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Prevalence of syphilis infection among migrant workers in Qatar: a nationwide cross-sectional survey

Gheyath K Nasrallah,[1,2] Hiam Chemaitelly ,[3,4] Ahmed Ismail Ahmed Ismail ,[5] Duaa W Al-Sadeq,[1] Fathima H Amanullah,[1,2] Jawaher A Al-Emadi,[1] Hadiya M Khalid,[1,2] Parveen B Nizamuddin,[1,2] Ibrahim Al-Shaar,[5] Ibrahim W Karimeh,[5] Mutaz M Ali,[5] Houssein H Ayoub ,[6] Sami Abdeen,[7] Ashraf Abdelkarim,[7] Faisal Daraan,[8] Ahmed Ibrahim Hashim Elhaj Ismail,[8] Nahid Mostafa,[8] Mohamed Sahl,[7,8] Jinan Suliman,[7] Elias Tayar ,[7] Hasan Ali Kasem,[9] Meynard J A Agsalog,[9] Bassam K Akkarathodiyil,[9] Ayat A Alkhalaf,[9] Mohamed Morhaf M H Alakshar,[9] Abdulsalam Ali A H Al-Qahtani,[9] Monther H A Al-Shedifat,[9] Anas Ansari,[9] Ahmad Ali Ataalla,[9] Sandeep Chougule,[9] Abhilash K K V Gopinathan,[9] Feroz J Poolakundan,[9] Sanjay U Ranbhise,[9] Saed M A Saefan,[9] Mohamed M Thaivalappil,[9] Abubacker S Thoyalil,[9] Inayath M Umar,[9] Einas Al Kuwari,[7] Peter Coyle,[1,7,10] Andrew Jeremijenko,[7] Anvar Hassan Kaleeckal,[7] Hanan F Abdul Rahim ,[11] Hadi M Yassine,[1,2] Asmaa A Al Thani,[1,2] Odette Chaghoury,[7] Mohamed Ghaith Al-Kuwari ,[12] Elmoubasher Farag,[8] Roberto Bertollini,[8] Hamad Eid Al Romaihi,[8] Abdullatif Al Khal,[7] Mohammed H Al-Thani,[8] Laith J Abu-Raddad [3,4,11,13]

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For numbered affiliations see end of article.

Correspondence to
Dr Gheyath K Nasrallah; gheyath.nasrallah@qu.edu.qa and
Dr Laith J Abu-Raddad; lja2002@qatar-med.cornell.edu

ABSTRACT

Objectives Scant data are available on syphilis infection within migrant populations worldwide and in the population of the Middle East and North Africa region. This study investigated the prevalence of both lifetime and recent syphilis infections among migrant craft and manual workers (MCMWs) in Qatar, a diverse demographic representing 60% of the country's population.

Methods Sera specimens collected during a nationwide cross-sectional survey of SARS-CoV-2 seroprevalence among the MCMW population, conducted between 26 July and 9 September 2020, were analysed. *Treponema pallidum* antibodies were detected using the Mindray CL-900i Chemiluminescence Immunoassay Analyzer. To differentiate recent infections, rapid plasma reagin (RPR) testing was performed, with an RPR titre of ≥1:8 considered indicative of recent infection. Logistic regression analyses were employed to identify factors associated with lifetime syphilis infection. Sampling weights were incorporated into all statistical analyses to obtain population-level estimates.

Results *T. pallidum* antibodies were identified in 38 of the 2528 tested sera specimens. Prevalence of lifetime infection was estimated at 1.3% (95% CI 0.9% to 1.8%). Among the 38 treponemal-positive specimens, 15 were reactive by RPR, with three having titres ≥1:8, indicating recent infection. Prevalence of recent infection was estimated at 0.09% (95% CI 0.01 to 0.3%). Among treponemal-positive MCMWs, the estimated proportion with recent infection was 8.1% (95% CI: 1.7 to 21.4%). The adjusted OR for lifetime infection increased with age, reaching 8.68 (95% CI 2.58 to 29.23) among those aged ≥60 years compared with those ≤29 years of age. Differences in prevalence were observed by nationality and occupation, but no differences were found by educational attainment or geographic location.

Conclusions Syphilis prevalence among MCMWs in Qatar is consistent with global levels, highlighting a disease burden with implications for health and social well-being. These findings underscore the need for programmes

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study was conducted on a large, nationally representative sample and on a population representing 60% of Qatar's total population.
⇒ The study assessed the prevalence of both lifetime and recent syphilis infections and investigated associations with lifetime infection.
⇒ Syphilis diagnosis is inherently complex due to the lack of precise and direct diagnostic tools for current infection, potentially leading to an underestimation of the prevalence of recent infection.
⇒ Although the study was designed to employ a probability-based sampling approach, logistical challenges necessitated the adoption of a systematic sampling method.
⇒ The study did not have access to participants' medical records and did not collect sexual behaviour data, limiting the ability to associate infection with clinical histories and sexual behaviour.

addressing both sexually transmitted infections and the broader sexual health needs of this population.

INTRODUCTION

Syphilis, a common sexually transmitted infection (STI), is caused by the spirochete *Treponema pallidum*.[1] The initial stages of infection often present with mild and easily overlooked symptoms.[2] Left untreated, syphilis can inflict damage on the nervous and reproductive health systems, potentially leading to serious or fatal outcomes.[1 3] The primary mode of syphilis transmission is through sexual contact,[1 3] but it can also be transmitted from mother to child during pregnancy or childbirth, resulting in congenital syphilis—a significant contributor to global foetal and neonatal morbidity and mortality.[4 5] The asymptomatic nature of the infection in a substantial proportion of cases complicates its control.[1]

The WHO estimated 6.3 million new cases in 2016, with the majority occurring in low- and middle-income countries.[6] The WHO's Global Health Sector Strategy on STIs for 2022–2030 aims to decrease the overall incidence of syphilis by 90% and the incidence of congenital syphilis to less than 50 cases per 100 000 live births by 2030.[7] Monitoring progress towards these global targets necessitates a regular assessment of syphilis prevalence in the population.

Qatar, situated in the Arabian Peninsula, has a unique demographic profile. Only 9% of its residents are aged 50 or older, and a significant 89% are expatriates hailing from more than 150 countries.[8] Among these residents, about 60% comprise migrant craft and manual workers (MCMWs), predominantly single men aged 20–49, working in large-scale development projects such as those associated with the World Cup 2022.[9 10] Against a backdrop of poorly documented STI prevalence levels in migrant populations[11 12] and in the Middle East and North Africa region,[13 14] the primary objective of this study was to evaluate the prevalence of both lifetime and recent syphilis infections among the expatriate MCMW population, a predominant segment of Qatar's population, with the aim of providing insights for national health policy planning.

METHODS

Study design and sampling

This study examined blood sera specimens collected from MCMWs during a nationwide serological survey conducted between 26 July 2020 and 9 September 2020.[9 15–17] The survey aimed to determine the seroprevalence of SARS-CoV-2 infection among the MCMW population,[9] which was identified as the population group most affected by the first SARS-CoV-2 infection wave in Qatar.[8 18]

A sampling strategy for the MCMW population was formulated through an analysis of the registered users' database of the Qatar Red Crescent Society (QRCS), the primary healthcare provider for MCMWs in the country.[9] QRCS oversees four strategically located centres, specifically designed to cater to the MCMW population across the country. These centres operate extended hours, are situated in areas where workers reside and provide services either free of charge or with substantial subsidies, ensuring accessibility and affordability. To ensure sample representativeness, the probability distribution of MCMWs by age and nationality from the QRCS database was compared with that of expatriate residents from the Ministry of Interior database.[19]

Given that men constitute the overwhelming majority of MCMWs (>99%),[20] the sampling strategy did not explicitly account for sex. The recruitment of MCMWs was conducted at the QRCS centres using a systematic sampling approach, guided by the average daily attendance at each centre.[9] The recruitment process at each centre involved inviting every fourth attendee to participate in the study until the required sample size was achieved across all age and nationality strata. To overcome challenges in recruiting participants in smaller age-nationality strata, especially among younger individuals of certain nationalities, the recruitment criteria were adjusted towards the end of the study. In these instances, all attendees in these strata were invited to participate, rather than every fourth attendee.

Sample collection and handling

Trained interviewers collected written informed consent and the study instrument from participants, using any of nine languages: Arabic, Bengali, English, Hindi, Nepali, Sinhala, Tagalog, Tamil and Urdu, depending on the participant's language preference.[9] The instrument, designed in accordance with WHO guidance for developing SARS-CoV-2 sero-epidemiological surveys,[21] gathered essential sociodemographic information. Certified nurses drew a 10-mL blood sample for serological testing, which was then stored in an icebox before transportation to the Qatar Biobank for subsequent testing and long-term storage.

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of our research.

Laboratory methods

A 150 µL aliquot of serum was extracted from the stored serum specimens at the Qatar Biobank and then transferred to the virology laboratory at Qatar University for serological testing. The sera at both the Qatar Biobank and Qatar University were maintained at −80°C until used for serology testing. Lifetime syphilis infection (indicating ever having been infected with syphilis) was determined by testing sera for *T. pallidum* antibodies using the automated Mindray CL-900i Chemiluminescence Immunoassay Analyzer (Mindray Bio-Medical Electronics, Shenzhen, China).[22 23]

The testing results were interpreted in accordance with the manufacturer's guidelines. Sera were categorised as negative if index values were <1.00 and positive if index values were ≥2.00. Intermediate values (1.00 ≤index values <2.00) were considered equivocal and underwent centrifugation, followed by duplicate retesting using the same kit. Specimens with values <1.00 in both retests were classified as negative, while those with values≥1.00 in either of the retests were considered positive.

Positive specimens were subsequently subjected to rapid plasma reagin (RPR) testing at the Laboratory Section of the Medical Commission Department of the Ministry of Public Health. RPR testing was done using the RPR Carbon Antigen kit (Fortress Diagnostics Limited, UK)[24] where titres ≥1:8 were deemed indicative of a recent (within a year) syphilis infection.[25 26] Detailed methods for the RPR testing and the quality control/quality assurance procedures can be found in online supplemental section S1.[24 27]

In this study, the test results were interpreted to distinguish recent from lifetime infection, with no utilisation of terms such as active, latent or secondary syphilis. This approach was adopted due to the study's emphasis on the epidemiology of the infection rather than clinical interpretation, taking into account that the assays employed assess seroreactivity against syphilis rather than the actual presence of the pathogen.

Oversight

This study received approval from the Institutional Review Boards of Hamad Medical Corporation (MRC 05 133), Qatar University (QU-IRB 1558-EA/21) and Weill Cornell Medicine-Qatar (21–00002). The reporting of the study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines, as detailed in online supplemental table S1.

Statistical analysis

The characteristics of study participants were described through frequency distributions and measures of central tendency. To address the unequal selection of participants and ensure the sample's representativeness of the broader MCMW population, probability weights were applied to all statistical analyses. These weights were calculated based on the population distribution of MCMWs by age, nationality and QRCS centre, as obtained from the QRCS registered-user database.[9]

The weighted prevalence of lifetime syphilis infection in the study population was estimated. The weighted prevalence of recent syphilis infection was also calculated, applying logistic regression-based multiple imputations with 1000 iterations. This imputation process addressed a single treponemal-positive specimen that had sufficient sera for *T. pallidum* antibody testing using the Mindray CL-900i Chemiluminescence Immunoassay Analyzer but lacked enough sera for RPR testing. This method predicted the missing value based on the characteristics of participants with treponemal-positive specimens and complete RPR test results. The imputed dataset was also used to calculate the proportion of recent infections among treponemal-positive MCMWs.

A histogram was employed to visually depict the distribution of index values assessing *T. pallidum* antibodies in sera among the treponemal-positive specimens. The association between the *T. pallidum* antibody index value and the RPR titres was examined using the Spearman correlation coefficient.

Associations with lifetime syphilis infection were explored through χ^2 tests and bivariable logistic regression analyses. Variables with a p value ≤0.2 in the bivariable regression analysis were included in the multivariable model. A p value<0.05 in the multivariable analysis was considered indicative of a statistically significant association. The sampling probability weights were applied in the regression analyses. The study reported unadjusted and adjusted odds ratios (ORs and AORs, respectively), along with their respective 95% CIs and p values. Interactions were not considered in this analysis. Associations with recent syphilis infection could not be explored due to the limited number of cases. All statistical analyses were conducted using Stata/SE V.18.0 (Stata Corporation, College Station, TX, USA).

RESULTS

Study population

Table 1 describes the characteristics of study participants. Out of the 2641 blood specimens collected from MCMWs during the original SARS-CoV-2 survey,[9] only 2528 (95.7%) retained sufficient sera for syphilis testing and were consequently included in the study.

More than two-thirds of the study participants (69.3%) were below 40 years of age (table 1), with a median age of 35.0 years (IQR: 29.0–43.0 years). Educational attainment for 42.7% of participants was at intermediate or lower levels, and for 44.3%, it was at the high school or vocational training level. The most common nationality groups were Indians (29.4%), Bangladeshis (26.0%) and Nepalese (21.8%), aligning with the broader nationality distribution of the MCMW population in Qatar.[19] Among study participants, 53.6% were engaged in technical and construction roles, encompassing occupations such as carpenters, crane operators, electricians, masons, mechanics, painters, plumbers and welders.

Lifetime syphilis infection

Out of the 2528 sera specimens tested, 38 were positive for *T. pallidum* antibodies (table 1). The estimated prevalence of lifetime syphilis infection among MCMWs was 1.3% (95% CI 0.9% to 1.8%). *T. pallidum* antibody index values in positive specimens ranged from 1.05 to 21.18 (online supplemental figure S1), with a median of 9.30 (IQR: 2.44–13.39).

Table 1 outlines the prevalence of lifetime syphilis infection across various population characteristics. The prevalence increased with age, reaching its highest at

Table 1 Characteristics of study participants and prevalence of lifetime syphilis infection among the craft and manual worker population in Qatar

Characteristics	Total tested	Lifetime syphilis infection		
	N (%*)	N	%† (95% CI†)	χ^2 p value
Age (years)				
≤29	719 (27.4)	7	0.8 (0.4 to 1.8)	0.001
30–39	940 (41.9)	8	0.9 (0.5 to 1.8)	
40–49	534 (21.6)	14	2.2 (1.3 to 3.9)	
50–59	249 (7.4)	4	1.4 (0.5 to 4.0)	
60+	86 (1.7)	5	6.6 (2.7 to 15.3)	
Nationality				
Bangladeshi	603 (26.0)	7	0.9 (0.4 to 2.1)	0.047
Egyptian	86 (3.1)	1	1.5 (0.2 to 9.6)	
Filipino	99 (2.7)	1	0.3 (0.05 to 2.4)	
Indian	699 (29.4)	7	1.1 (0.5 to 2.3)	
Nepalese	552 (21.8)	7	1.1 (0.5 to 2.4)	
Pakistani	132 (4.9)	4	2.2 (0.8 to 6.2)	
Sri Lankan	138 (4.7)	2	0.8 (0.2 to 4.0)	
All other nationalities‡	219 (7.4)	9	4.0 (2.0 to 7.7)	
QRCS centre (catchment area within Qatar)				
Fereej Abdel Aziz (Doha-East)	558 (22.1)	9	1.3 (0.7 to 2.7)	0.525
Zekreet (North-West)	234 (2.3)	6	2.5 (1.1 to 5.5)	
Hemaila (South-West; 'Industrial Area')	942 (42.3)	12	1.2 (0.7 to 2.1)	
Mesaimeer (Doha-South)	794 (33.3)	11	1.4 (0.8 to 2.5)	
Educational attainment				
Primary or lower	611 (24.8)	9	1.4 (0.7 to 2.8)	0.187
Intermediate	416 (17.9)	11	1.9 (1.0 to 3.6)	
Secondary/high school/vocational	1058 (44.3)	14	1.3 (0.8 to 2.3)	
University	348 (12.9)	3	0.4 (0.1 to 1.5)	
Occupation				
Professional workers§	126 (4.6)	1	0.7 (0.1 to 4.8)	0.110
Food and beverage workers	85 (3.0)	0	0.0 (0.0 to 0.0)	
Administration workers	79 (3.0)	1	1.6 (0.2 to 10.7)	
Retail workers	162 (6.5)	0	0.0 (0.0 to 0.0)	
Transport workers	410 (16.1)	11	2.3 (1.2 to 4.2)	
Security workers	57 (2.3)	0	0.0 (0.0 to 0.0)	
Cleaning workers	102 (4.0)	0	0.0 (0.0 to 0.0)	
Technical and construction workers¶	1290 (53.6)	19	1.2 (0.7 to 2.0)	
Other workers**	168 (6.8)	5	2.9 (1.2 to 6.8)	
Total (%, 95% CI)	**2528 (100.0)**	**38**	**1.3 (0.9 to 1.8)**	**--**

*Percentage of the sample weighted by age, nationality, and QRCS centre. Missing values for sociodemographic variables were excluded from the analysis.
†Percentage of positive out of the sample weighted by age, nationality and QRCS centre. 95% CIs estimated using binomial distribution.
‡Includes all other nationalities of craft and manual workers residing in Qatar.
§Includes architects, designers, engineers, operation managers and supervisors among other professions.
¶Includes carpenters, construction workers, crane operators, electricians, foremen, maintenance/air conditioning/cable technicians, masons, mechanics, painters, pipe-fitters, plumbers and welders among other professions.
**Includes barbers, firefighters, gardeners, farmers, fishermen and physical fitness trainers among other professions
QRCS, Qatar Red Crescent Society.

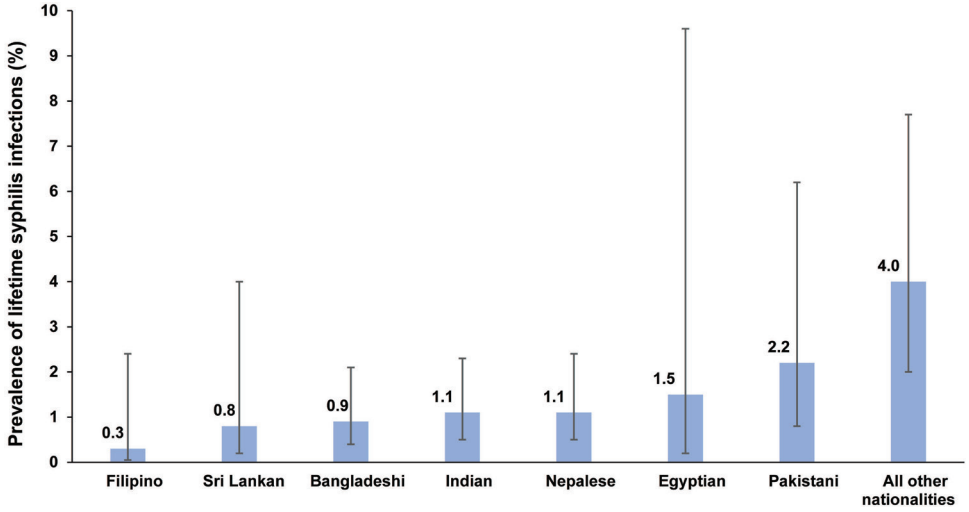

Figure 1 Prevalence of lifetime syphilis infection by nationality group among the craft and manual worker population in Qatar.

6.6% (95% CI 2.7 to 15.3%) for those aged ≥60 years. Variations in prevalence were observed by nationality, ranging from 0.3% (95% CI 0.05 to 2.4%) in Filipinos to 4.0% (95% CI 2.0 to 7.7%) in the group comprising all other nationalities (figure 1). Among different occupations, transport workers exhibited the highest prevalence at 2.3% (95% CI 1.2 to 4.2%).

Table 2 reports the associations with lifetime syphilis infection. The AOR exhibited an increase with age, reaching 3.28 (95% CI 1.21 to 8.86) among MCMWs aged 40–49 years and 8.68 (95% CI 2.58 to 29.23) among those aged ≥60 years, in comparison to those ≤29 years of age. The differences by nationality did not attain statistical significance, except for the group encompassing all other nationalities, where the AOR, compared with Filipinos, was 14.1 (95% CI 1.67 to 118.76). While the differences by occupation did not reach statistical significance, the AOR among transport workers, compared with professional, administration and retail workers, was 4.18 (95% CI 0.88 to 19.74), with the difference being of borderline statistical significance. No evidence for differences was found by educational attainment or by QRCS centre (proxy of catchment area/geographic location).

Recent syphilis infection

Out of the 38 treponemal-positive specimens, 15 were reactive by RPR, as detailed in table 3, but one specimen lacked sufficient sera for RPR testing. Among the 15 RPR-reactive specimens, only three had titres ≥1:8, indicating recent syphilis infection. The prevalence of recent syphilis infection among MCMWs was estimated, incorporating multiple imputations to adjust for the single treponemal-positive specimen with inadequate sera at 0.09% (95% CI 0.01 to 0.3%).

Among treponemal-positive MCMWs, the estimated proportion with recent infection was 8.1% (95% CI 1.7 to 21.4%). The Spearman correlation coefficient between the *T. pallidum* antibody index value and the RPR titres was 0.48 (95% CI 0.21 to 0.75; p value: 0.003).

DISCUSSION

The estimated prevalence of lifetime syphilis infection among the MCMW population was 1.3%, while that of recent syphilis infection was estimated at 0.1%. The prevalence of lifetime infection exhibited an increase with age, aligning with expectations for a measure of cumulative exposure. There was evidence of variability in prevalence among different nationality groups and occupations within this diverse MCMW population. Interestingly, there was compelling evidence of an association between the *T. pallidum* antibody index value and the RPR titres, supported by a Spearman correlation coefficient of approximately 0.5.

The observed prevalence levels are overall consistent, though lower, than the estimated global prevalence of 0.6% for recent syphilis infection,[6 28 29] and a recent systematic review and meta-analysis that estimated the prevalence at 0.5% in the general population of the Middle East and North Africa.[30] It is important to note methodological variations in defining current or recent syphilis infection across studies.[26 29–31] In our study, we applied a stringent definition for recent infection, requiring RPR titres ≥1:8.[25 26] However, individuals with lower titres, or even non-reactive titres, may still have experienced a recent infection.[25 31] Individuals with very recent infections may not test positive in both treponemal and non-treponemal tests,[31] potentially leading to missing infections in individuals who have not yet developed antibodies. However, the latter is unlikely to appreciably impact the prevalence estimates. Of note, some individuals with titres ≥1:8 may have also had an earlier non-recent infection that was treated but remained serologically non-responsive, resulting in persistently high RPR titres (serofast state after treatment).[31 32]

The observed cases of recent syphilis infection indicate recent sexual activity among some members of the MCMW population. Since these migrants are typically single and if married, their wives are not residing with

Table 2 Associations with lifetime syphilis infection

Characteristics	Bivariable regression analysis			Multivariable regression analysis	
	OR* (95% CI*)	P value	F test p value†	AOR* (95% CI*)	P value‡
Age (years)					
≤29	1.00		0.003	1.00	
30–39	1.08 (0.38 to 3.08)	0.887		1.27 (0.43 to 3.72)	0.669
40–49	2.67 (1.01 to 7.09)	0.048		3.28 (1.21 to 8.86)	0.019
50–59	1.63 (0.42 to 6.29)	0.475		2.04 (0.56 to 7.45)	0.283
60+	8.34 (2.46 to 28.31)	0.001		8.68 (2.58 to 29.23)	<0.001
Nationality					
Filipino§	1.00		0.054	1.00	
Bangladeshi	2.80 (0.33 to 23.60)	0.006		3.04 (0.35 to 26.14)	0.311
Egyptian	4.41 (0.27 to 72.00)	0.332		4.34 (0.27 to 68.58)	0.297
Indian	3.36 (0.41 to 27.72)	0.018		3.26 (0.38 to 27.57)	0.279
Nepalese	3.30 (0.39 to 27.96)	0.012		3.01 (0.34 to 26.79)	0.323
Pakistani	6.68 (0.70 to 63.24)	0.016		5.01 (0.52 to 48.57)	0.164
Sri Lankan	2.38 (0.18 to 31.16)	0.342		2.12 (0.16 to 28.44)	0.570
All other nationalities¶	12.44 (1.53 to 100.99)	0.070		14.1 (1.67 to 118.76)	0.015
QRCS centre (catchment area within Qatar)					
Fereej Abdel Aziz (Doha-East)	1.00		0.494	-	--
Zekreet (North-West)	1.88 (0.64 to 5.50)	0.250		-	--
Hemaila (South-West; 'Industrial Area')	0.86 (0.35 to 2.13)	0.747		-	-
Mesaimeer (Doha-South)	1.02 (0.41 to 2.57)	0.964		-	-
Educational attainment				-	-
Primary or lower	1.00		0.227	-	-
Intermediate	1.35 (0.51 to 3.54)	0.541		-	-
Secondary/high school/vocational	0.96 (0.39 to 2.34)	0.921		-	-
University	0.29 (0.07 to 1.27)	0.099		-	-
Occupation					
Professional, administration and retail workers**	1.00		0.180	1.00	
Transport workers	4.84 (1.02 to 23.02)	0.047		4.18 (0.88 to 19.74)	0.071
Technical and construction workers††	2.53 (0.56 to 11.44)	0.227		2.79 (0.61 to 12.75)	0.186
Other workers‡‡	3.20 (0.60 to 17.14)	0.175		2.56 (0.44 to 14.83)	0.295

*Estimates weighted by age, nationality and QRCS centre.
†Covariates with p value ≤0.2 in the bivariable analysis were included in the multivariable analysis.
‡Covariates with p value <0.05 in the multivariable analysis were considered to provide statistically significant evidence for an association with antibody positivity.
§Filipino was selected as the reference group due to Filipinos having the lowest prevalence of lifetime syphilis infection.
¶Includes all other nationalities of craft and manual workers residing in Qatar.
**Includes architects, designers, engineers, operation managers and supervisors among other professions.
††Includes carpenters, construction workers, crane operators, electricians, foremen, maintenance/air conditioning/cable technicians, masons, mechanics, painters, pipe-fitters, plumbers and welders among other professions.
‡‡Includes security workers, cleaning workers, barbers, firefighters, gardeners, farmers, fishermen and physical fitness trainers among other professions.
AOR, adjusted OR; QRCS, Qatar Red Crescent Society.

them in Qatar, this may suggest the presence of sexual risk behaviours leading to the acquisition of STIs. This inference may also be supported by the considerable seroprevalence of herpes simplex virus type 2 in the same population, as observed in our recent study,[15] which is higher than that observed in other populations in

Table 3 Results of the rapid plasma reagin (RPR) testing among *Treponema pallidum* antibody-positive individuals

Specimen	*T. pallidum* antibody index value (treponemal test)	RPR test result (non-treponemal test)	RPR test titres	Interpretation of RPR test result
1	1.05	Non-reactive	--	Lifetime infection
2	1.12	Reactive	1:2	Lifetime infection
3	1.17	Non-reactive	--	Lifetime infection
4	1.26	Non-reactive	--	Lifetime infection
5	1.31	Non-reactive	--	Lifetime infection
6	1.48	Non-reactive	--	Lifetime infection
7	1.66	Non-reactive	--	Lifetime infection
8	1.92	Non-reactive	--	Lifetime infection
9	2.11	Non-reactive	--	Lifetime infection
10	2.44	Non-reactive	--	Lifetime infection
11	3.06	Reactive	1:2	Lifetime infection
12	3.08	Non-reactive	--	Lifetime infection
13	3.25	Non-reactive	--	Lifetime infection
14	3.9	Non-reactive	--	Lifetime infection
15	5.55	Reactive	1:4	Lifetime infection
16	6.86	Non-reactive	--	Lifetime infection
17	8.25	Non-reactive	--	Lifetime infection
18	8.66	Non-reactive	--	Lifetime infection
19	9.23	Reactive	1:4	Lifetime infection
20	9.36	Reactive	1:1	Lifetime infection
21	10.26	Non-reactive	--	Lifetime infection
22	12.05	Non-reactive	--	Lifetime infection
23	12.17	Reactive	1:1	Lifetime infection
24	12.21	Reactive	1:2	Lifetime infection
25	12.85	Reactive	1:4	Lifetime infection
26	12.91	Non-reactive	--	Lifetime infection
27	12.98	Reactive	1:2	Lifetime infection
28	13.04	Non-reactive	--	Lifetime infection
29	13.39	Non-reactive	--	Lifetime infection
30	13.61	Reactive	1:4	Lifetime infection
31	13.73	Reactive	1:64	Recent infection
32	14.14	Non-reactive	--	Lifetime infection
33	14.82	Non-reactive	--	Lifetime infection
34	14.84	Reactive	1:4	Lifetime infection
35	14.94	Reactive	1:1	Lifetime infection
36	15.15	Reactive	1:8	Recent infection
37	15.63	Reactive	1:8	Recent infection
38	21.18	Specimen did not have sufficient serum to conduct RPR testing	--	--

Qatar and the Middle East and North Africa region.[33–35] However, the specific nature of sexual behaviours and networking within this population remains unexplored. Despite the observed levels of infection, STIs among this population remain unaddressed and inadequately documented, reflecting the limited availability of sexual health and STI programmes.[11 13 36–38]

Limited STI screening among this population could result in a large number of undetected cases, particularly because a large fraction of STI infections are

asymptomatic, making infected individuals unlikely to seek testing and treatment in the absence of symptoms.[29 30 38] Untreated, these infections may persist for extended periods, increasing the risk of health complications and transmission.[29 30 38] The study findings thus emphasise the need to implement programmes addressing STIs in this population and to meet their broader sexual health needs. Furthermore, the results indicate that enhanced efforts are needed for Qatar to achieve the WHO's target of a 90% reduction in syphilis incidence by 2030.[7]

This study has limitations. Due to limitations in the availability of sera specimens allocated for this study and other logistical challenges, the testing algorithm used a single treponemal test followed by a non-treponemal test for only treponemal-positive specimens. The study did not implement a reverse sequence syphilis screening algorithm,[31] which would involve a second treponemal assay to test treponemal-positive specimens with a non-reactive RPR result or a reactive RPR result but with titres <1:8. Individuals with non-reactive RPR results and those with titres <1:8 may still have had a recent infection that could not be identified using the study's diagnostic methods. Also, due to limitations in the availability of sera specimens and other logistical challenges, the prozone phenomenon[39]—which can result in false-negative RPR test results—was not ruled out for treponemal-positive RPR-negative specimens. Overall, the study might have underestimated the prevalence of recent infection.

However, an internal validation of assays at the Laboratory Section of the Medical Commission Department (not shown) indicated 100% agreement between the Mindray CL-900i Chemiluminescence Immunoassay Analyzer and the treponemal Chemiluminescent Microparticle Immunoassay test (Architect Syphilis TP; Abbott, Germany). This validation helps reduce the likelihood of false-positive or false-negative test results when using the Mindray CL-900i Chemiluminescence Immunoassay Analyzer.

Some of the migrants originated from countries where non-venereal treponematoses, such as yaws, bejel, and pinta, were endemic.[40] Consequently, the prevalence of lifetime syphilis infection may have been overestimated due to the cross-reactivity of syphilis serological diagnostics with antibodies against these infections.[40 41] It is also unclear whether SARS-CoV-2 antibody positivity could affect the outcome of RPR testing for the specific assay used in this study.[42]

Although the initial study design was intended to employ a probability-based sampling approach for the MCMW population, logistical challenges led to the adoption of a systematic sampling method targeting QRCS attendees. To address this shift, probability-based weights were incorporated in an effort to generate an estimate representative of the broader MCMW population. In order to ensure representation of smaller age-nationality strata, all individuals in these strata were approached to participate towards the conclusion of the study, deviating from the initial plan of selecting only every fourth attendee.

Operational challenges presented difficulties in tracking and maintaining consistent logs of the response rate by the nurses in the QRCS centres. Consequently, an exact estimate of the response rate could not be determined, although it was approximated based on the interviewers' experience to exceed 90%. While there is a possibility that the recruitment scheme might have influenced the generalisability of the study findings, this is deemed less likely given that MCMWs frequent these centres at a high volume, surpassing 5000 patients per day, and these centres serve as the primary healthcare providers specifically for MCMWs in the country.[9] MCMWs also use these centres for various services beyond illness, including periodic health certifications, vaccinations, and pretravel SARS-CoV-2 testing.

The study did not have access to the medical records of participants, limiting the ability to obtain information about their prior diagnosis and treatment of syphilis. Only basic sociodemographic variables were collected, excluding sexual behaviour data, in context of the challenging nature of collecting such information in this culturally conservative setting.[14 43 44] However, this difficulty underscores the relevance of using STI prevalence as a proxy biomarker to assess population sexual risk behaviour, as suggested previously.[43 45–47] Information on the length of residency in Qatar was not collected, limiting our ability to determine where the lifetime infection was acquired. This may reduce the relevance of study findings for informing public health policy in Qatar.

In conclusion, the study indicated that over 1% of MCMWs in Qatar show evidence of lifetime syphilis infection, with a lower prevalence of recent infection at approximately 0.1%. These findings highlight an often overlooked disease burden with implications for health and social well-being. Furthermore, they underscore the necessity of implementing programmes to address STIs and meet the broader sexual health needs of this population. Persistent challenges in controlling syphilis persist, compounded by issues such as STI stigma and sociocultural sensitivities. It is critical to develop targeted and culturally sensitive programmes that expand prevention and treatment services. Moreover, STI surveillance and research efforts in this and other population groups in Qatar are essential for monitoring trends, informing public health responses and efficiently allocating resources.

Author affiliations
[1]Biomedical Research Center, Qatar University, Doha, Qatar
[2]Department of Biomedical Science, College of Health Sciences, QU Health, Qatar University, Doha, Qatar
[3]Infectious Disease Epidemiology Group, Weill Cornell Medicine - Qatar, Cornell University, Doha, Qatar
[4]Department of Population Health Sciences, Weill Cornell Medicine, Cornell University, New York, New York, USA
[5]Laboratory Section, Medical Commission Department, Ministry of Public Health, Doha, Qatar

[6]Mathematics Program, Department of Mathematics, Statistics, and Physics, College of Arts and Sciences, Qatar University, Doha, Qatar
[7]Hamad Medical Corporation, Doha, Qatar
[8]Ministry of Public Health Qatar, Doha, Qatar
[9]Qatar Red Crescent Society, Doha, Qatar
[10]Wellcome-Wolfson Institute for Experimental Medicine, Queens University, Belfast, UK
[11]Department of Public Health, College of Health Sciences, QU Health, Qatar University, Doha, Qatar
[12]Primary Health Care Corporation, Doha, Qatar
[13]College of Health and Life Sciences, Hamad bin Khalifa University, Doha, Qatar

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Contributors GKN and LJA co-conceived, co-designed, and co-led the study. AlAl, DWA-S, FHA, JAA-E, HMK, PBN, IWK and MMA conducted the lab testing of the specimens. HC developed the study design, managed the databases, performed the data analyses and co-wrote the first draft of the article. LJA led the statistical analyses and co-wrote the first draft of the article. GKN, HC, AlAl, DWA-S, FHA, JAA-E, HMK, PBN, IA-S, IWK, MMA, HHA, SA, AA, FD, AlHEl, NM, MS, JS, ET, HAK, MJAA, BKA, AAA, MMMHA, AAAHA-Q, MHAA-S, AA, AAA, SC, AKKVG, FJP, SUR, SMAS, MMT, AST, IMU, EAK, PC, AJ, AHK, HFAR, HMY, AAAT, OC, MGAK, EF, RB, HEAR, AAK, MHA-T and LJA contributed to development of study protocol, data collection and acquisition, database development, discussion and interpretation of the results, and the writing of the manuscript. All authors have read and approved the final manuscript. The guarantors of the study are GKN and LJA; they accept full responsibility for the finished work and/or the conduct of the study, had access to the data and controlled the decision to publish. ChatGPT was exclusively used to verify grammar and refine the English phrasing in our text. No other functionalities or applications of ChatGPT were employed beyond this specific scope. Following the use of this tool, the authors thoroughly reviewed and edited the content as necessary and took full responsibility for the accuracy and quality of the publication.

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ORCID iDs
Hiam Chemaitelly http://orcid.org/0000-0002-8756-6968
Ahmed Ismail Ahmed Ismail http://orcid.org/0000-0003-0102-8155
Houssein H Ayoub http://orcid.org/0000-0003-2512-6657
Elias Tayar http://orcid.org/0000-0001-9343-3400
Hanan F Abdul Rahim http://orcid.org/0000-0002-3719-5142
Mohamed Ghaith Al-Kuwari http://orcid.org/0000-0002-9158-5395
Laith J Abu-Raddad http://orcid.org/0000-0003-0790-0506

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