A pilot application of the Spectrum-STI model in a low-prevalence setting:

Estimation of STI prevalence and incidence trends in Georgia

Technical Report

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Acknowledgement:
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Summary

Sexually transmitted infections (STIs) are a leading public health issue in Georgia. However, there is limited information on the current burden of these infections and trends over time. The Spectrum-STI modelling tool has been developed to assist countries collate and interpret their STI data. Georgia was the first country in the WHO European Region to apply the tool to estimate the adult prevalence, incidence and case reporting completeness of syphilis, chlamydia and gonorrhea between 2000 and 2016. This exercise furthermore constituted a pilot for a new Spectrum-STI approach tailored to low-STI settings, where the national estimate is built up from separate estimations for distinct population groups, each based on its own data (e.g. blood donor screening, Bio-Behavioural Surveys (BBS) in FSW, MSM, IDUs and prisoners) and weighted according to its share in the total national population. .

Adult syphilis prevalence was estimated for blood donors and ANC women based on routine screening data, and for FSWs, MSM, prisoners, IDUs and sexual partners of IDUs based on BBS data. Trend estimates for blood donors, FSWs and MSM, based on good longitudinal data (routine screening and Bio-Behavioural Surveys), showed a decline in prevalence over the period 2000-2016. In contrast, there was an increase in prevalence among pregnant women screened during routine antenatal care (ANC). In 2016 the estimated national prevalence was 0.39% and 0.67% in men and women, respectively; and there were an estimated 1,553 new incident syphilis cases in women and 2,619 in men. The actual number of syphilis cases reported in 2016 was 544 in women and 905 in men, which corresponds to a reporting completeness of 28-35% in women and 25-31% in men, depending on whether one considers reported cases of all disease stages, or only cases reported as early-stage (corresponding to Spectrum's prevalence definition).

Prevalence and incidence of chlamydia and gonorrhea in adults were estimated based on estimations for FSWs, MSM (BBS data in two cities), and selected sub-national studies in pregnant and non-pregnant women and students. There were far fewer data for these two infections than for syphilis and, as a result the estimates should be treated with caution. The estimated prevalence in 2016 for chlamydia was 3.4% in women and 2.6% in men and for gonorrhea 0.36% in women and 0.41% in men; there were not enough data to conclude on a time trend. Considering typical fractions symptomatic and seeking treatment, these estimated prevalences would suggest that reporting completeness for symptomatic, treated gonorrhea and chlamydia episodes was in the range of 22-66% for women but only 8-10% for men.

In all the adult estimations, the weakness was in data available for lower-risk populations. For syphilis, in longitudinal screening data prevalence was much higher in blood donors than in ANC women, leaving uncertainty about the prevalence in non-donor non-ANC adults. Also, the recent prevalence trend in ANC women was uncertain due to multiple shifts in test types and screening algorithms, to possibly less well performing tests. For chlamydia, the key high-risk groups made up less than 11% of national burden, hence improving chlamydia surveillance and control should not be limited to higher-risk populations – but consider screening in, for example, ANC women and/or adolescents and young women. For gonorrhea there was no single prevalence study from a low-risk population within Georgia, so that the estimation borrowed from a European regional estimate by the WHO back in 2012. Gonorrhea was estimated to be relatively concentrated in FSW and MSM, yet few BBS surveys measured gonorrhea in these groups. To improve surveillance and future estimations, it is recommended to exploit opportunities for periodic screening of (at least, small samples of) both low-risk and higher-risk populations, e.g. gonorrhea and chlamydia in blood donors or ANC women.

Furthermore, the burden and recent trends of congenital syphilis and associated adverse birth outcomes were explored using the WHO CS estimation tool, applied to the Spectrum syphilis estimation for ANC women. This considers coverage of ANC (97.6% in 2016), of ANC-based syphilis screening (93.5% in 2016) and of syphilis treatment among ANC-diagnosed women (provisionally set at 75%, in the absence of any national data). Based on these assumptions there was an estimated 42 CS cases, as defined by WHO, in 2016. The WHO definition includes both adverse birth outcomes (clinically ill infants, infants born low-birth-weight or premature due to CS, and CS-attributable stillbirths and neonatal deaths) and asymptomatic CS cases (i.e. any infant born to a mother with

untreated or inadequately treated syphilis). In comparison, there were 17 reported CS cases (Georgian CS definition), suggesting that 40% of the CS cases (WHO definition) were reported. The estimated trend in annual CS incidence was downward over 2008-2016, reflecting recent increase in the coverage of ANC-based syphilis screening. To achieve elimination of CS, it is essential to improve (and, better monitor) the treatment coverage for ANC-diagnosed women, and reducing loss to follow-up resulting from referral to STI clinic, preferably by instituting immediate, on-site treatment within the ANC – and more closely monitor and ensure treatment of all syphilis-infected women.

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Annexes

1. Introduction

This report provides a summary of the output from the Spectrum-STI Estimation Workshop held in Tbilisi, Georgia in August 2017. Georgia is the first country in the WHO European Region to use Spectrum-STI to generate STI estimates. The Georgia workshop is also the first time that the Spectrum-STI model has been used in a country with a low prevalence of STIs. This has involved generating estimates for different sub-groups and combining them to generate a national estimate.

The values assigned to the biomedical parameters in the Georgia estimations are the default values described in the STI User Manual unless specifically noted in this report. Information on the baseline values can be found in Spectrum-STI Manual [1].

The workshop also used the Spectrum estimates of the prevalence of syphilis in pregnant women to generate estimates of congenital syphilis (CS) and its associated adverse birth outcomes resulting from mother to child transmission (MTCT) of syphilis, and to identify areas for further improvement if Georgia is to meet the WHO criteria for the elimination of MTCT of syphilis (Annex 2).

Spectrum-STI Model
Estimations of national, regional and global prevalence and incidence of STIs are important for STI programming, evaluation, resource mobilization and advocacy. To support countries in evaluating levels and time trends in STI burdens, *Avenir Health* in collaboration with WHO developed the Spectrum-STI estimation model. This tool enables national program managers and surveillance staff to estimate their prevalence and incidence of syphilis, gonorrhea and chlamydia over time, and strengthen STI surveillance by informing data collection priorities.

Spectrum-STI is integrated within the Spectrum suite of estimation and health policy planning tools (http://www.avenirhealth.org/software-spectrum.php). The Spectrum suite of programs has been developed to support estimation of national burdens, trends, service needs and program impact for family planning, HIV/AIDS, tuberculosis and malaria [2]. Spectrum-STI was successfully piloted in 2016-2017 in a number of countries across the world [3-8].

A detailed description of the Spectrum-STI model can be found in the Spectrum User Manual [1]. It should be noted that the STI prevalence and incidence estimates generated by Spectrum-STI are for adults 15 to 49 years of age. For syphilis, corresponding estimations of congenital syphilis are produced using Spectrum-STI's adult/maternal prevalence estimates, but this is done in Excel outside the Spectrum-STI user interface.

STIs in Georgia
Sexually transmitted infections (STIs) are one of the leading public health issues. In 2016 a total of 1,349 cases of syphilis, 2,507 cases of chlamydia and 923 cases of gonorrhea were reported to NCDC. In reality, this is a fraction of the number of new infections. Chlamydia and gonorrhea are frequently asymptomatic, especially in men, and not all cases are reported. In Georgia, where only STI specialists are allowed to treat STIs many people self-treat, or are treated by their own physician without being referred to an STI specialist and hence not included in the national reports.

The Global Fund Programme provides services and STI treatment to female sex workers (FSWs), men who have sex with men (MSM), people who inject drugs (PWIDs) and their sexual partners. Its activities, however, do not extend to other populations. Pregnant women are screened for syphilis as part of routine ANC care and referred to a specialist STI physician for confirmation and treatment. From 2017 onwards, syphilis treatment cost is being covered by the State ANC Program – through reimbursement of ANC providers for reported treatments, with the treatment supposed to be free for pregnant women. But, uptake by ANC program providers has been poor, and in practice pregnant women are still being referred to STI clinics where they pay for treatment.

Estimates of the burden of these STIs are important for health care planning both to inform the design and evaluate interventions and to prioritize the allocation of scarce funds and human

resources. Estimates, however, require data and there is clearly a need for more data to be collected on these infections. Better syphilis data will also be required before Georgia can be assessed to see if it meets the WHO criteria for the elimination of mother-to-child transmission of syphilis (EMTCT).

The report

The report is based on the material discussed at the Workshop on STI estimation held in Tbilisi Georgia in August 2017 and additional data provided by NCDC up until September 30, 2017.

The report is divided into 3 main sections – (adult) syphilis, chlamydia and gonorrhoea, and congenital syphilis. The final part of the report contains a summary of the results and a series of recommendations to improve the quality of future estimations. There is also an Annex which contains the background workshop materials and other data that helped inform the results.

2. Syphilis

2.1 Methods

2.1.1 Collating Syphilis data and standardizing

Syphilis data were collated from the national and state surveillance system, published papers and unpublished reports. The data collection exercise focused on the period 2000 to 2017, although any data identified before 2000 were also collated. All identified data were assessed to see if they met the study entry criteria. The entry criteria included:

- no apparent bias in the selection of study participants (e.g., patients seeking care because of an STI or genital symptoms were not included),
- an internationally recognised diagnostic test,
- studies appear to have no deficiencies in the handling of specimens or performance of diagnostic tests.

Not all studies used the same diagnostic tests. Table 2.1 reports the adjustors that were used in this study to standardize across tests. The values assigned to the adjustors were based on [3, 9, 10]; for more information on these adjustors see Spectrum-STI Manual [1].

Table 2.1 Diagnostic test adjustors for syphilis

Test	Adjustor (ratio)
TPHA + RPR dual positivity	1.0
TPHA only	0.53
RPR/VDRL only	0.6
Rapid test (TPHA based)	0.7

Six population groups were identified for which there were enough data to generate separate estimates: ANC women, blood donors, FSW, MSM, Prisoners, IDUs (and female partners of male IDUs).

No adjustments in the Georgian analysis were made for geographical location.

2.1.2 Syphilis trends over time

The diagnostic test adjusted syphilis data were used to generate trend estimates for each of the 6 population groups. Table 2.2 summarizes the approach used to generate the trend estimates for each of the population groups.

For those population groups where there were sufficient data to use the Spectrum-STI model to generate the time trends 95% Confidence Intervals were generated using bootstrapping and the median of the bootstrapped prevalence was the final estimate (see STI User Manual [1]).

Table 2.2. Approach used to generate STI estimates over time for each of the subpopulations

Population group	Method used to estimate trends over time
ANC women	Spectrum-STI, logistic regression variant [11]
Blood donors	Spectrum-STI, logistic regression variant
FSW	Spectrum-STI, logistic regression variant for FSWs in Tbilisi and Batumi separately
MSM	Spectrum-STI, logistic regression variant for MSMs in Tbilisi
Prisoners	Assumed constant prevalence
IDUs & female partners of male IDUs	Assumed constant prevalence

2.1.3 National prevalence estimates

National prevalence estimates were generated for both males and females based on the data from the 6 population groups and any additional data found. Each of the groups was weighted according to its contribution to Georgia's adult population between the ages of 15 and 49 in 2016. The shares of the FSW and MSM populations were based on the AIM national population estimates. Other population sizes were based on information provided at the workshop (see Annex A2). The share of each population group in the overall national population was assumed to be constant throughout 2000 to 2016 in the Default Scenario.

The prevalence in the remaining population (defined as: all of the 15-49 years population, less the 6 distinct population groups) in the Default Scenario was estimated as follows:

- Females: prevalence was assumed to be the average of the prevalence in ANC women and in blood donors;
- Males: prevalence was assumed to be the same as the female prevalence.

Two other scenarios were also considered.

- Scenario 1: The prevalence of infection in the remaining female and male populations were the same as in ANC women.
- Scenario 2: The prevalence of infection in the remaining female and male populations were the same as in blood donors.
- Scenario 3: The prevalence of the infection in the remaining female and male populations as in the Default Scenario, but with the size and share of the MSM and FSW populations falling over time as in the AIM national estimates (see Annex A2).

2.1.4 Incidence and Case Reporting

Annual Incidence in adult men and women was estimated from the national prevalence estimates by adjusting for the average duration of infection. (I = P/ D where I is annual incidence, P is prevalence and Di s the average duration of infection). The average duration of infection with syphilis was set at the figures used in the WHO global and regional 2012 estimates for countries with medium access to treatment: 2.42 years for both men and women (see STI Manual, [12].WHO paper for 2012, 2005).

Case reporting completeness was estimated by comparing the number of syphilis cases reported in the Georgian Health Care Statistical Yearbooks (available on the Georgian NCDC website http://www.ncdc.ge/en-US/Statistics/DiseaseStatistics) to the estimated number of l cases each year.

2.2 Prevalence Data and Results by Subgroup

2.2.1 ANC Women

Syphilis data from the national ANC screening program were used as the basis of the Spectrum syphilis ANC estimations. The data for 2000 to 2016 are reported in Table 2.3. In addition, Table 2.3 records for each year the number of women positive, the number of women screened, the diagnostic test used, the diagnostic test adjusted prevalence, the number of eligible pregnancies, and the weight attached to each data point when generating the Spectrum ANC syphilis estimate. Each data point was weighted according to the ratio of pregnant women screened to the total number of reported pregnancies in that year. Table 2.2 also records data from the State ANC program for 2014 to the end of the first half of 2017.

In 2013 there was a change in the diagnostic testing regimen used to screen pregnant women in Georgia. Prior to 2013 syphilis screening was done using an RPR test. From 2013 to 2015 a dual rapid test (HIV and syphilis) was used, and in 2016 there was a change to a quadruple combo test (syphilis, HIV, Hep B and HCV, made by Express diagnostics).

Data on the number of people confirmed positive using a TPHA test in the State ANC Program were available for 2014 to 2017 (see Table 2.3); data for 2013 however were not accessible. The data for 2015 suggested that the sensitivity and specificity of the dual test was similar to other rapid tests (confirmed/ screened ratio of 0.75) and the decision was made to use the National ANC data for 2013 and to use the State ANC program data for 2014 to 2017.

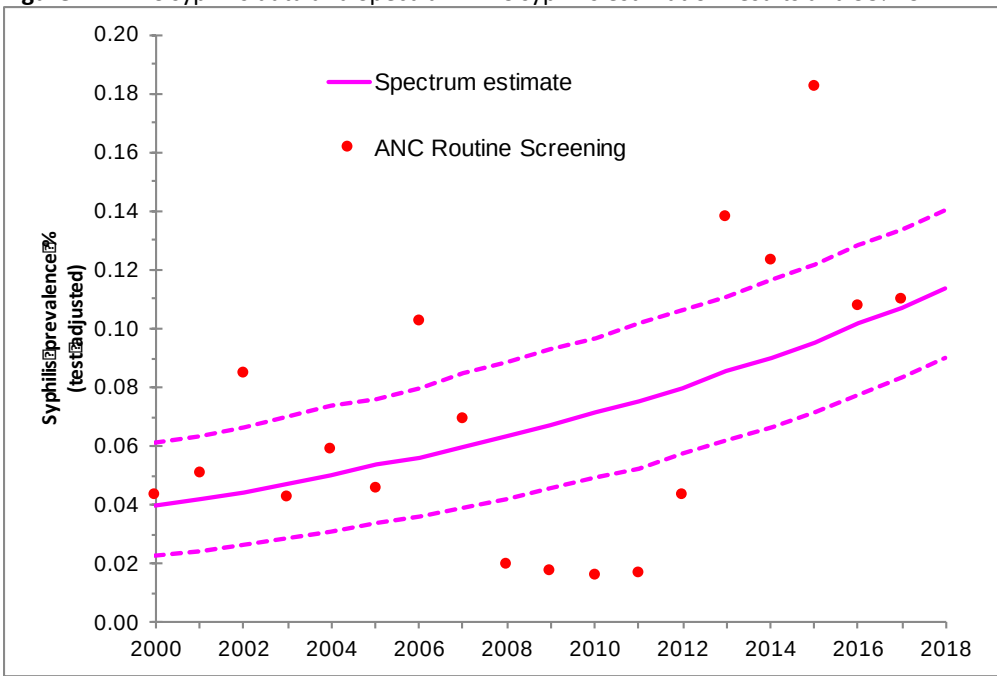
Table 2.3 ANC Syphilis Data. The data in light grey italics were not used in the Spectrum ANC syphilis estimations. The National ANC data were extracted from the National Health Statistics Yearbook "Health Care" and the State ANC data were provided by the Maternal and Children Health State Program.

Year	Number positive	Pregnant Women screened	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Number of women with one or more ANC visit	Weight for Spectrum ANC estimate
National ANC Data							
2000	26	35,800	RPR	0.07 %	0.04 %	44,285	0.81
2001	31	36,805	RPR	0.08 %	0.05 %	46,103	0.80
2002	52	36,647	RPR	0.14 %	0.09 %	40,220	0.91
2003	25	34,844	RPR	0.07 %	0.04 %	39,111	0.89
2004	32	32,551	RPR	0.10 %	0.06 %	42,291	0.77
2005	27	35,264	RPR	0.08 %	0.05 %	43,334	0.81
2006	63	36,859	RPR	0.17 %	0.10 %	48,283	0.76
2007	43	37,050	RPR	0.12 %	0.07 %	50,542	0.73
2008	14	42,885	RPR	0.03 %	0.02 %	59,742	0.72
2009	15	49,908	RPR	0.03 %	0.02 %	59,729	0.84
2010	14	52,836	RPR	0.03 %	0.02 %	55,853	0.95
2011	14	49,023	RPR	0.03 %	0.02 %	55,648	0.88
2012	35	48,176	RPR	0.07 %	0.04 %	59,529	0.81
2013	117	50,903	dual	0.23 %	0.14 %	59,529	0.86
2014	*115*	*54,924*	*dual*	*0.21 %*	*0.13 %*	*62,108*	*0.88*
2015	*88*	*52,107*	*dual*	*0.17 %*	*0.10 %*	*58,462*	*0.89*
2016	*146*	*51,287*	*quad*	*0.28 %*		*54,874*	
State ANC Program Data: Column 2 also records the number confirmed positive and the number screened positive (in brackets). The observed prevalence in column 5 is based on confirmed positive tests. **							
2011	*(142 or 111?)*						
2014	60	48,826	dual, TPHA confirmed	0.12 %	0.12 %	62,108	0.79
2015	71 (95)	38,974	dual, TPHA confirmed	0.18 %	0.18 %	58,462	0.67
2016	49 (587)	45,399	quad, TPHA confirmed	0.11 %	0.11 %	54,874	0.83
2017*	26 (80)	23,688	quad, TPHA confirmed	0.11 %	0.11 %	54,874	0.43

* First 6 months only, have used the 2016 estimate of number of women with one or more ANC visits as denominator for weighting. This will be a low estimate

The results from the Spectrum estimation are also shown in Figure 2.1. The Spectrum line of best fit suggests that the prevalence of syphilis has been increasing over the last 15 years. In 2016 the prevalence (test adjusted) was estimated to be 0.10% (95% CI: 098-0.13). Looking in more detail at the individual data points there appears to have been a marked increase in prevalence between 2011 and 2015. This, however, is also the period when there was a change in the diagnostic test used and, whilst the Spectrum method adjusts for diagnostic tests, the adjustment factor is based on global figures and may not reflect testing in Georgia.

Figure 2.1 ANC syphilis data and Spectrum ANC syphilis estimation results and 95% CI.



2.2.2 Blood donors

All blood in Georgia is screened for syphilis using an RPR or VDRL test. Table 2.4 records data from NCDC for 2006-2016 and up to August 23, 2017. In 2006 management of the blood donor program changed and no were available before 2006. Table 2.3 also records, the diagnostic test adjusted values used in the Spectrum trend estimation, the number of blood donations screened, the number screened positive and the weights attached to the blood donor data; all of the national data were assigned a weight of 1.0.

The gender breakdown of the screening positive blood donations was available for 2015 (164 female and 373 male), 2016 (107 female and 278 male) and for the first nine months of 2017 (133 female and 206 male). But no data was available on the breakdown of total donations by gender meaning that it is difficult to interpret these data.

Blood donors in Georgia are a mix of volunteers and paid and this balance has changed over time, as have the eligibility requirements for blood donations. The proportion of volunteer blood donors has increased from under 5% in 2000 to 20% in 2015.

The results from the blood donor estimation are shown in Figure 2.2. There are based on the national data from 2006. Whilst the individual data points vary from year to year the overall trend suggests that the prevalence in blood donors has been fairly constant. In 2016 the estimated prevalence was 0.48% (95% CI: 0.36-0.62). In generating the national estimates we assumed equal number of male and female blood donors, and an equal prevalence in men and women.

In addition, there is a published study that provides data from one of the main laboratories in Tbilisi from 1998 [13]. This study reported a confirmed positive prevalence (RPR and confirmed by TPHA) of 2.3% (N=4,970). The prevalence in men was 1.45% (N=2,629) and in women 3.25% (N=2,341) (Table 2.3). *There is also one other data point which we still need to confirm from 2001.*

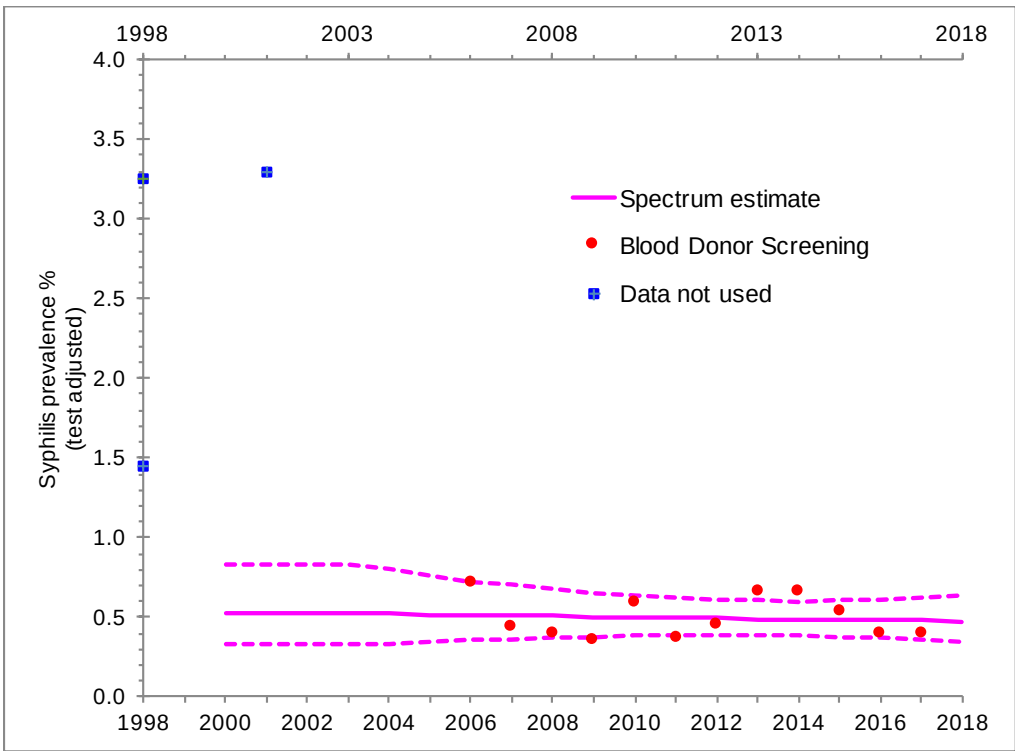
The 1998 and 2001 data points are much higher but they are much smaller samples. If these earlier data are representative of the general blood donor population, then there may have been a significant fall in the prevalence among blood donors between 2000 and 2006. However, this

apparent trend may reflect changes in blood donor recruitment patterns and criteria as well as in the underlying prevalence.

Table 2.4 Blood donor data, syphilis prevalence. The data in light grey italics were not used in the Spectrum blood donor syphilis estimations.

Year	Number positive	Number of blood donations	Diagnostic Test	Observed Prevalence (%)	Test Adjusted Prevalence (%)	Weight for Spectrum estimate	Reference & comments
National blood donor data from the Annual Reports of the National Safe Blood Program published in the NCDC Annual Report							
2006	103	8,658	RPR	1.19 %	0.71 %	1.0	
2007	124	16,625	RPR	0.75 %	0.45 %	1.0	
2008	122	18,263	RPR	0.67 %	0.40 %	1.0	
2009	115	19,302	RPR	0.60 %	0.36 %	1.0	
2010	224	22,569	RPR	0.99 %	0.60 %	1.0	
2011	165	26,832	RPR	0.61 %	0.37 %	1.0	
2012	257	34,157	RPR	0.75 %	0.45 %	1.0	
2013	471	42,322	RPR	1.11 %	0.67 %	1.0	
2014	566	51,584	RPR	1.10 %	0.66 %	1.0	
2015	535	59,239	RPR	0.90 %	0.54 %	1.0	
2016	390	57,853	RPR	0.67 %	0.40 %	1.0	
2017 *	265	39,686	RPR	0.67 %	0.40 %	1.0	First 6 months only
Other blood donor data							
1998	*38 men*	*2,629*	*RPR & TPHA*	*1.45 %*	*1.4 5%*	*0.0*	*[13]*
1998	*76 women*	*2,341*	*RPR & TPHA*	*3.25 %*	*3.25 %*	*0.2*	*[13]*
2001	*165 (inferred)*	*5,000*	*RPR & TPHA?*	*3.3 %*	*3.3 %?*	*0*	*Quoted in: [14].*

Figure 2.2 Blood donor syphilis data and Spectrum blood donor syphilis estimation results and 95% CI. (dotted lines).



2.2.3 Female Sex Workers

Table 2.5 records the syphilis data identified from studies conducted in FSWs. This includes data from BBS surveys in Tbilisi and Batumi and routine prevalence data collected as part of the FSW prevention program. Data from women seeking care for STIs symptoms, however, have been excluded.

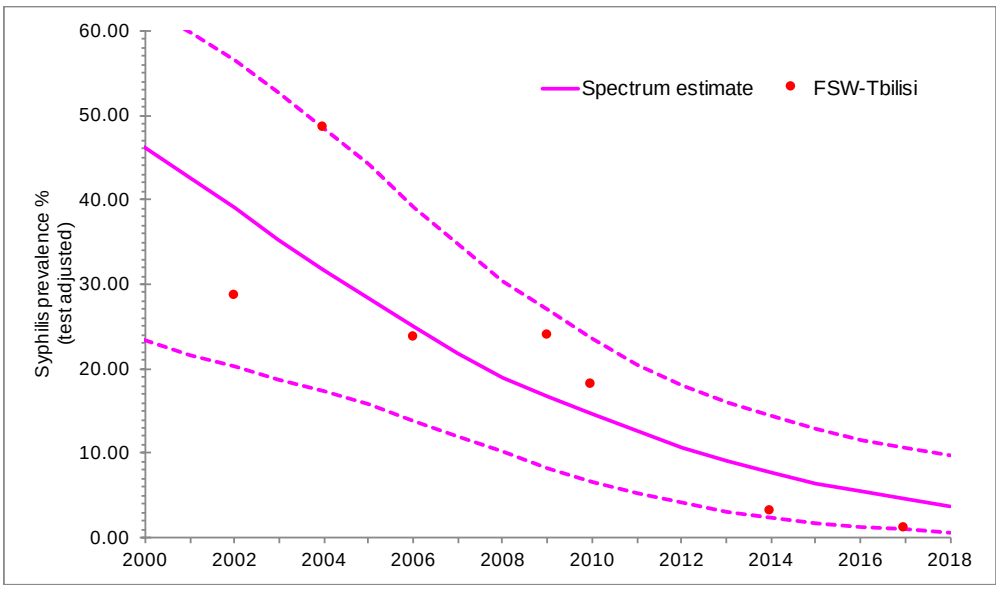
Separate Spectrum estimations were done for Tbilisi and Batumi City based on the BBS date (Figure 2.3 a and b). Both graphs show a marked decline in the prevalence of syphilis. In Tbilisi the Spectrum estimate fell from 46.2% in 2000 to 5.5% in 2016 and in Batumi City from 41.6% in 2000 to 8.2% in 2016.

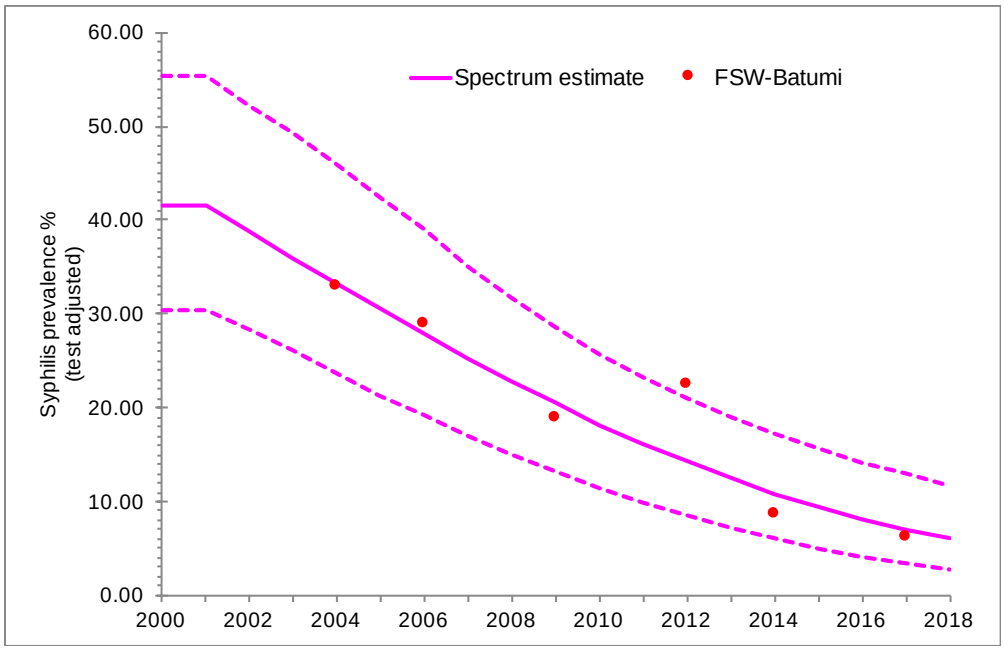
To generate national estimates over time for FSWs we combined the two Spectrum FSW estimates assigning a weight of 0.75 to the Tbilisi estimates and 0.25 to Batumi, for all years. Tbilisi was given a larger weighting as it has a larger population than Batumi. The national FSW estimate for 2016 using this approach was 6.14%.

Table 2.5 Syphilis prevalence in FSWs.

Year	Number positive	N tested	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Data type	Spectrum Weight	Reference
Tbilisi								
2002	44	153	RPR & TPHA	28.8 %	28.8 %	BBS	1.0	[16]
2004	77	158	RPR & TPHA	48.7 %	48.7 %	BBS	1.0	[16, 17]
2006	38	160	RPR & TPHA	23.8 %	23.8 %	BBS	1.0	[16, 17]
2008-9	71	156	TPHA	45.5 %	24.1 %	BBS	1.0	[18]
2012	54	156	TPHA	34.6 %	18.3 %	BBS	1.0	[19]
2014	10	157	TPHA	6.4 %	3.4 %	BBS	1.0	[20]
2017	5	195	TPHA	2.6 %	1.4 %	BBS	1.0	[21]
Batumi								
2004	38	115	RPR & TPHA	33.0 %	33.0 %	BBS	1.0	[17]
2006	41	141	RPR & TPHA	29.1 %	29.1 %	BBS	1.0	[17]
2008-9	43	120	TPHA	35.8 %	19.0 %	BBS	1.0	[18]
2012	51	120	TPHA	42.5 %	22.5 %	BBS	1.0	[19]
2014	20	120	TPHA	16.7 %	8.8 %	BBS	1.0	[20]
2017	18	150	TPHA	12.0 %	6.4 %	BBS	1.0	[21]

Figure 2.3 FSW syphilis data and FSW syphilis estimation results for (a) Tbilisi and (b) Batumi City. Only BBS data (not: Programmatic data) are shown in the graph.





2.2.4 Men who have Sex with Men

Table 2.6 records the syphilis data identified from studies conducted in MSMs. This includes data from BBS surveys conducted in Tbilisi roughly every two years since 2005 and data from Batumi in 2015.

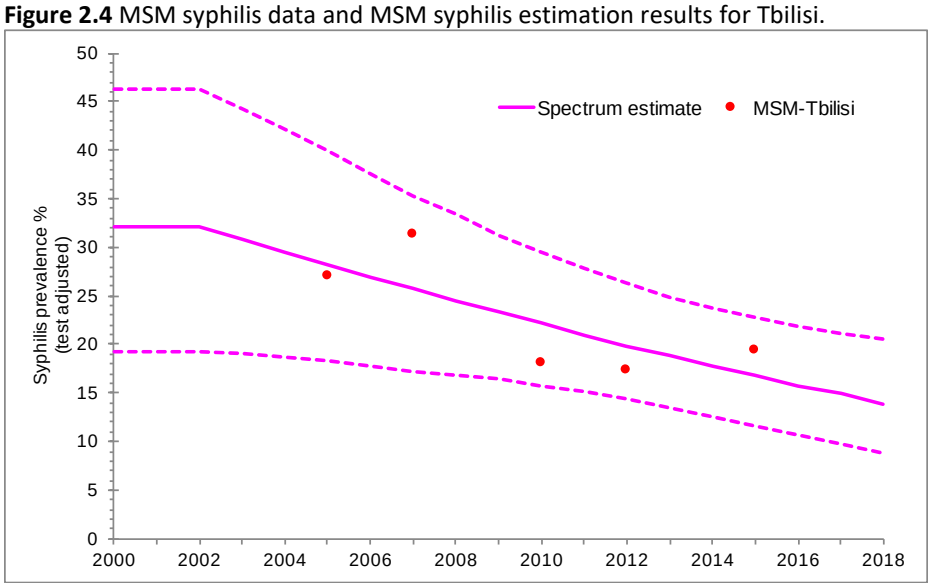
Spectrum STI was used to generate a trend for MSM in Tbilisi using the BBS data (Figure 2.4). Figure 2.4 also records the diagnostic test adjusted data points for Tbilisi. There were insufficient data however to do a similar analysis for Batumi. The prevalence of syphilis has been falling in MSMs although the decline is not as steep as in FSWs. Between 2000 and 2016 the estimated prevalence in Tbilisi fell from 32.1% to 15.8%.

To generate national estimate over time for MSMs we assigned a weight of 0.75 to the Spectrum estimation for Tbilisi. The prevalence in the rest of the population of MSMs (weight of 0.25) was set at 0.66 of the value for Tbilisi. This figure was based on the ratio of the prevalence of syphilis in MSMs in Batumi to Tbilisi in 2015, the only year with data for both cities. In 2016 the estimated national MSM prevalence of syphilis was 14.5%.

Table 2.6 Syphilis prevalence in MSM

Year	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Type of Study or sample	Spectrum Weight	Reference
Tbilisi								
2005	19	70	RPR & TPHA	27.14 %	27.1 %	BBS	1.0	[22] (quoted in: [23]
2007	44	140	RPR & TPHA	31.43 %	31.4 %	BBS	1.0	[24]
2010	93	271	TPHA	34.32 %	18.2 %	BBS	1.0	[25] (RPR data also reported 13.65%)
2012	71	216	TPHA	32.87 %	17.4 %	BBS	1.0	[26]
2015	110	300	TPHA	36.67 %	19.4 %	BBS	1.0	[27]
Batumi								
2015	28	115	TPHA	24.35 %	12.9 %	BBS	NA	[27]

Figure 2.4 MSM syphilis data and MSM syphilis estimation results for Tbilisi.



2.2.5 Prisoners

Table 2.7 records the syphilis data we had access to as of September 30, 2017. Three of the data points were from BBS studies. The fourth was routine prison entry screening data provided by the prison services. Given the difficulties in interpreting the data from the BBS studies as they were from different populations we have used the new prison entry data for 2017 (separately for men and women) for generating the national estimate, and assumed this prevalence also applied for all earlier years. This figure is probably an overestimate.

Table 2.7 Syphilis prevalence in prisoners. The data from 2008-9, 2012 and 2015 were from BBS surveys. The data from 2017 were from routine prison entry screening.

Year	Gender	Prison Number	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Reference
2008-9	Both	1, 2, 5	11	211	TPHA	5.21 %	2.8 %	[28]
2012	Both	5, 7, 17	22	286	TPHA	7.69 %	4.1 %	[29]
2015	Both	2, 15, 17	2	301	TPHA	0.66 %	0.4 %	[30]
2017	Male	routine	57	918	RPR	6.21 %	3.73 %	
2017	Female	routine	5	76	RPR	6.58 %	3.95 %	

2.2.6 Intravenous Drug Users (IDU) and their partners

Table 2.8 records the syphilis data from IDUs and the female partners of male IDUs in 2016. In the absence of any other data points we have used program data and assumed that the prevalence in previous years was the same as in 2016 - 2.6% for male IDUs, and 3.2% for their partners. We have also assumed that the prevalence in male and female IDUs were the same.

Table 2.8 Syphilis prevalence in IDU and the female partners of male IDUs.

Year	Population	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Type of study	Reference
2016	IDU*	600	15,912	Rapid test (TPHA-based)	3.77 %	2.6 %	Program	Stvilia-Ketevan, p.c. 24th Aug. 2017; Global Fund program data

Year	Population	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Type of study	Reference
2016	Female partners of male IDUs	33	713	Rapid test (TPHA-based)	4.63 %	3.2 %	Program	Stvilia-Ketevan, p.c. 24th Aug. 2017; Global Fund program data

*We have assumed that all of these IDUs are male; data from the program suggest that over 98% are male.

2.2.7 Other data

In addition to the data in the 6 groups, we identified one other study that was relevant for the national estimates (see Table 2.9). This study, conducted in 2001, reports a prevalence in sexually active women that is an order of magnitude higher than in ANC women in the same year (0.8% vs 0.05%). In the current estimation we have not used this data point.

Table 2.9 Other syphilis prevalence data

Population	Year	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Diagnostic Test Adjusted Prevalence	Reference
Community based – sexually active but not high risk women in Kakheti region & Tbilisi	February 2001 to May 2002	8	999	RPR, confirmed TP-PA	0.8 %	0.8 %	[14]

2.3 National Prevalence

National syphilis prevalence estimates for 2016 were generated by adding together the estimated prevalence in 2016 blood donors, FSWs, MSM, prisoners, IDUs and wives of IDUs after adjusting for their contribution of each group to the adult national population of 15-49 year olds (see Annex A2). The results for 2016 and underlying assumptions are presented in Table 2.10 for the Default Scenario, in which the prevalence in the remaining female and male populations was set at the average of the prevalence in ANC women and blood donors. In this estimation, the overall national prevalence in the female population in 2016 was 0.39% and 0.67% in the male population. If instead the prevalence in the "remaining population" was set at the value in ANC women only (Scenario 1) then the overall prevalence in females in 2016 was 0.22% and 0.50% in males whilst if the prevalence in the "remaining population" was set at the value in blood donors only (Scenario 2) then the overall prevalence in the female population increased to 0.56% and in the male population to 0.84%.

Figure 2.6 records the estimated national prevalence in adult 15 to 49 year old men and women between 2000 and 2018 for the Default Scenario, Scenario 1 and Scenario 2. It also shows the results for women under Scenario 3 in which the proportion of the FSW and MSM change over time (see Annex A2). The male line is not shown as it overlaps with the Default line for men.

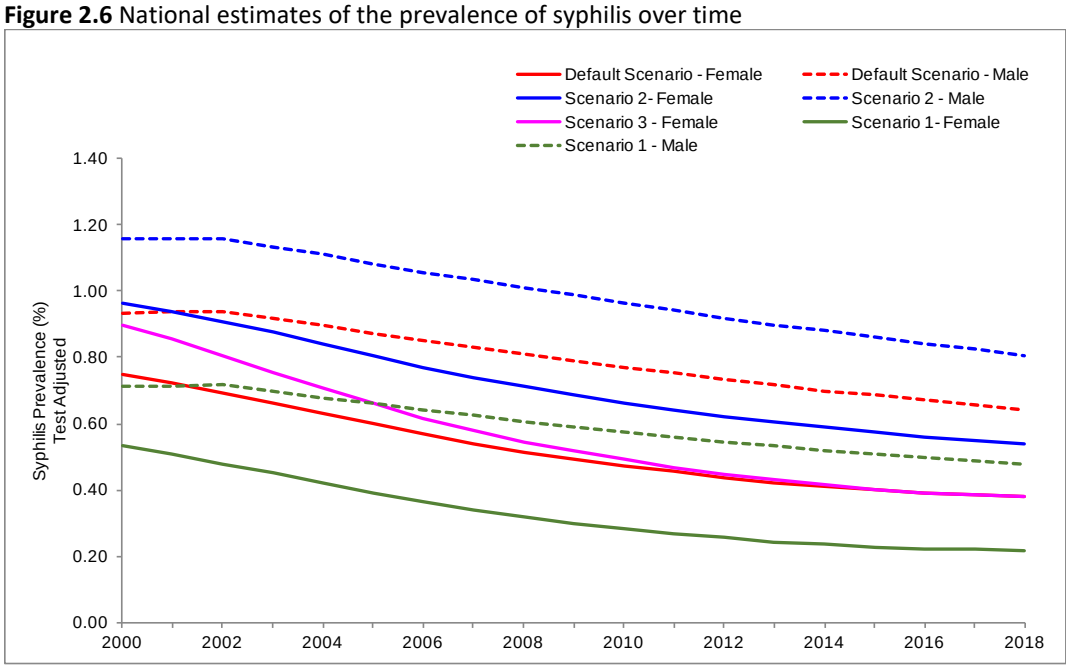
In all four scenarios the prevalence of syphilis fell between 2000 and 2016. The increased decline in women in Scenario 3 reflects both the steep decline in prevalence among FSWs and a fall in the proportion of the female population that are FSWs (from 1.33% to 0.96%). During the same period the proportion of the male population that are MSMs increased very slightly (from 1.71% to 1.78%).

Table 2.10 also shows the contribution of each population group to the total number of prevalent cases in 2016. FSWs, who only accounted for 0.94% of the female population in 2016 accounted for 15% of the prevalent cases in women. For men, the group that dominated was MSMs: they accounted for only 1.8% of the population but 39% of the cases.

Table 2.10 2016 Syphilis Prevalence Estimates for Georgia in adults 15 to 49 years of age for the Default Scenario. See Annex A2 for more information on the sizes of the various populations.

Females								
	ANC women	**Blood donors**	**FSW**	**Prisoners**	**IDU**	**Wives of IDU**	**Remaining Population**	**Total**
Prevalence: test-adjusted	0.10%	0.48%	6.14%	3.95%	2.64%	3.24%	0.29%	0.39%
Population size	54,874	28,926	9,017	1,800	7,677	7,776	848,105	958,175
Percentage of population	5.7%	3.0%	0.9%	0.2%	0.8%	0.8%	88.5%	100%
Prevalent cases	56	140	554	71	203	252	2,483	3,758
Percentage of female prevalent cases	1.5%	3.7%	14.7%	1.9%	5.4%	6.7%	66.1%	100%
Males								
		Blood donors	**MSM**	**Prisoners**	**IDUs**		**Remaining Population**	**Total**
Prevalence: test-adjusted		0.48%	14.46%	3.73%	2.64%		0.29%	0.67%
Population size		28,926	17,240	10,200	30,706		859,307	946,379
Percentage of population		3.1%	1.8%	1.1%	3.2%		91%	100%
Prevalent cases		140	2,492	380	810		2,515	6,338
Percentage of male prevalent cases		2.2%	39%	6.0%	12.8%		39.7%	100%

Figure 2.6 National estimates of the prevalence of syphilis over time



Notes to Figure 2.6: In Scenario 1 the prevalence in the remaining female and male populations was set at the value in ANC women only, and in Scenario 2 as in blood donors only. In Scenario 3 the proportion of the male and female populations that are MSM and FSWs fall over time, as in Georgia's Spectrum-based HIV estimates. The male line in Scenario 3 is not shown as it overlaps with the male Default Scenario line.

2.4 Incidence and Case Reporting

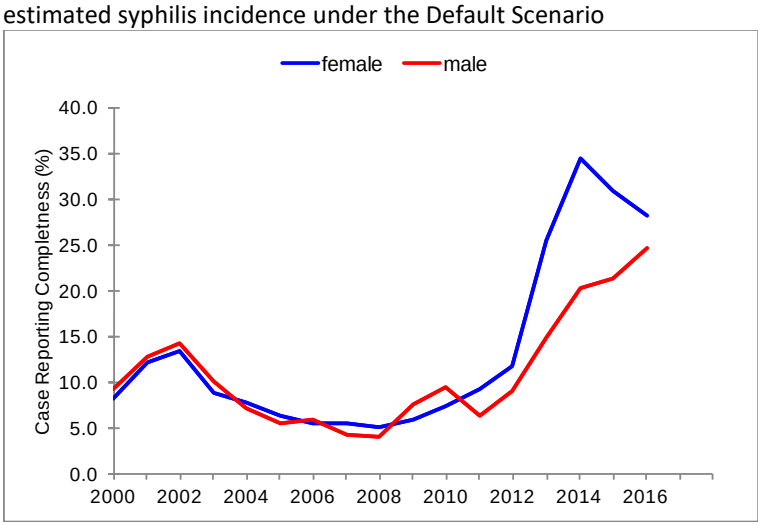
Table 2.11 records the number of Spectrum-estimated incident syphilis cases, and estimated case reporting completeness for 2016 under the Default Scenario. In 2016, we estimated that there were 1,559 incident cases in women and 2,619 in men. Comparing these data to the number of cases reported in 2016 suggests a reporting completeness between 28-35% for women and between 25-31% for men. The reporting completeness estimate depends on whether we consider reported cases of all stages, or only the subset notified as early-stage. The slightly higher reporting completeness for women may reflect that ANC-based screening picks up relatively many cases among women. Compared to the subset of symptomatic cases that get treated (561 in women, and 943 in men in 2016), the actual case reports (544 female and 805 male) are quite high – but likely the reporting represents in part asymptomatic cases identified through screening, while other symptomatic cases remain un-diagnosed.

Figure 2.7 shows trends over time in the number of incident cases, reported cases and case reporting completeness. The estimates suggest that case reporting completeness improved over the last 10 years, although it fell back in women in 2015-2016, after a peak in 2014.

Table 2.11 Syphilis - Incident cases and case reporting in 2016 – Default Scenario

		Females	Males	Source & assumptions
Incident cases per 100,000 person-years		162	277	
Incident cases		1,553	2,619	
Symptomatic incident cases		932	1,571	60% of all incident cases (global assumption, [12])
Symptomatic incident cases that get treated		559	943	60% in countries with medium treatment access [12]
Actual case reports – all disease stages		544	805	Health Care Statistical Yearbook (available on NCDC website)
Proportion of reported cases that are "early" infections		81%	81%	Based on data for 2013 from CISID (http://data.euro.who.int/cisid/?TabID=430494): 863 early-stage and 208 late-stage reported cases (without sex break-down). Over 2006-2013 averaged, 90% of reported syphilis cases were early-stage. These data are no longer collected.
Reporting completeness, of:	All reported cases, relative to all estimated cases	35%	31%	
	Reported 'early-stage' cases, relative to all estimated cases	28%	25%	

Figure 2.7 Syphilis reporting completeness (of reported early-stage cases), relative to Spectrum-estimated syphilis incidence under the Default Scenario



2.5 Discussion

National estimates of the prevalence and incidence of syphilis in adults 15 to 49 were generated by combining the prevalence estimates generated using Spectrum-STI or other assumptions from 6 population groups.

In three of the four populations where there were sufficient data to use Spectrum-STI (blood donors, FSWs and MSM) the prevalence fell between 2000 and 2016. In the fourth, ANC women, the prevalence increased. This may be a real increase or may be due to a change in the tests used to screen ANC women for syphilis. In 2016 the estimated prevalence in ANC women was 0.10%. This figure is considerably lower than the prevalence in blood donors (0.48%).

The prevalence in FSW and MSMs fell considerably between 2000 and 2016 but both were still relatively high in 2016 - 6.1% and 14.5% respectively. The prevalence in 2016 in prisoners (3.73% for men and 3.95% for women) and IDUs (2.6% in IDUs and 3.2% in their wives) were moderate.

The overall national estimate for 2016 in the Default Scenario – 0.39% in women and 0.67% in men is higher than the WHO estimate for Eastern Europe in 2012 – 0.15% in both women and men. This primarily reflects the fact that the Georgian estimate explicitly includes FSWs and MSMs. The WHO estimate was based on data from ANC women only, which were adjusted upward by 10% to account for high-risk groups. Our Default estimate instead considered also prevalence measurements in blood donors (higher than ANC women), and higher-risk groups screened through BBS, which when combined suggested a considerably higher national prevalence than in ANC women, and a larger than 10% share of key groups in the national prevalence.

The estimated number of incident syphilis cases in Georgia in 2016 was 1,553 in women and 2,619 in men. The higher figure in men reflects the higher national prevalence estimate in men than in women. The actual number of cases reported in 2016 was 544 in women and 905 in men, which corresponds to a reporting completeness in 2016, after adjusting for the proportion of cases that are early versus late syphilis, of 28% in women and 25% in men.

There are a number of actions that NCDC could take in the short term to improve the quality of the national syphilis estimates these include:

- ANC data: Evaluate & optimize performance and accuracy of ANC screening tests
- Blood donor data: collate data on prevalence by sex, mix of voluntary vs. paid donors.
- Prisoner data: collect entry screening data from the prison services.
- IDU data: studies done in IDUs to include prevalence by sex

Actions to consider in the longer term include:

- Population based study in men and women
- Additional surveys in populations at higher risk

The piloting of Spectrum STI to generate national syphilis estimates in Georgia was a success but there are some limitations. Six population groups were identified with sufficient prevalence data to generate some sort of estimate and for four of the groups there were sufficient data points to use Spectrum STI. The 6 population groups, however, account for only 11.5% of the female population and 9.2% of the male population. The remaining female and male populations were treated as one population and assigned a value based on the prevalence in ANC women and/or blood donors.

3. Chlamydia & Gonorrhea

3.1 Methods

3.1.1 Collating and standardizing prevalence data

Chlamydia and gonorrhoea prevalence data were collated from the national and state surveillance system, published papers and unpublished reports. The data collection exercise focused on the period 2000 to 2017, although any data identified before 2000 were also collated. All identified data were assessed to see if they met the study entry criteria. The entry criteria included:

- no apparent bias in the selection of study participants (e.g., patients seeking care because of an STI or genital symptoms were not included),
- an internationally recognised diagnostic test,
- studies appear to have no deficiencies in the handling of specimens or performance of diagnostic tests.

Owing to a lack of data only three subpopulations were used in the chlamydia and gonorrhea analysis – Low risk populations, FSWs and MSMs.

The studies that met the study entry criteria used a variety of laboratory tests and were from different populations. To improve the consistency of data across these studies, the observed prevalence values were converted into true prevalence estimates by adjusting for the sensitivity and specificity of the diagnostic test used, geographic location of the study population, and for chalmydia, but not gonorrhea, the age of the study population.

The method used for standardizing data from prevalence studies is based on the methods used in the WHO global and regional estimates (for more information see the Spectrum-STI Overview Manual).

SP = OP x diagnostic test adjustor × geography adjustor × age adjustor
Where SP is standardized prevalence and OP the observed prevalence

Table 3.1 records the relevant diagnostic test adjustors for the studies identified in Georgia (see STI Spectrum Overview Manual [1] for adjustors for other tests.

Table 3.1 Sensitivity and specificity of diagnostic tests for chlamydia and gonorrhea

		Sensitivity	**Specificity**
PCR on Urine Samples			
Chlamydia	Women	87.0%	99.8%
	Men	87.8%	99.3%
Gonorrhea	Women	91.6%	99.7%
	Men	80.9%	99.9%

Sources: [3, 9, 31].

For both gonorrhea and chlamydia, the rural/ urban prevalence ratio in the Spectrum estimates was set at 0.9 for studies conducted in the general population. No adjustment was made for studies conducted in either MSMs or FSWs.

The age adjustor (as in the WHO 2012 global and regional estimations [12]) was only applied to chlamydia in women, and is used to adjust for the decline in the prevalence of chlamydia among women with increasing age, observed in many studies.

Table 3.2 Age adjustors for estimates for women 15-49 years with chlamydial infection, based on prevalence data from selected age groups – default values.

Age range (years)	**Adjustment factor**
Youths (15–24)	0.67

Adults (25–49)	1.15
15-49 years, other (or no) information	1.0

3.1.2 Trends over time

The diagnostic test adjusted prevalence data were used to generate trend estimates for the three population groups (Low risk, FSWs and MSMs). The approach used to generate trend estimates depended on the number of data points available (see Table 3.3).

For those population groups where there were sufficient data to use the Spectrum-STI model to generate the time trends 95% Confidence Intervals were generated using bootstrapping and the median of the bootstrapped prevalence was the final estimate (see STI User Manual [1]).

Table 3.3 Approach used to generate STI estimates over time for each of the sub-populations

Population group	Chlamydia	Gonorrhea
Low Risk – female	Simple average of 3 data points and assumed to remain constant over time	WHO 2012 estimate for EURO region [12]
Low Risk - male	Multiple of the Low risk – female estimate	WHO 2012 estimate for EURO region [12]
FSW	Simple average of 3 data points and assumed to remain constant over time	Spectrum time trend, on test-adjusted prevalences
MSM	Constant over time based on test-adjusted value from 2010 study	Assumed to be the same as FSW gonorrhea

3.1.3 National prevalence estimates

National prevalence estimates were generated for both males and females based on the data from the 3 population groups. Each of the groups was weighted according to its contribution to Georgia's adult population between the ages of 15 and 49 (see Annex A2). In the Default Scenario the size of each group was assumed to remain constant over time. In Scenario A they were assumed to change over time (see Annex A2).

In those situations where no prevalence data were identified for low risk males or females (or for FSWs or MSMs,) we drew on other data sets to inform the estimates, this included:

1. Data from nearby countries in the Spectrum-STI global data file or in the datasets used to generate the 2005, 2008 and 2012 WHO global STI estimates.
2. The WHO 2012 estimates for Western, Central and Eastern Europe. These (including the 10% adjustment for high risk populations) were:
   Chlamydia: Women: 1.86% (95% UI: 1.44-2.50); Men: 1.37% (95% UI: 0.61-2.68)
   Gonorrhea: Women: 0.29% (95% UI: 0.18-0.42); Men: 0.25% (95% UI: 0.13-0.41).

3.1.4 Incidence and Case Reporting

Annual Incidence in adult men and women was estimated from the national prevalence estimates by adjusting for the average duration of infection. (I = P/ D where I is annual incidence, P is prevalence and Di s the average duration of infection). The average duration of each of the two infection was set at the figures used in the WHO global and regional 2012 estimates for countries with medium access to treatment (see STI Manual, [12].WHO paper for 2012, 2005).

- chlamydia: 1.11 years for women and 0.8 years for men
- gonorrhea: 0.46 years for women and 0.25 years for men.

Many cases of gonorrhea and chlamydia are asymptomatic and not all who develop symptoms seek care. In order to get a better feeling of case reporting rates we adjusted the number of incident cases to take into account the proportion of cases that are symptomatic and the proportion of those that are symptomatic that are treated (see Table 3.4)

Table 3.4 Probability a newly infected person is symptomatic and of being treated.

	Chlamydia		Gonorrhea	
	Females	**Males**	**Females**	**Males**
Probability symptomatic	0.17	0.54	0.34	0.64
Probability treated if symptomatic	0.50	0.65	0.50	0.65

Case reporting completeness was estimated by comparing the number of cases of chlamydia and of gonorrhea reported in the Georgian Health Care Statistical Yearbooks (available on the Georgian NCDC website: http://www.ncdc.ge/en-US/Statistics/DiseaseStatistics) to the estimated number of annual cases.

3.2 Chlamydia Prevalence Data and Results

3.2.1 Low risk populations

Table 3.5 records the data found for low risk populations in Georgia. Three data sources were identified, one of which provided data for both ANC women and students. The study by Kadzhaia D et al [32], however, was excluded from the analysis as the study looked at anti-chlamydial antibodies in serum. The high prevalence recorded probably relates to the non-specificity of the test (cross-reactivity with *chlamydia Psiticci* and *chlamydia pneumonia* and can detect old infections of trachomatis).

Table 3.5 Chlamydia prevalence in low risk populations. The data in light grey were not used in the estimation.

Population	Year	Number Positive	Sample Size	Diagnostic Test	Observed Prevalence	Adjusted Prevalence	Reference
Female							
Community based – sexually active but not high risk women in Kakheti region and Tbilisi	2001 - 2002	25	999	PCR, Urine	2.5 %	2.7 %	[14]
ANC, Tblisi – 1 site	*2001 - 2002*	*30*	*351*	*???*	*8.5 %*	*8.9 %*	[32]
ANC, Tblisi - 3 sites	2011	15	300	PCR, Urine	5.0 %	5.2 %	[33]
Students*	2011	2	76	PCR, Urine	2.6 %	1.7 %	[33]
Male							
Students*	2011	0	76	PCR, Urine	0.0 %	0.01 %	[33]

* Study did not break down the student population by gender, but said both chlamydia cases were in women. We have assumed that the student population was divided equally between men and women.

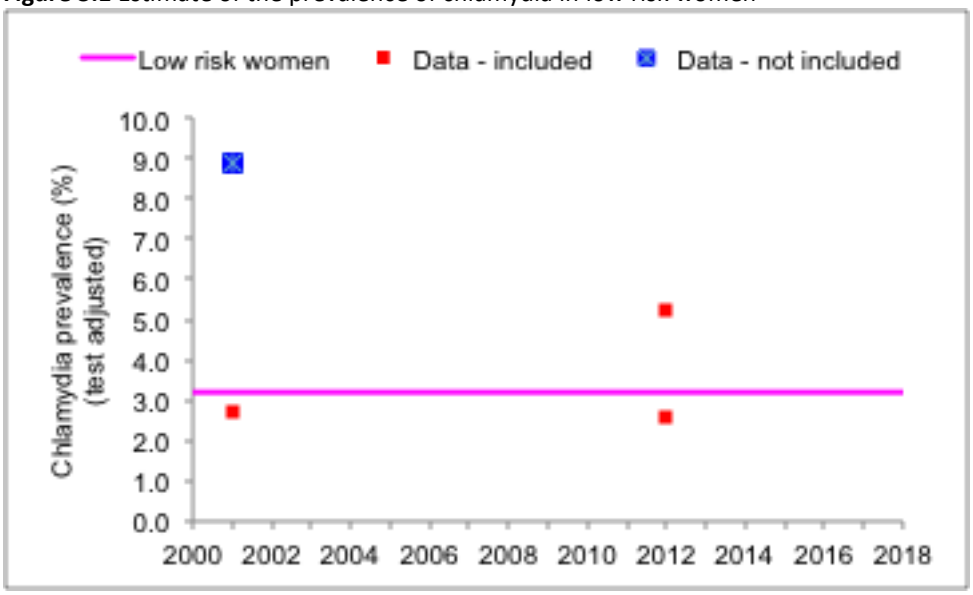
Data from 2000 or later from nearby countries were also identified from the Spectrum global STI data file and in the WHO datasets.

- Armenia, Azerbaijan, Czech Repubic, Latvia, Moldova, Russia, Slovakia, Turkey, Ukraine: none;
- Lithuania: 1999/2000: women attending 4 gynaecological and 2 ANC clinics in Kaunas -8.4% (N=1008, genital fluids -micro-immuno-fluorescence). Prevalence varied across the 6 clinics – from 4% to 13.5% [34].
- Slovenia: 2000: national survey (probability sample): males – 2.9% (N=683, urine PCR/LCR) and females – 1.6% (N=764, urine PCR/LCR) [35].

Female estimate: Based on the available data the decision was made to use the 3 data points for women to generate a female estimate after adjusting for diagnostic test, age and location. The current estimate (see Figure 3.1) is based on the average of the three data points (3.20%) and assumed to remain constant over time.

Male estimates: As there was only one data point for men and the sample size was very small (under 100), the decision was made to use the male-to-female ratio for chlamydia from the 2012 WHO regional estimate for Western, Central and Eastern Europe (1.37 divided by 1.86 or 0.74 [12]) to estimate the prevalence in low risk males from the low risk female estimate, and we assumes this ratio was fixed over time.

Figure 3.1 Estimate of the prevalence of chlamydia in low risk women



3.2.2 FSW

Table 3.6 records the data found for FSWs. The current estimate of 25.9 % is the simple unweighted average between the 5 data points (after test adjustment) from Tbilisi (2002, 2004 and 2006) and Batumi (2004, 2006], and it was assumed that the prevalence was constant throughout 2000-2016.

Table 3.6 Chlamydia prevalence in FSWs.

Year	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Adjusted Prevalence	Type of study	Reference
Tbilisi							
2002	40	155	Urine PCR	25.8 %	29.5 %	BBS	[16]
2004	35	157	Urine PCR	22.3 %	25.5 %	BBS	[17, 36]
2006	34	159	Urine PCR	21.4 %	24.4 %	BBS	[17, 36]
Batumi							
2004	24	120	Urine PCR	20.0 %	22.8 %	BBS	
2006	28	117	Urine PCR	23.9 %	27.3 %	BBS	[17]

3.2.3 MSM

One MSM data point was identified (see Table 3.7). This study used an EIA test which has poor specificity (cross reactivity with chlamydia *Psiticci and chlamydia pneumonia* and can detect old infections of trachomatis). In the absence of any other data, we assumed the national estimate in 2016 was 17% and assumed the prevalence was constant over the period 2000 to 2016 [12].

Table 3.7 Chlamydia prevalence in MSMs. Data from Tbilisi.

Year	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Adjusted Prevalence	Type of study	Reference
2010	45	271	ELISA/ EIA; Specimen?	16.6 %	17.0	BBS	[25]

3.2.3 National prevalence estimates

National chlamydia prevalence estimates for 2016 were generated by adding together the estimated prevalent cases in 2016 in low risk populations, FSWs and MSM based on the test adjusted prevalence estimate and size of each population group (see Annex A2). The results for 2016 and underlying assumptions are presented in Table 3.8. In 2016, the estimated national, test adjusted prevalence was 3.42% in females and 2.62% in males.

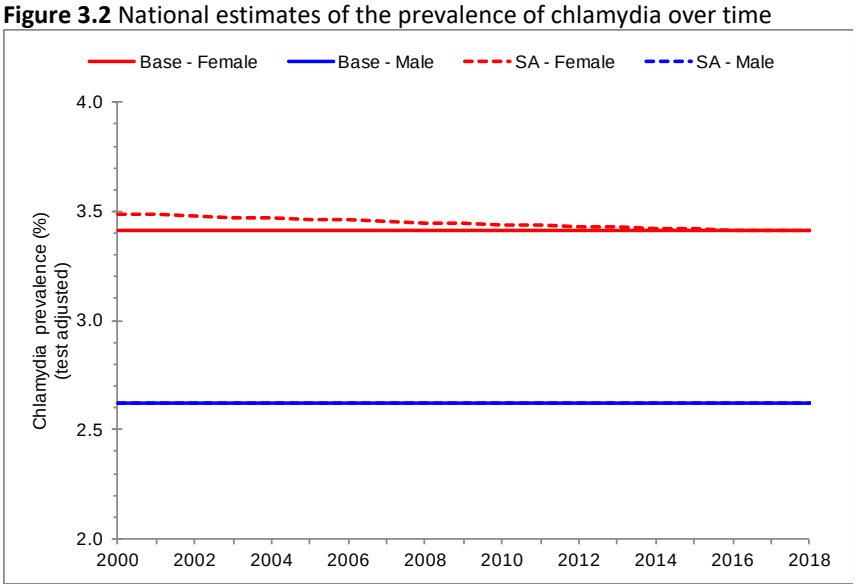
Figure 3.2 records the estimated national prevalence in adult 15 to 49 year old men and women between 2000 and 2018 for both the Default Scenario and Scenario A. In the Default Scenario the prevalence of chlamydia was constant over time owing to the underlying assumptions. In Scenario A there was a slight decline for women reflecting changes in the proportion of FSWs in the female population.

Table 3.8 also shows the contribution of each population group to the total number of prevalent cases. FSWs, who only accounted for 0.94% of the female population in 2016 accounted for 7.1% of the prevalent cases in women. For men, MSMs accounted for only 1.82% of the population but 11.8% of the cases. Overall, chlamydia burden is thus relative widespread in the general population, and not so concentrated in the higher-risk groups.

Table 3.8 2016 Chlamydia prevalence estimates for Georgia in adults 15 to 49 years of age. Total population in this age group in 2016 was 1,906,450.

Females			
	Low-risk women	**FSW**	**Total**
Prevalence: test-adjusted	3.20%	25.90%	3.42%
Population size	949,158	9,017	958,175
Percentage of population	99%	0.94%	100%
Prevalent cases	30,373	2,336	32,766
Percentage of female prevalent cases	92.9%	7.1%	100%
Males			
	Low-risk men	**MSM**	**All men**
Prevalence: test-adjusted	2.36%	17.0%	2.62%
Population size	929,139	17,240	946,379
Percentage of population	98.2%	1.82%	100%
Prevalent cases	21,900	2,931	24,830
Percentage of male prevalent cases	88.2%	11.8%	100%

Figure 3.2 National estimates of the prevalence of chlamydia over time



3.3 Gonorrhea: Prevalence Data and Results

3.3.1 Low risk populations

Only one study was identified that provided data from a low risk population in Georgia (see Table 3.9)

Table 3.9 Gonorrhea prevalence in low risk populations

Population	Year	Number Positive	Sample Size	Diagnostic Test	Observed Prevalence	Adjusted Prevalence	Reference
Community based – sexually active but not high-risk women in Kakheti region & Tbilisi	2001	0	999	PCR, Urine	0.0	0.01	[14]

Data from 2000 or later from nearby countries were also identified from the Spectrum global STI data file and in the WHO datasets.

- Armenia, Azerbaijan, Czech Repubic, Latvia, Moldova, Russia, Slovakia, Slovenia, Turkey, Ukraine: none;
- Lithuania: 2000: women attending women's health care unit in Kaunas: 0.4% of 1008 (cervical swabs, culture or gram stain) [34].

Owing to the absence of data, the decision was made to use the WHO 2012 estimates for Western, Central and Eastern Europe, adjusted down by 10% to remove the high risk populations contribution as these were being estimated separately for Georgia. We thus assumed that the prevalence in low risk women was 0.264% and in low risk men 0.227% *[12]* and that these values were fixed for 2000 to 2016.

3.3.2 FSW

BBS surveys that collected data on gonorrhea have been conducted among FSWs in Batumi and Tbilisi every two years since 2002. These are recorded in Table 3.10 and the observed prevalence data are also show in Figure 3.2.

Separate Spectrum estimations were done for Tbilisi and Batumi City based on the BBS date (Figure 3.3 a and b). Both graphs show a slight decline in the prevalence of gonorrhea. In Tbilisi the Spectrum estimate fell from 14.5% in 2000 to 11.1% in 2016 and in Batumi City from 9.6% in 2000 to 7.2% in 2016.

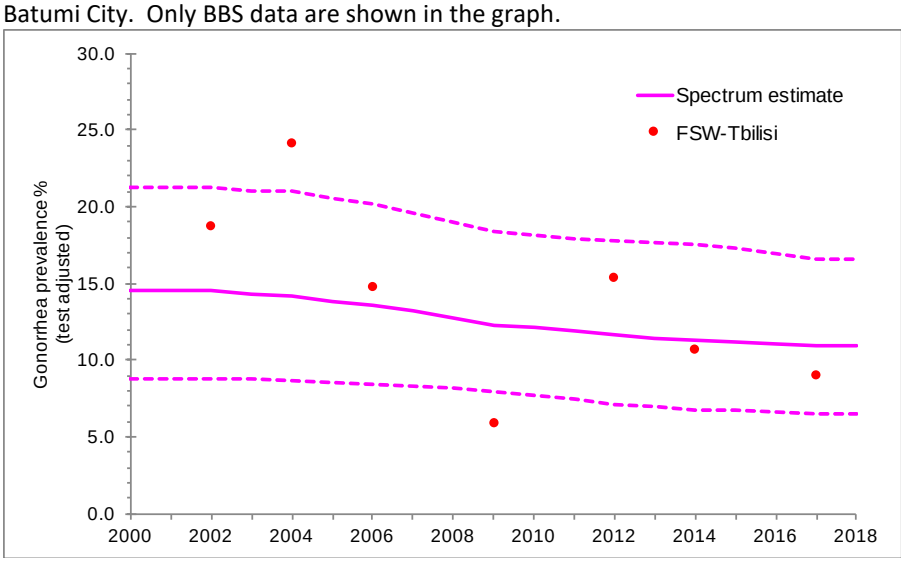
To generate national estimates over time for FSWs we combined the two Spectrum FSW estimates assigning a weight of 0.75 to the Tbilisi estimates and 0.25 to Batumi (for all years). The higher weight for Tbilisi reflects the fact that Tbilisi has a larger population than Batumi. The national estimate for 2016 using this approach was 9.91%.

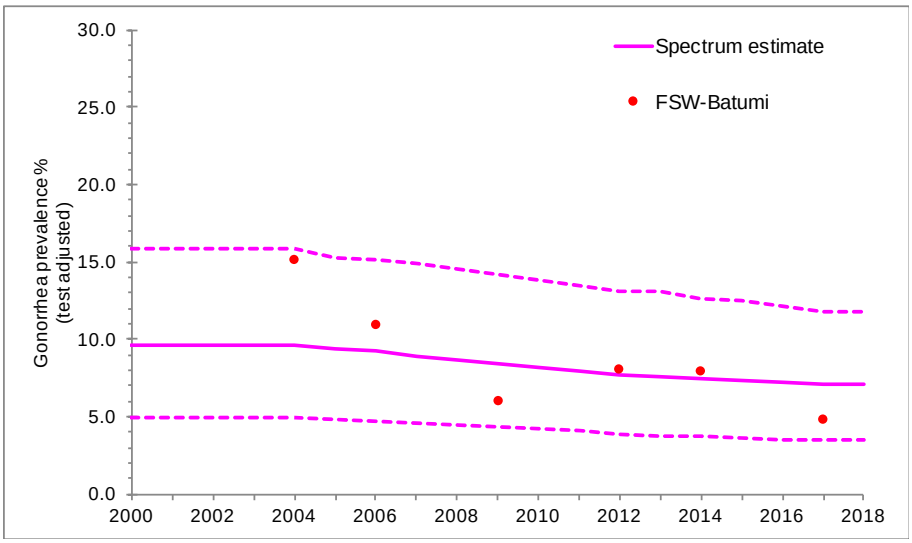
Table 3.10 Gonorrhea prevalence in FSWs.

Year	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Adjusted Prevalence	Type of Survey	Spectrum Weight	Reference
Tbilisi								
2002	27	155	Urine PCR	17.4 %	18.8 %	BBS	1.0	[16]
2004	35	157	Urine PCR	22.3 %	24.1%	BBS	1.0	
2006	22	159	Urine PCR	13.8 %	14.8 %	BBS	1.0	[17, 36]
2008-9	9	157	Urine PCR	5.7 %	6.0 %	BBS	1.0	[18]
2012	23	160	Urine PCR	14.4 %	15.4 %	BBS	1.0	[37]
2014	16	159	Urine PCR	7.6 %	10.7 %	BBS	1.0	[20]
2017	17	199	Urine PCR	8.5 %	9.0 %	BBS	1.0	[21]
Batumi								
2004	17	120	Urine PCR	14.2%	15.2%	BBS	1.0	[17]

Year	Number positive	Sample Size	Diagnostic Test	Observed Prevalence	Adjusted Prevalence	Type of Survey	Spectrum Weight	Reference
2006	12	117	Urine PCR	10.3 %	10.9 %	BBS	1.0	[17]
2008-9	7	120	Urine PCR	5.8 %	6.1%	BBS	1.0	[18]
2012	9	117	Urine PCR	7.7 %	8.1%	BBS	1.0	[37],
2014	9	119	Urine PCR	7.6 %	8.0%	BBS	1.0	[20]
2017	7	150	Urine PCR	4.7 %	4.8 %	BBS	1.0	[21]

Figure 3.3 FSW gonorrhea data and FSW gonorrhea Spectrum estimation results for (a) Tbilisi and (b) Batumi City. Only BBS data are shown in the graph.





3.3.3 MSM

No prevalence data were found for MSM that met the study entry criteria. Given the lack of any gonorrhea prevalence data from surveys using modern diagnostic methods MSM, we did not formally estimate the prevalence in MSM, but assumed it to be the same as the prevalence in FSWs.

3.3.4 National estimates

National gonorrhea prevalence estimates for 2016 were generated by adding together the estimated prevalence in 2016 in low risk populations, FSWs and MSM after adjusting for their contribution of each group to the adult national population of 15-49 year olds (see Annex A2). The results for 2016

are presented in Table 3.12. In 2016, the estimated national, test adjusted prevalence was 0.36% in females and 0.41% in males.

Figure 3.4 records the estimated national prevalence in adult 15 to 49 year old men and women between 2000 and 2018 for both the Default Scenario and Scenario A. In both scenarios the prevalence of gonorrhea decreased between 2000 and 2016. This decrease is driven by the decrease in prevalence in FSWs, a population that has benefited from extensive control efforts especially since the start of Global Fund-supported prevention services. The decline in prevalence in key groups, through dynamic transmission, may have driven a corresponding decline in the low-risk and overall national population but there is insufficient data to show this.

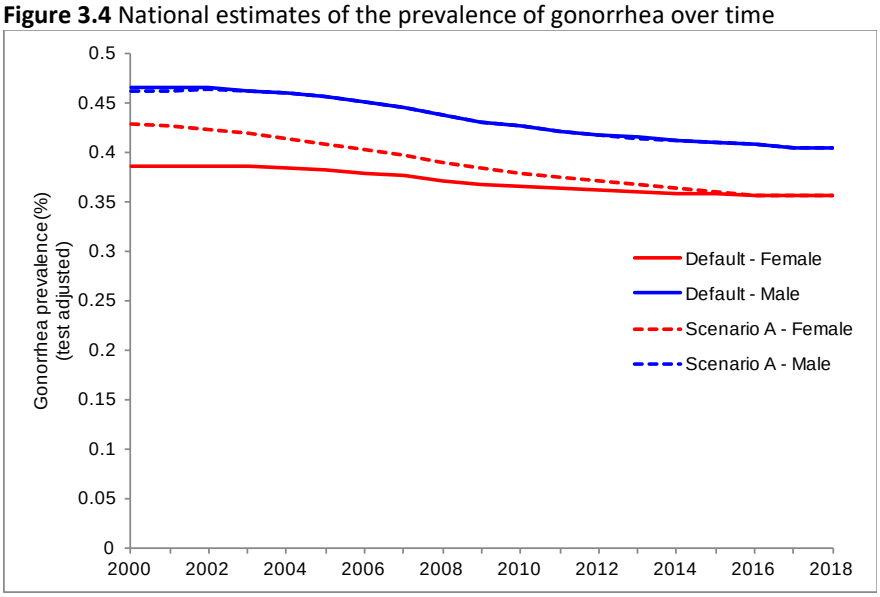
The increased decline in women in Scenario A relative to the Default Scenario reflects both the decline in prevalence among FSWs and the fall in the proportion of the female population that are FSWs (from 1.32% to 0.95%).

Table 3.12 also shows the contribution of each population group to the total number of prevalent cases. FSWs, who only accounted for 0.94% of the female population in 2016 accounted for 26.7% of the prevalent cases in women. For men, the group that dominated was MSMs: They accounted for only 1.82% of the population but 45.2% of the prevalent cases.

Table 3.12 2016 Gonorrhea prevalence estimates for Georgia in adults 15 to 49 years of age. Total population in this age group in 2016 was 1,906,450 of whom half were men.

Females			
	Low-risk women	**FSW**	**Total**
Prevalence: test-adjusted	0.26%	10.12%	0.36%
Population size	949,158	9,017	958,175
Percentage of population	99.1%	0.94%	100%
Prevalent cases	2,502	913	3,415
Percentage of female prevalent cases	73.3%	26.7%	100%
Males			
	Low-risk men	**MSM**	**All men**
Prevalence: test-adjusted	0.23%	10.12%	0.41%
Population size	929,139	17,240	946,379
Percentage of population (%)	98.2%	1.8%	100%
Prevalent cases	2,112	1,745	3,857
Percentage of male prevalent cases	54.8%	45.2%	100%

Figure 3.4 National estimates of the prevalence of gonorrhea over time



3.4 Incidence and Case Reporting Results

Table 3.13 records the estimated number of incident cases, symptomatic cases and treated symptomatic cases for men and women with chlamydia in 2016. Similar information for gonorrhea are recorded in Table 3.14. In addition, both tables provide information on the number of actual cases reported and the estimated case reporting completeness for the Default Scenario. For females the case reporting completeness for chlamydia was 66.2% and for gonorrhea 22.2%. For males the figures are much lower – 7.8% and 9.5%.

Figure 3.5 shows temporal trends in the estimated reporting completeness for chlamydia and gonorrhea. The graphs suggest that there has been little change in reporting completeness for males, but there may have been some recent improvement in females – especially for chlamydia. Reporting completeness was particularly poor in 2012 for both infections. In contrast, no such temporary drop, was seen for syphilis (see section 2.4).

The marked difference between male versus female reporting completeness, especially in recent years, suggests that we may have:

- Under estimated male prevalence relative to female;
- Under-estimated STI diagnostic and treatment access and coverage in women (especially in recent years) compared to men.

Table 3.13 Chlamydia - Incident cases and case reporting in 2016. Default Scenario.

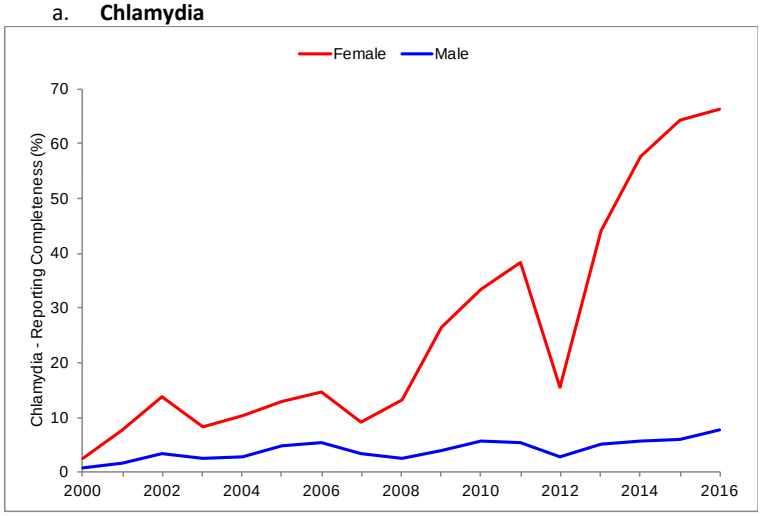
	Females	Males	Source & assumptions
Incident cases per 100,000	3,075	3,280	Based on estimated national prevalence and duration of infection
Incident cases	29,467	31,038	Female population assumed to be 937,450 and male population 969,000
Episode duration	1.11	0.80	WHO 2012 [12]
Estimated symptomatic cases	5,009	16,761	34% of infected women are symptomatic and 64% of men (WHO 2012 [12])
Estimated symptomatic cases treated	2,505	10,894	50% of symptomatic women are treated and 65% of men (WHO 2012 [12])
Actual case reports	1,658	849	
Reporting completeness	66.2%	7.8%	

Table 3.14 Gonorrhea - Incident cases and case reporting in 2016. Default Scenario

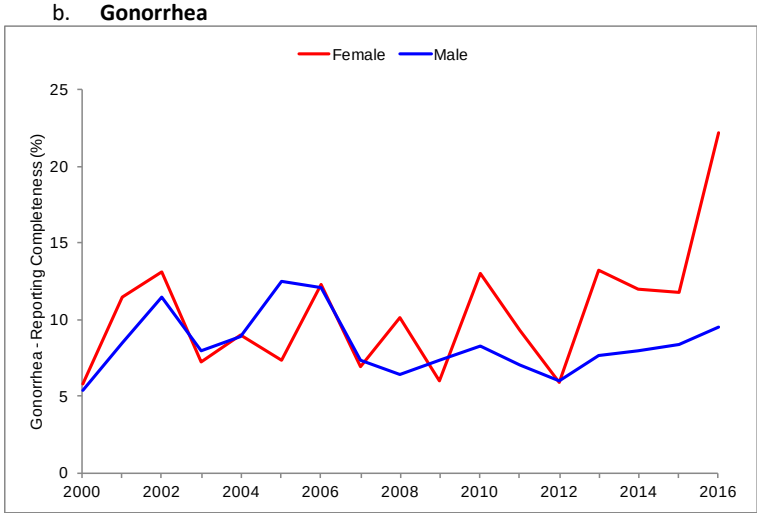
	Females	Males	Source & assumptions
Incident cases per 100,000	869	1,630	Based on estimated national prevalence and duration of infection
Incident cases	8,330	15,427	Female population assumed to be 937,450 and male population 969,000
Episode duration	0.41	0.25	WHO 2012 [12]
Estimated symptomatic cases	2,832	9,873	34% of infected women are symptomatic and 64% of men (WHO 2012 [12])
Estimated symptomatic cases treated	1,416	6,418	50% of symptomatic women are treated and 65% of men (WHO 2012 [12])
Actual case reports	314	609	
Reporting completeness	22.2%	9.5%	

Figure 3.5 National estimates of case reporting completeness among symptomatic, treated cases

a. **Chlamydia**



b. **Gonorrhea**



3.5 Discussion

National estimates of the prevalence and incidence of chlamydia and gonorrhea in adults 15 to 49 were generated by adding together the estimated prevalence in 2016 in low risk populations, FSWs and MSM after adjusting for their contribution of each group to the adult national population of 15-49 year olds.

There is considerably less data for chlamydia and gonorrhea than for syphilis and, as a result, we only tried to split out MSMs and FSWs and even for these there were insufficient data, apart from gonorrhea in FSWs, to use Spectrum STI to generate trend estimates.

For both infections the national estimates should be treated with caution. For chlamydia we identified only 7 data points, the latest of which was from 2011: 3 in low risk populations, 3 in FSWs (the latest study was from 2006), and 1 study looking at chlamydial antibodies in MSMs. For gonorrhea, apart from one study conducted in low risk women in 2001 the only other data were for FSWs. There is clearly a need for more data – from both low and high risk populations – before meaningful estimates can be made.

The estimated prevalence in 2016 for chlamydia was 3.4% in women and 2.6% in men and for gonorrhea 0.36% in women and 0.41% in men. These figures are higher than the WHO 2012 regional estimates for Western, Central and Eastern Europe.

Chlamydia: Women: 1.86% (95% UI: 1.44-2.50); Men: 1.37% (95% UI: 0.61-2.68)
Gonorrhea: Women: 0.29% (95% UI: 0.18-0.42); Men: 0.25% (95% UI: 0.13-0.41).

The much higher chlamydia prevalence figures in Georgia than the WHO regional figures reflect the relatively high estimated prevalence in low risk women. This estimate was based on three data points – a community based study (2001-2002), a study in ANC women (2011) and one in students (2011)). The high prevalence was driven particularly by the ANC study in Tbilisi where the test adjusted prevalence was 5.2%. The Georgian and WHO gonorrhea prevalence are much more similar – but this reflects the fact that the WHO estimates were used as the basis of the Georgian low risk population estimates – and not any real data.

For chlamydia, the key high-risk groups made up less than 11% of national burden, hence improving chlamydia surveillance and control should not be limited to higher-risk populations – but consider screening in, for example, ANC women and/or adolescents and young women. Gonorrhea was estimated to be relatively concentrated in FSW and MSM yet few BBS surveys measured gonorrhea in these groups.

The uncertainties in the national prevalence estimates mean that the estimated number of incident cases is also very uncertain. We did, however, generate estimates of case reporting completeness. The low levels of reporting completeness estimated, especially, for men may reflect that we have overestimated the prevalence of infection. However, there are other factors that may also be coming into play including people self-treating or being treated by doctors who are not authorised to treat STI patients and hence do not report diagnosed cases. What is surprising is the difference in completeness rates between women and men, suggesting that the male to female ratio we assumed (based on the WHO regional estimates) may not be appropriate in Georgia, or that our assumptions about treatment seeking need to be refined. Resolving these issues, however, is not possible with the data that are currently available.

The lack of chlamydia and gonorrhea data clearly hamper any attempt to generate national estimates. There is clearly a need for more data to be collected both from the general population and populations that may be at higher risk. Actions that NCDC and its collaborators could explore include:

- Expanding future BBS studies in FSWs and MSM to include both gonorrhea and chlamydia.
- Identifying opportunities for small scale population-based screening of gonorrhea and chlamydia in sentinel ANC clinics
- Exploring opportunities for other small scale studies looking at specific populations e.g., blood donors, military recruits, students, women being screened for HPV.
- Exploring opportunities to link the collection of chlamydia and gonorrhea data to other studies, e.g., the pilot study of GeneXpert diagnosis of TB patients
- Collecting data on where men and women seek care for STIs. At present the most recent data is from the Reproductive Health Survey, 2010 and it only provides information for women.

The piloting of Spectrum STI to generate national chlamydia and gonorrhea estimates in Georgia was only a limited success. Owing to the lack of data Spectrum STI was only used to generate estimates for gonorrhea in FSWs. Estimates for the other populations were made by extrapolating from the limited number of data points or using regional figures. As a result, for these two infections the Spectrum STI model did not add greatly to the quality of the final estimates.

4. Congenital syphilis

Congenital syphilis (CS), or mother-to child-transmission (MTCT) of syphilis can result in adverse pregnancy outcomes such as stillbirth, neonatal death, prematurity, low birth weight or congenital defects.

WHO surveillance definition of CS

- a stillbirth, live birth, or fetal loss at >20 weeks of gestation or >500 grams to a syphilis seropositive mother without adequate syphilis treatment; OR (*aside, am not sure what the >500 g refers to)*
- a stillbirth, live birth, or child aged <2 years with microbiological evidence of syphilis infection

Georgia CS surveillance case definition:

(From NCDC list of notifiable infections. Last updated in 2016).

- child aged <2 years born to a syphilis seropositive mother without adequate syphilis treatment

The current definition of CS in Georgia differs slightly from the WHO definition. The Georgian definition does not include asymptomatic infants born to untreated infected women, and whilst it does include stillbirths and neonatal deaths these are probably under reported.

Pregnant women are screened for syphilis as part of routine ANC care. Women are usually screened for syphilis at their first ANC visit and as of 2016/17 Georgia introduced an additional repeat screening in the third trimester as well. Women need to come back to the ANC clinic to get the results from their screening test and those who are screened positive are referred to a specialist STI physician for confirmation and treatment. Confirmation and treatment is free, but only from a specialist STI physician.

The analysis in this paper uses the WHO definition and breaks CS cases into two groups:

1. Infants with Adverse Birth Outcomes (ABO) born to treated or untreated women. ABOs include early fetal loss, stillbirth, neonatal death, prematurity, low birth weight and clinical evidence of syphilis in a neonate.
2. Syphilis exposed infants born to untreated mothers without clinical signs

4.1 Methods

Cases of CS associated with syphilis were based on:

1. Spectrum estimates of syphilis prevalence in women attending ANC care and in the national female population;
2. Service coverage data on the number of pregnancies in Georgia, the number of pregnant women screened for syphilis, and the number treated
3. A tool developed with WHO support to estimate CS-attributable ABO [38, 39].

4.1.1 Syphilis prevalence in pregnant women

The Spectrum estimates of syphilis prevalence in ANC women (e.g. 0.10% in 2016, see Section 2.2.1) were used to estimate the prevalence of syphilis in pregnant women screened during ANC. For women not screened during ANC (i.e. women not attending ANC, and women attending ANC but not screened), we applied the – slightly higher -- prevalence in the national female population (e.g. 0.39% in 2016.

4.1.2 Service coverage data

Numbers of pregnant women who attended ANC, number of women screened for ANC and total number of live births are available from routine records in Georgia and used to estimate service coverage. Any missing values were interpolated from values at years with data before and after.

The number of pregnant women treated each year for syphilis is given by:

Number of pregnancies X (probability of attending ANC X probability screened if attends ANC X probability test positive if screened X probability treated if test positive).

The number of pregnant women with syphilis and not treated is given by:
Number of pregnancies X prevalence of syphilis in pregnant women – number of pregnant women treated for syphilis.

4.1.3 Adverse birth outcomes (ABO)

The WHO CS estimation tool (*http://www.who.int/reproductivehealth/topics/rtis/*) was used to calculate the number of ABOs. Table 4.1 records the assumptions underlying the model. In the current version of the model the probability of developing an adverse outcome for a treated woman does not depend on which trimester she was treated in.

Data from a meta-analysis suggests that 52% of pregnancies in an untreated women with syphilis results in an ABO [40] and 8.3% of pregnancies in a treated women [41]. The latter reflecting both inadequate treatment and reinfection.

The total ABOs are then given by 0.52 times the number of pregnant women not treated for syphilis + 0.083 times the number of pregnant women treated for syphilis.

Table 4.1 Estimated proportion of adverse birth outcomes (ABOs) in untreated and treated pregnant women affected by syphilis

Outcome	**Estimated risk probability of adverse birth outcome, to mother with syphilis**	
	Mother untreated [40]	**Mother treated*** (Treatment efficacies from [41]; applied to 'base' risk probabilities from [40]
Early fetal loss/ stillbirth	21 %	3.8 %
Neonatal death	9 %	1.8 %
Prematurity or low birth weight	6 %	2.2 %
Clinical evidence of syphilis in newborn	16 %	0.5 %
Any adverse birth outcome	52 %	8.3 %

* Treatment is assumed to reduce the proportion of infants who develop an ABOs by different amounts, for example: treatment reduces neonatal deaths by 80% [41], from 9% [40] to 1.8%.

4.1.4 Syphilis exposed infants born to untreated mothers without clinical signs

Syphilis exposed infants born to untreated mothers without clinical signs are a key component of the WHO CS definition.

The total number of syphilis exposed infants born to untreated women without clinical signs is given by: The number of untreated pregnant women, multiplied with (1 – probability of developing an ABO if untreated (0.52).

4.1.5 Case reporting completeness

Completeness of case reporting was evaluated by comparing annual CS cases reported by NCDC to the annual number of CS cases generated by Spectrum.

4.2 Results

Table 4.2 records Georgia's ANC-related service indicators and program data used to generate the CS estimates for 2008 to 2016.

Table 4.2. Georgia-specific data used to generate national CS estimates

Year	**Pregnancies**	**Women with >=1 ANC visit**		**ANC women screened for syphilis**		**Treatment coverage for syphilis-infected women diagnosed during ANC**	**Reported CS cases**
2008	61,211	59,742	97.6 %	42,885	71.8 %	75%	0

Year	Pregnancies	Women with >=1 ANC visit		ANC women screened for syphilis		Treatment coverage for syphilis-infected women diagnosed during ANC	Reported CS cases
2009	61,198	59,729	97.6 %	49,908	83.6 %	75%	3
2010	57,226	55,853	97.6 %	52,836	94.6 %	75%	2
2011	57,016	55,648	97.6 %	49,023	88.1 %	75%	8
2012	60,993*	59,529*	97.6 %	48,176	80.9 %	75%	5
2013	60,993*	59,529*	97.6 %	50,903	85.5 %	75%	13
2014	63,635	62,108	97.6 %	54,924	88.4 %	75%	12
2015	59,900	58,462	97.6 %	52,107	89.1 %	75%	17
2016	56,223	54,874	97.6 %	51,287	93.5 %	75%	12

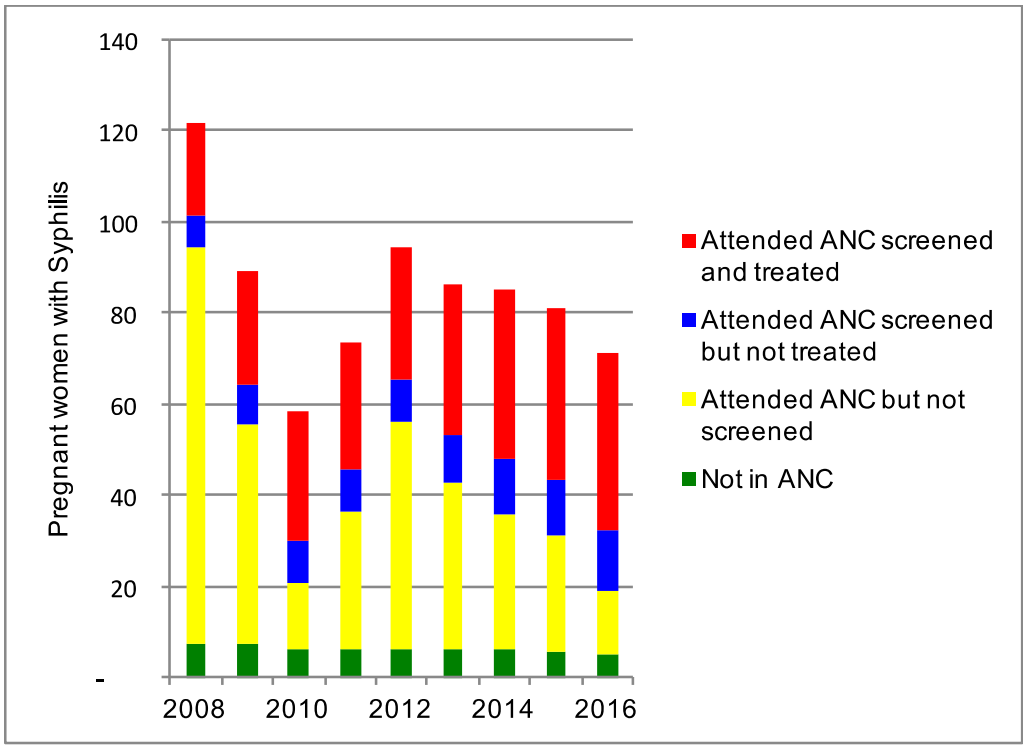
- The same figures were used for 2012 & 2013 owing to a missing data point.

Footnotes for table 4.2

Indicator	Data source	Additional assumptions
Pregnancies	Estimated	Estimated from the number of women with more than one ANC visit and assuming that 97.6% of women had one or more ANC visit (2010 Reproductive Health Survey reported that 97.6% of women had one or more ANC visits (two earlier surveys reported 1999: 91% and 2005: 95.4%).
Women with one or more ANC visit	NCDC	
ANC women screened for syphilis	NCDC	
Treatment coverage for syphilis infected women diagnosed during ANC	Estimated	Given the lack of data this was set at 75% for all years throughout 2007-2017. All treated women were assumed to have been treated adequately, with at least one dose of 2.4 million units of benzathine penicillin, per the WHO recommendation [42]
Reported CS cases	NCDC	In 2013 CS reporting moved to a case based system using the new EIDSS.

Figure 4.1 records the estimated number of pregnant women with syphilis and their access to ANC services and syphilis treatment from 2008 to 2016. In 2016, of the estimated 73 pregnant women with syphilis, 38 were treated, and an additional 13 were screened for syphilis but not treated. The high number of screened yet untreated women reflects the fact that women are referred for confirmation and treatment and not treated at the same facility where screened -- we assumed that only 75% of mothers diagnosed in ANC got treated appropriately.

Figure 4.1 Estimated number of pregnant women with syphilis and their access to ANC services and syphilis treatment from 2008 to 2016

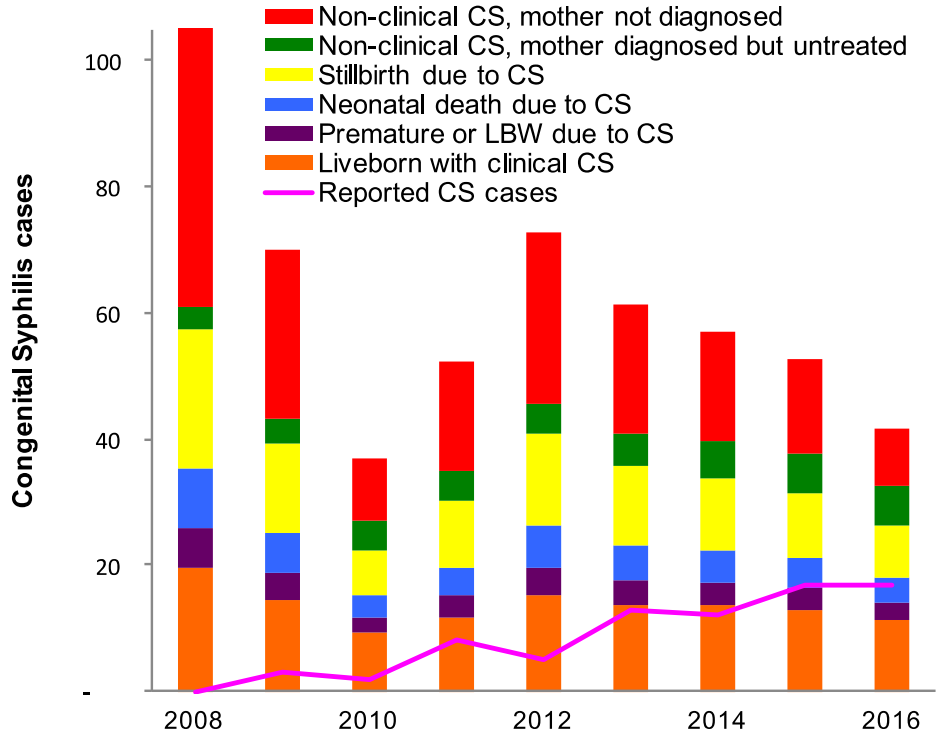


The estimated number of CS cases by type and by year is shown in Figure 4.2, under the Default Scenario, using the WHO definition of CS. The 42 estimated CS cases for 2016 correspond to a CS rate of 75 per 100,000 live births, above the WHO target for the elimination of CS of 50 per 100,000 live births (Fig 4.3).

While we estimated 42 CS cases in 2016, there were 17 reported CS cases (Georgian CS definition) that year, suggesting a reporting completeness of 40% against estimated CS cases according to the WHO case definition. The 17 reported cases are more than the estimated 14 CS-attributable premature or LBW infants + other liveborn infants with clinical symptoms – confirming that the Georgian system does pick up not only the symptomatic live-born CS cases (like in some other countries) but also part of the asymptomatic CS burden and/or CS-attributable still-births and neonatal deaths.

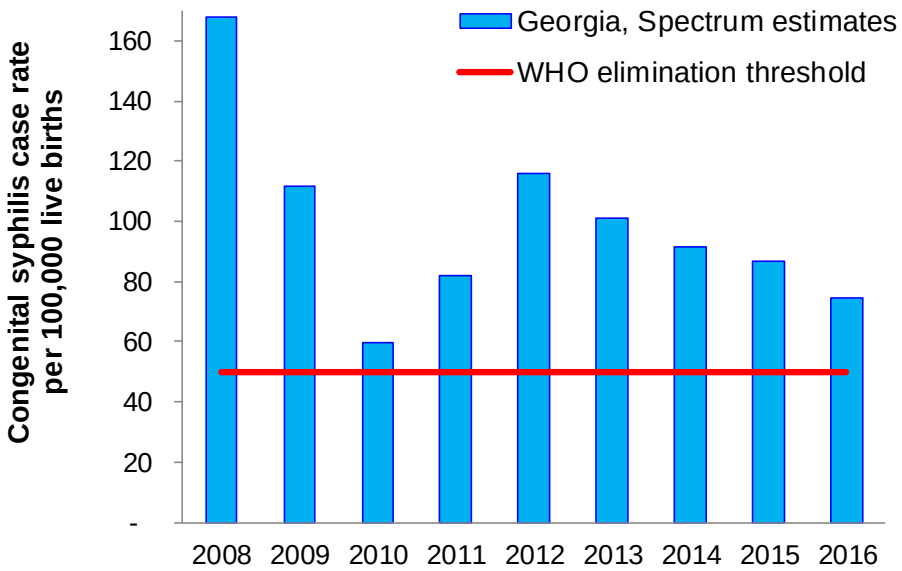
Over 2008 to 2016, numbers of CS and ABO fell as a function of improving screening coverage; a dip in 2010 reflects that year's peak in recorded screening coverage.

Figure 4.2 Estimated number of congenital syphilis cases (WHO definition) over time



Notes to Figure 4.2. Prevalence of syphilis in pregnant women screened for ANC based on data from the national program. Prevalence in all other pregnant women (i.e. those who did not attend ANC or who attended ANC and not screened for syphilis) was set at the midpoint of the prevalence in blood donors and ANC women.

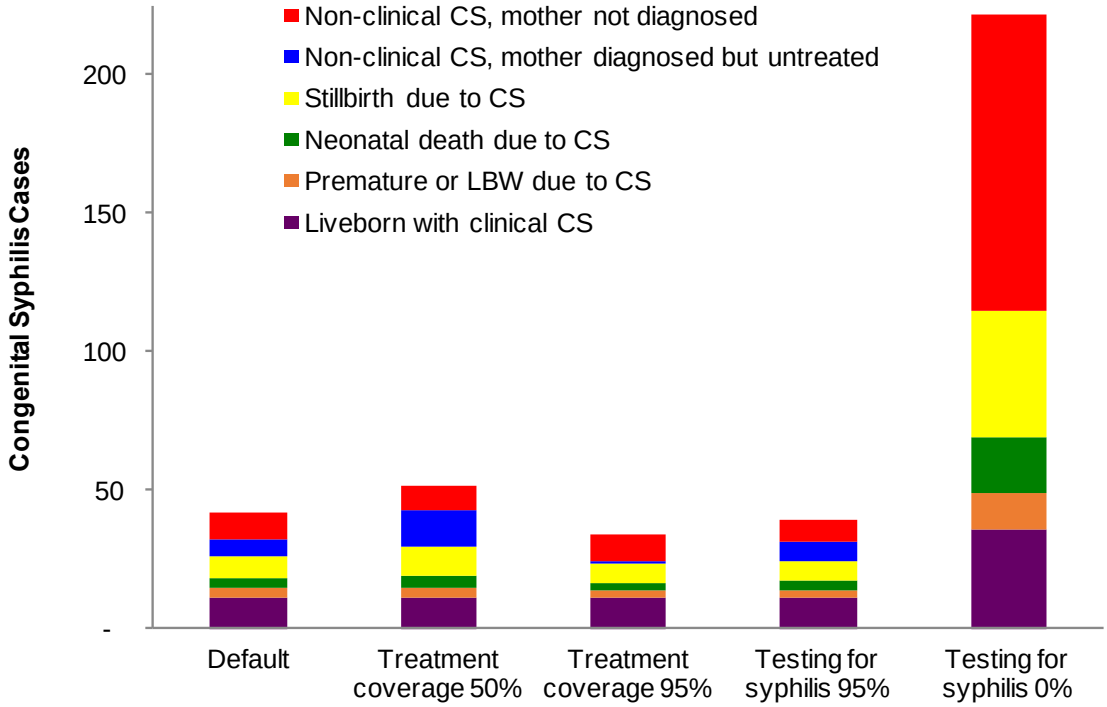
Figure 4.3 Estimated congenital syphilis case rate per 100,000 live births



The consequences of altering some of the default assumptions are shown in Figure 4.4. Increasing treatment coverage has a significant impact on CS case numbers – increasing coverage from 75% to 95% would decrease CS cases from 8 in the Default to 3, whilst decreasing coverage from 75% to 50% would increase CS cases from 8 in the Default to 15. Figure 4.3 also shows the number of cases of CS in the absence of any screening program. Under the Default Scenario, the Georgian ANC program in 2016 prevented a total of 30 cases of CS - 1 case of premature or LBW, 3 cases of neonatal death, 7

cases of stillbirth and 19 infants counted as CS who were asymptomatic but syphilis-exposed either because their mother was not diagnosed or she was diagnosed but not treated.

Figure 4.4 Estimated number of congenital syphilis cases (WHO definition) in 2016. In the Default Scenario treatment coverage was set at 75% and syphilis testing among ANC women at 93.5%*.



* Data from the three Georgian Reproductive Health Surveys provide data on the percentage of women self-reporting that their first ANC visit was in the 1st trimester. The estimates were 63%, 71% and 90% in 1999, 2006 and 2010. Programmatic data from the NCDC Annual Report for 2009 to 2013 record 53%, 54%, 66%, 73% and 78% of first ANC visits were in the 1st trimester.

4.3 Discussion

Combining syphilis estimates generated using Spectrum STI and the WHO CS estimation tool provides useful data for exploring the impact of Georgia's ANC services on CS cases. In the absence of any ANC services, the estimated number of CS in 2016 would have been 73. The current Georgian program prevented 30 of these cases, leaving 42 CS cases or a CS rate of 75 per 100,000 live births.

A key factor contributing to the success of the programme is the high rate of ANC coverage – according to the 2010 Reproductive Health Survey 97.6% of pregnant women attended ANC.

ANC screening of pregnant women is also relatively high, and has been increasing over time from 71.8% in 2008 to 93.5% in 2016. This is a major success and the programme has almost reached the WHO criteria for the elimination of CS (95%).

The area where the Georgian program could implement improvements is maternal syphilis treatment coverage. In the Default Scenario we assumed maternal syphilis treatment coverage was 75% as treatment coverage data is not collected systematically. This clearly needs to change. Improving treatment coverage from the estimated 75% to 95% (the WHO elimination criteria) would result in an additional 8 fewer infants with CS.

Data on treatment coverage for Georgia are reported in the global GAM/ GARPR database but it is not clear what the numerators and/ or denominators were for 2009 or 2015:

- 2009: 95%;
- 2014: 92% based on data from the main STI clinic in Tbilisi which reported that 45 of 49 pregnant women (92%) with confirmed syphilis were treated;
- 2015: 23%.

Preliminary data from a study of the CS cases in 2016/17 suggest that 7 of the 11 CS (64%) cases were among women who had been screened and treated. Extrapolating from these data then treatment coverage among all syphilis screened women was probably over 64%.

There are a number of actions that NCDC and partners could take to improve the quality of CS estimates. These include:

- Documenting and reducing loss-to-follow-up between ANC screening and treatment.
- Introducing systematic monitoring of syphilis treatment coverage in ANC women.
- Training & improving the use of the WHO CS case definition, including all infants of untreated women.

5. Conclusion

This report summarizes the results from the first application of the Spectrum STI model to a country in the WHO European Region, and the first attempt to generate estimates for a low prevalence country.

The model was presented and the available data discussed at a workshop in August 2017. The discussion at the workshop highlighted what information was/ wasn't available in Georgia and in some cases people were reminded of studies that were not in the published domain.

For syphilis there was a considerable quantity of data from a variety of populations. This was not the case for gonorrhea and chlamydia and as a result the final estimates are based on a number of assumptions which may or may not be valid.

Box 5.1 summarizes the main recommendations from the workshop.

Box 1. Summary of Recommendations

Syphilis
- Evaluate & optimize performance and accuracy of ANC screening tests
- Collate blood donor data: prevalence by sex, mix of voluntary vs. paid donors.
- Collect entry screening data from the prison services.
- Ensure future BBS studies in IDU include prevalence by sex
- Explore feasibility of conducting a population based survey in men and women
- Identify studies in high risk populations where it would be straightforward to also test for syphilis

Congenital syphilis
- Introduce systematic monitoring of syphilis treatment coverage in ANC women.
- Document and reduce loss-to-follow-up between ANC screening and treatment.
- Train & improve the use of the WHO CS case definition, including stillbirth cases and all babies of untreated women.

Gonorrhea & Chlamydia
- Expand future BBS studies in FSWs and MSM to include both gonorrhea and chlamydia
- Identify opportunities for small scale population-based screening of gonorrhea and chlamydia in sentinel ANC clinics
- Explore opportunities for other small-scale studies looking at specific populations e.g., blood donors, military recruits, students, women being screened for HPV.
- Explore opportunities to link the collection of chlamydia and gonorrhea data to other studies, e.g., the pilot study of GeneXpert diagnosis of TB patients

Case Reporting:
- Improve STI case reporting at all facilities, particularly private clinics and private hospitals
- Collate/ monitor laboratory data: Test types used, Numbers of positive tests, Total numbers of tests conducted
- Evaluate the scale of (unreported) STI treatments outside specialty clinician's setting.
- Collect data on where men and women seek care for STIs. At present the most recent data is from the Reproductive Health Survey, 2010 and it only provides information for women.

Other:
- Evaluate time trends in HIV/STI risk behaviours: condom usage, multiple partnerships, prevention reach/coverage
- Triangulate HIV and STI estimations: key population sizes, peak years?

Spectrum STI:
- Continue development of the low prevalence model.

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