<i>p</i> -Value
Overall score		6.8 ± 1.45		3.9 ± 1.15		3.6 ± 1.75	
Gender							
Female	256	7.3 ± 1.29	0.95	4.2 ± 0.98	0.98	4.0 ± 1.60	<0.05
Male	89	7.3 ± 1.37		4.3 ± 0.85		4.5 ± 1.64	
Age group (years)							
<30	51	7.5 ± 1.45	0.36	4.0 ± 0.99	0.37	3.8 ± 1.47	<0.05
30–39	76	7.5 ± 1.23		4.3 ± 0.75		4.4 ± 1.58	
40–49	86	7.4 ± 1.14		4.3 ± 1.00		4.0 ± 1.68	
50–59	77	7.1 ± 1.31		4.3 ± 1.00		4.0 ± 1.66	
>60	55	7.1 ± 1.47		4.2 ± 0.99		4.5 ± 1.61	

Table 5. Cont.

Variable	N	Knowledge Mean (SD)	p-Value	Attitudes Mean (SD)	p-Value	Practices Mean (SD)	p-Value
Work experience							
<1 year	10	6.9 ± 1.20		4.6 ± 0.69		4.6 ± 0.69	
1–5 years	69	7.5 ± 1.49	0.31	4.1 ± 0.98	0.14	4.1 ± 0.98	0.25
6–10 years	44	7.6 ± 1.07		4.2 ± 0.81		4.1 ± 0.80	
11–15 years	34	7.1 ± 1.14		4.3 ± 0.97		4.3 ± 0.29	
>16 years	188	7.3 ± 1.31		4.3 ± 0.97		4.3 ± 0.97	
Work department							
Gynecological	59	7.0 ± 1.34		4.5 ± 1.09		4.3 ± 1.69	
Therapeutic (family doctors)	163	7.4 ± 1.24		4.2 ± 0.90		4.2 ± 1.46	
Surgical	47	7.1 ± 1.33	0.28	4.1 ± 0.89	<0.05	3.9 ± 1.75	<0.05
ICU	18	7.4 ± 1.50		4.0 ± 0.84		3.7 ± 1.40	
Laboratory	44	7.4 ± 1.30		4.0 ± 0.93		3.5 ± 1.89	
Other	7	7.5 ± 1.27		4.8 ± 0.38		5.0 ± 1.53	
I don't want to answer	7	7.0 ± 1.71		4.2 ± 0.93		4.6 ± 1.46	
Work region							
Armavir	19	6.9 ± 0.78		4.6 ± 0.74		5.2 ± 0.99	
Lori	29	7.2 ± 1.38		4.3 ± 0.96		3.9 ± 2.15	
Shirak	19	6.5 ± 1.43	<0.05	3.8 ± 1.30	<0.05	4.2 ± 1.59	<0.05
Tavush	3	7.6 ± 2.00		5.0 ± 0.00		5.6 ± 0.57	
Vayoc Dzor	21	7.7 ± 0.80		4.4 ± 0.92		4.3 ± 1.45	
Yerevan	254	7.4 ± 1.32		4.2 ± 0.92		4.1 ± 1.59	

p-values calculated using Kruskal–Wallis test.

The majority of participants (56%) demonstrated a moderate level of knowledge regarding the clinical presentation of syphilis. More than half expressed a good attitude towards syphilis prevention. However, fewer than half (41%) displayed moderate practice scores for syphilis diagnosis and management (Table 6).

Table 6. Interpretation of scores for knowledge, attitudes, and practices associated with syphilis among primary care physicians. Survey of general practitioners on syphilis prevention and diagnosis, Armenia, December 2023–February 2024.

Variable	Poor (0–<30%) N (%)	Moderate (30–<70%) N (%)	Good (>70%) N (%)
Knowledge	84 (24)	193 (56)	68 (20)
Attitudes	69 (20)	95 (28)	181 (52)
Practices	106 (31)	143 (41)	96 (28)

The Spearman correlation test revealed a weak positive correlation between the knowledge and practice scores among physicians ($r = 0.23$, $p < 0.001$), suggesting that an increase in knowledge was associated with a slight improvement in practice.

Similarly, a weak positive correlation was found between knowledge and attitude scores ($r = 0.25$, $p < 0.001$), indicating that higher knowledge led to improved attitudes among physicians.

Additionally, a moderate positive correlation was observed between attitude and practice scores ($r = 0.38$). This suggests that more favorable attitudes towards syphilis prevention led to improved practices for syphilis diagnosis and management.

The p-value of 0.002 indicates that this relationship is also statistically significant.

4. Discussion

There have been no studies in Armenia examining the knowledge, attitudes, and practices of physicians regarding syphilis. Given the observed re-emergence of syphilis over the past decade, medical providers should be well-informed and proactive in identifying risk factors, testing at-risk populations, and providing appropriate treatment [18].

The participants demonstrated a strong understanding of the basic facts about syphilis and the potential complications of untreated cases. However, we identified significant gaps in their understanding of disease transmission and symptom recognition [19]. A previous survey among university students found that most had sufficient knowledge of HIV/AIDS, STIs, and transmission routes [20]. However, our respondents' understanding of risk groups was insufficient. This gap is particularly concerning, as proper knowledge of transmission routes is critical for effective prevention and patient counseling [21]. This finding aligns with other studies that have identified similar gaps in transmission knowledge among healthcare providers [22].

The PCPs generally demonstrated good attitudes toward syphilis prevention and management, recognizing the importance of early diagnosis and treatment for pregnant women and their partners. Most agreed on the necessity of treatment during pregnancy, aligning with established public health recommendations. However, more than half of the respondents believed that pregnancy should be terminated when syphilis is diagnosed. This reflects a harmful misconception, as appropriate treatment during pregnancy can effectively prevent congenital syphilis [23]. Such attitudes may stem from outdated training or cultural biases, highlighting the need for targeted educational interventions. Evidence from other regions suggests that improving provider attitudes toward maternal screening and treatment can significantly enhance pregnancy outcomes for both mothers and infants [24]. This underscores the urgency of specialized training to correct misconceptions and promote evidence-based clinical decision making.

Another important finding is that only half of the participants reported using "National guideline to the management of sexually transmitted infections", suggesting that nearly half of the respondents may not rely on standardized protocols for syphilis management. The underutilization of guidelines can negatively impact clinical decision making and patient outcomes, as adherence to evidence-based protocols is crucial for ensuring consistent and effective care. A previous study found that professionals' adherence to clinical practice guidelines decreased after more than one-year post-implementation in approximately half of cases [25]. Furthermore, while more than half of the PCPs knew where to report syphilis cases, a significant proportion lacked clarity on reporting procedures. This highlights the need to strengthen communication and reporting protocols to ensure accurate and timely surveillance, which is critical for planning and monitoring preventive programs and controlling syphilis outbreaks. A similar study conducted at Jubilee District Hospital demonstrated that doctors' knowledge and practices were suboptimal, emphasizing the need for training on the syndromic management of STIs to address this gap [26].

Significant regional disparities in KAP scores ($p < 0.05$) suggest unequal access to resources, training, and healthcare infrastructure. For instance, rural PCPs may have fewer opportunities for professional development compared to their urban counterparts. Tailored interventions, such as region-specific training programs or telemedicine initiatives, could help to bridge this gap and promote uniform standards across the country. Additionally, the higher attitude and practice scores in gynecological departments highlight the importance of context-specific training, particularly for physicians in other specialties who may encounter syphilis cases less frequently. This trend aligns with findings from other studies, where specialization and targeted experience positively influenced knowledge, attitudes, and practices [27,28].

Although no significant differences were found in the knowledge and attitude scores between male and female physicians, the higher practice scores among males raise questions about potential gender-related factors influencing clinical practice. Similarly, while age did not affect knowledge or attitudes, physicians over 60 years old demonstrated better practice scores. This finding suggests that experience may enhance certain practical skills but also highlights the need for ongoing training to maintain high clinical practice standards across all age groups. A study analyzing the management rates of sexually transmissible infections (STIs) by Australian general practitioners (GPs) from 2000 to 2012 found that female GPs and those under 60 years of age managed STIs better compared to their counterparts. This suggests that younger and female GPs may be more proactive or encounter more opportunities in diagnosing and treating STIs [29].

Interestingly, no significant differences in KAP scores were found based on work experience, indicating that experience alone may not predict better knowledge, attitudes, or practices regarding syphilis prevention, diagnosis, and management. This finding highlights the importance of structured training programs and continuous medical education (CME) initiatives. Ongoing education, regardless of gender or years in practice, is essential to maintaining high-quality care. Similar studies conducted in the Netherlands indicated that CME courses play a crucial role in enhancing healthcare professionals' knowledge and behavior concerning STI prevention and management [30].

The weak positive correlations between the PCPs' knowledge and practices and between knowledge and attitudes suggest that greater knowledge moderately improves attitudes and practices. However, the moderate correlation between the attitude and practice scores suggests that fostering positive attitudes may have a more substantial impact on clinical practices than knowledge alone. These results underscore the importance of integrating attitude-shaping strategies with knowledge dissemination efforts to achieve better clinical outcomes [31].

5. Limitations

This study had several limitations. First, the selection process led to a predominance of healthcare practitioners working in large cities. Their experience may not have been representative of all Armenian practitioners. We tried to prevent this selection bias by carefully carrying out the random selection of primary care clinics and practitioners within these clinics. The high response proportion indicates that our respondents may be a reasonable representation of our target population. Second, the self-administered online questionnaire may have led to distorted results, particularly concerning knowledge and practices. Practitioners might have felt embarrassed by their lack of knowledge on certain textbook facts or good practices, potentially cross-checking their responses with more experienced colleagues or online resources. We attempted to address this possible limitation by making the survey fully anonymous and providing a carefully crafted introduction explaining the purpose of the survey and how its results would be used in the future. Third, the scores in the three domains investigated (knowledge, attitudes, and practices) were not validated in the study population, so the reliability and validity of the intended measures were not established. Our intention was for these scores to reflect the spontaneous responses of Armenian physicians regarding their clinical practice and to inform the development of recommendations for improvement.

6. Conclusions

This study highlights both strengths and challenges in the management of syphilis among physicians in Armenia. While most physicians demonstrated moderate knowledge and moderate attitudes, significant gaps were found in the understanding of disease

transmission, underutilization of guidelines, and misconceptions about managing syphilis during pregnancy, which require urgent attention. Regional disparities may indicate unequal access to training and diagnostic resources. Our findings suggest that improving knowledge could lead to more meaningful improvements in both practices and attitudes.

7. Recommendations

We recommend implementing targeted continuous medical education (CME) programs for dermatologists, STI specialists, primary care providers (PCPs), and general practitioners to enhance their knowledge of syphilis management, including disease transmission, diagnosis, and treatment protocols. These programs should be designed to ensure that all physicians, especially those in underserved regions, have access to the most up-to-date information. Efforts should be made to encourage the use of existing syphilis management guidelines, with a focus on their integration into routine clinical practice. Additionally, awareness campaigns and training workshops should be organized to correct misconceptions about syphilis management during pregnancy, ensuring that physicians understand appropriate treatment protocols. Interventions should not only aim to increase knowledge, but also promote positive changes in clinical behaviors.

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Abbreviations

PCPs	Primary care physicians
CME	Continuous medical education
WHO	World Health Organization
NCD&STI	National Center for Disease Control and Sexually transmitted infections
KAPs	Knowledge, Attitudes, and Practices

STI Sexually transmitted infections
 GPs General practitioners
 NIH National Institute of Health
 MSM Men having sex with men
 HIV Human immunodeficiency virus

Appendix A. Questionnaire for the Health Worker

Interviewer's name/surname _____			
Date of interview		____/____/2024 <i>day month year</i>	
Country			
№	Question	Answer	Notes
Section 1: General Information			
101	Region	_____	
102	City/County		
103	Village		
Section 2: Information about the medical organization			
201	Your place of work/name of medical organization		
202	In which department do you work?	<input type="checkbox"/>	Therapeutic
		<input type="checkbox"/>	Surgical
		<input type="checkbox"/>	Resuscitation
		<input type="checkbox"/>	Urgent medical assistance
		<input type="checkbox"/>	Reception
		<input type="checkbox"/>	I don't want to answer
		<input type="checkbox"/>	Other _____
Section 3: Health Care Provider Information			
301	Your age (in years)	_____ years	
302	Gender	<input type="checkbox"/>	Male:
		<input type="checkbox"/>	Female
303	Your professional occupation.	<input type="checkbox"/>	Doctor/doctor laboratory technician
		<input type="checkbox"/>	Average medical staff/laboratory technician
		<input type="checkbox"/>	Sanitary
		<input type="checkbox"/>	Administrative staff
		<input type="checkbox"/>	Technical staff
		<input type="checkbox"/>	I don't want to answer
		<input type="checkbox"/>	Other _____
304	How much work experience do you have in this profession?	<input type="checkbox"/>	<1 year
		<input type="checkbox"/>	1–5 years
		<input type="checkbox"/>	6–10
		<input type="checkbox"/>	11–15
		<input type="checkbox"/>	>16

305	What is your highest level of education?	<input type="checkbox"/>	University graduate	
		<input type="checkbox"/>	Medium professional	
		<input type="checkbox"/>	Highest professional	
		<input type="checkbox"/>	I don't want to answer	
Section 4. Information about syphilis disease (You can choose several options)				
(Do not read the answers aloud)				
401	What is syphilis?	<input type="checkbox"/>	Infectious disease	Knowledge
		<input type="checkbox"/>	A non-infectious disease	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other-----	
402	How is the disease transmitted?	<input type="checkbox"/>	Household contact	Knowledge
		<input type="checkbox"/>	Alimentary	
		<input type="checkbox"/>	Airdrop	
		<input type="checkbox"/>	Biological fluids	
		<input type="checkbox"/>	From mother to child	
		<input type="checkbox"/>	Sexually	
		<input type="checkbox"/>	I don't know	
<input type="checkbox"/>	I don't want to answer			
403	Who are the risk groups for the disease?	<input type="checkbox"/>	Men having sex with men	Knowledge
		<input type="checkbox"/>	Pregnant women	
		<input type="checkbox"/>	Sex workers	
		<input type="checkbox"/>	Frequent partner changers	
		<input type="checkbox"/>	People with substance abuse issues	
		<input type="checkbox"/>	Dialysis patients	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other_____	
404	What are the symptoms of the disease?	<input type="checkbox"/>	Pain or sores at the site of infection	Knowledge
		<input type="checkbox"/>	Skin rash	
		<input type="checkbox"/>	Swollen lymph nodes	
		<input type="checkbox"/>	Subfebrile temperature (about 37 °C or slightly higher)	
		<input type="checkbox"/>	Multiple developing destructive lesions in various organs and systems	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other_____	
405	How confident are you that early diagnosis of syphilis can prevent the spread of the disease? (Read the answers)	<input type="checkbox"/>	I'm sure	Attitude
		<input type="checkbox"/>	I'm pretty sure	
		<input type="checkbox"/>	I doubt	
		<input type="checkbox"/>	I am not sure	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	

406	Are you familiar with which diagnostic methods are used in your medical institution? (You can choose several options)	<input type="checkbox"/>	Dark-field microscopy	Practices
		<input type="checkbox"/>	PCR	
		<input type="checkbox"/>	Non trepanemal rapid tests (RPR and VDRL)	
		<input type="checkbox"/>	Trepanemal rapid tests (FTA, TP-PA, EIA)	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	Other _____	
407	Could you interpret syphilis laboratory results?	<input type="checkbox"/>	Yes, no problem	Practices
		<input type="checkbox"/>	Yes, but need to use the guide	
		<input type="checkbox"/>	With difficulty	
		<input type="checkbox"/>	I cannot	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other _____	
408	Can you order additional laboratory tests for the patient based on the result of the rapid test?	<input type="checkbox"/>	Yes, no problem	Practices
		<input type="checkbox"/>	I cannot	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other _____	
409	Have you ever consulted on a suspected case of syphilis? (If "Yes" answer question 410)	<input type="checkbox"/>	Yes	Practices
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	Other _____	
410	Do you order laboratory tests based on clinical symptoms and disease stage?	<input type="checkbox"/>	Yes	Practices
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I cannot	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other _____	
411	For diagnosis, treatment, and any questions you may have, use the Sexually Transmitted Disease Management Guide.	<input type="checkbox"/>	Yes	Practices
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I cannot	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other _____	
412	Do you think it is necessary to test pregnant women for syphilis?	<input type="checkbox"/>	Yes	Attitudes
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I don't want to answer	
413	Do you think a patient can be treated for syphilis during pregnancy?	<input type="checkbox"/>	Yes, as soon as possible	Attitudes
		<input type="checkbox"/>	Yes, but after a while	
		<input type="checkbox"/>	No, shouldn't	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
414	Do you think that a pregnant woman with syphilis should have her pregnancy terminated?	<input type="checkbox"/>	Yes	Attitudes
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
415	Do you think it is necessary to treat the partner as well?	<input type="checkbox"/>	Yes	Attitudes
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other _____	

416	If syphilis is not treated, can it cause complications?	<input type="checkbox"/>	Yes	Knowledge
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
		<input type="checkbox"/>	Other _____	
417	Is differential diagnosis performed in the diagnosis of syphilis?	<input type="checkbox"/>	Yes	Knowledge
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
418	Is a diagnosis of syphilis a reason to complete an emergency reporting form?	<input type="checkbox"/>	Yes	Knowledge
		<input type="checkbox"/>	No	
		<input type="checkbox"/>	I don't know	
		<input type="checkbox"/>	I don't want to answer	
419	To whom do you report diagnosed syphilis at your health care facility?	<input type="checkbox"/>	National Center of Disease Control and Prevention MoH RA	Practices
		<input type="checkbox"/>	National Center of Burns and Dermatology MoH RA	
		<input type="checkbox"/>	To the dermatologist at my medical facility	
Thank you!				

Appendix B. Map of Armenia



Appendix C. Answers to Individual Questions with All Possible Responses on Knowledge, Attitudes, and Practices Associated with Syphilis Among Primary Care Physicians

	Question No.	Questionnaire Items by Domain	Values for Score		
			0 points No. (%)	1 point No. (%)	2 points No. (%)
Knowledge	401	What is syphilis?	4 (1)	341 (99)	-
	402	How is the disease transmitted?	45 (13)	271 (78.6)	29 (8.4)
	403	Who are the risk groups for the disease?	22 (6.4)	129 (37.4)	194 (56.2)
	404	What are the symptoms of the disease?	4 (1)	172 (49.1)	169 (48.9)
	4016	If syphilis is not treated, can it cause complications?	4 (1)	341 (99)	-
	417	Is differential diagnosis performed in the diagnosis of syphilis?	89 (25.8)	256 (74.2)	-
	418	Is a diagnosis of syphilis a reason to complete an emergency reporting form?	105 (30.4)	240 (69.6)	-
	Attitudes	405	How confident are you that early diagnosis of syphilis can prevent the spread of the disease?	11 (3.2)	334 (96.8)
412		Do you think it is necessary to test pregnant women for syphilis?	22 (6.4)	323 (93.6)	-
413		Do you think a patient can be treated for syphilis during pregnancy?	94 (27)	251 (73)	-
414		Do you think that a pregnant woman with syphilis should have her pregnancy terminated?	120 (34.8)	225 (65.2)	-
415		Do you think it is necessary to treat the partner as well?	9 (2.6)	336 (97.4)	-
Practices	406	Are you familiar with which diagnostic methods are used in your medical institution?	3 (0.9)	46 (13.3)	296 (85.8)
	407	Could you interpret syphilis laboratory results?	6 (1.7)	43 (12.5)	296 (85.8)
	408	Can you order additional laboratory tests for the patient based on the result of the rapid test?	92 (26.7)	253 (73.3)	-
	409	Have you ever consulted on a suspected case of syphilis?	196 (56.8)	149 (43.2)	-
	410	Do you order laboratory tests based on clinical symptoms and disease stage?	169 (48.9)	176 (51.1)	-
	411	For diagnosis, treatment, and any questions you may have, use the Sexually Transmitted Disease Management Guide.	158 (45.8)	187 (54.2)	-
	419	To whom do you report diagnosed syphilis at your healthcare facility?	116 (33.6)	229 (66.4)	-

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