TEN YEARS OF SYPHILIS TRENDS IN THE NORTHERN CAPE PROVINCE, SOUTH AFRICA, UTILISING THE NHLS CORPORATE DATA WAREHOUSE

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Introduction

Syphilis continues to be a major global public health problem, with an estimated 12 million people infected each year.[1] Worldwide, nearly 2 million pregnant women are infected with syphilis annually, most of whom are not tested, while most of those tested are either not treated promptly or are not treated at all.[2] Approximately 80% of pregnant women with untreated syphilis will transmit the infection to their unborn children, resulting in early foetal loss or stillbirth, or adverse pregnancy outcomes such as low-birth-weight or congenital disease.[3,4]

In developing countries an estimated 3-15% of women of child-bearing age have syphilis, although the burden of congenital syphilis (CS) is likely underestimated.[5] About 30% of pregnant women with syphilis will have stillbirths and another 30% will birth a live baby with CS, with subsequent mortality reaching 50%.[6]

The World Health Organization launched its initiative for the Global Elimination of Congenital Syphilis in 2007, with the goal that at least 90% of pregnant women are tested for syphilis and at least 90% of seropositive pregnant women receive adequate treatment by 2015.[1] In order to achieve these goals, strengthening of existing surveillance systems to track and monitor syphilis disease burden is important.

Since 1990, monitoring the syphilis seroprevalence amongst pregnant women in South Africa has been conducted annually using unlinked anonymous surveys in sentinel antenatal clinics (ANC) and the National Antenatal Sentinel HIV & Syphilis Prevalence Surveys (ANSUR). It is now also important to explore a complementary approach to understanding the syphilis burden in South Africa by utilising routinely-collected electronic laboratory data for surveillance, an approach that provides efficient access to data and has large-scale coverage.

The Northern Cape Province (NCP) is a region with a high syphilis burden compared with other provinces in South Africa.[7] The aim of this study was to determine whether the National Health Laboratory Service (NHLS) Corporate Data Warehouse (CDW), which contains electronically stored laboratory test records, can be employed as an appropriate surveillance instrument to track and monitor trends in syphilis seroprevalence. The specific objectives were to describe trends in syphilis seroprevalence in women of reproductive age in NCP between 2003 and 2012 using laboratory data routinely collected through the NHLS CDW and to compare the computed trends with findings from the ANSUR during the same period.

Methods

This cross-sectional study retrospectively analysed secondary data of longitudinally-collected laboratory measurements from the NHLS CDW. Data from the public sector health facilities of the NCP, where syphilis

serology tests are conducted, were utilized. The study population was females of reproductive age, 12-49 years, identified for the NCP and included as a proxy to define or identify ANC attendees because the syphilis serologic tests done in public sector health facilities include people other than pregnant women, and the NHLS CDW dataset does not contain information on pregnancy status.

Criteria for inclusion in the study were females of reproductive age (12-49 years) who were tested for syphilis by serology (rapid plasma reagin (RPR) and *Treponema pallidum* hemagglutination assay (TPHA)). Exclusion criteria included females of the same reproductive age range with no syphilis test result. Data for this study were sourced from the NHLS CDW between 2003 and 2012. Variables included patient identifying information, demographic information, name of health facility where the test was performed, tests requested, date of test and test result. The standard algorithm for testing for syphilis infection includes screening using the non-treponemal test (RPR). The RPR test can distinguish between an active infection and a past infection. An RPR titre of >1:4 is indicative of active infection. RPR tests are not specific for syphilis and can produce false-positive results. Reactive RPR tests are confirmed using the treponemal (TPHA) test.[8]

A total of 8 471 425 syphilis tests covering South Africa's nine provinces for the period 2003-2012 was extracted. Analysis was then limited to the NCP from which 310 730 tests among females of reproductive age were identified. This dataset was then de-duplicated for each year to remove duplicate records. As a unique identifier (master patient index) is not available in the CDW laboratory database, identification fields were used together and a probabilistic record linkage technique was applied. The Chi-square test for trend was used to determine whether there was a decreasing trend in syphilis seroprevalence from 2003 to 2012. The modified-Poisson regression to estimate prevalence ratios (PR) of syphilis seroprevalence (SSP) over time was used. Separate analyses by age group and geographical location were performed. All statistical analyses were conducted using STATA version 13 and a p-value of less than 0.05 was considered statistically significant.

Permission to analyse the data was obtained from the NHLS. Ethical clearance was obtained from the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria.

Results

A total of 286 024 women was included in the study after de-duplication and exclusion of participants with missing data on key variables. The mean (SD) age ranged from 25.7 (6.9) years in 2003 to 27.9 (8.1) years in 2012. The majority of women were in the 26-49 years age group - ranging from 45.4% in 2003 to 55.4% in 2012. Out of 154 women for whom population group (race) was captured, 132 (86%) were black. The highest numbers of tests were performed in Frances Baard District (58.4% in 2012), whereas Namakwa District recorded the least number of tests (5.5% in 2012) (table 1).

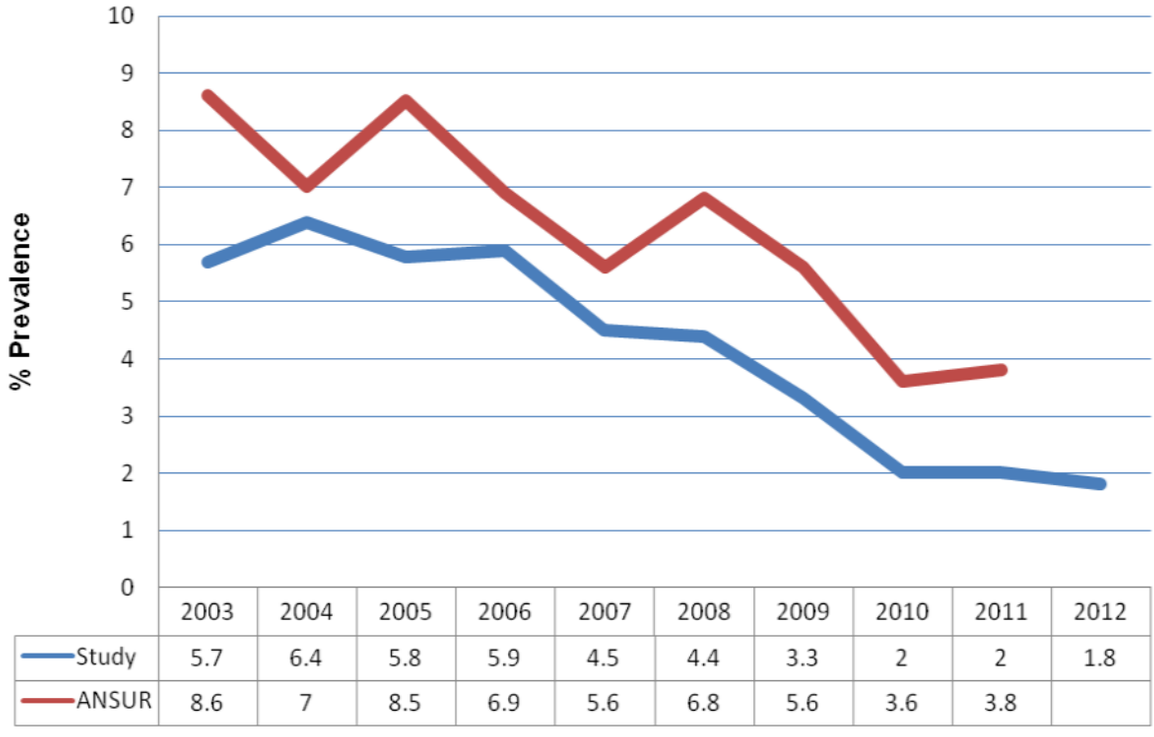
Table 1: Numbers of females of reproductive age (12-49 years) tested for syphilis by age, year and district in the Northern Cape Province, South Africa, 2003-2012.

	Year			
	2003 (N=14 514)	**2006 (N=31 006)**	**2009 (N=34 937)**	**2012 (N=19 792)**
Age category, n (%)				
12-17 yrs	1 312 (9.0)	2 742 (8.8)	2 897 (8.3)	1 455 (7.4)
18-25 yrs	6 624 (45.6)	12 777 (41.2)	13 261 (37.9)	7 363 (37.2)
26-49 yrs	6 578 (45.4)	15 487 (50.0)	18 779 (53.8)	10 974 (55.4)
Age, mean (SD)	25.7 (6.9)	26.7 (7.6)	27.5 (7.9)	27.9 (8.1)
District				
Frances Baard	5 248 (36.2)	11 623 (37.5)	12 267 (35.1)	11 565 (58.4)
John Taolo Gaetsewe	1 591 (11.0)	6 249 (20.1)	7 908 (22.6)	3 115 (15.7)
Namakwa	1 354 (9.3)	2 271 (7.3)	2 134 (6.1)	1 078 (5.5)
Pixley Ka Seme	2 859 (19.7)	5 130 (16.6)	6 342 (18.2)	1 427 (7.2)
Siyanda	3 462 (23.8)	5 733 (18.5)	6 286 (18.0)	2 607 (13.2)

Overall, there was a decline in SSP between 2003 (5.7%) and 2012 (1.8%) (p<0.01), which matches the downward trend reported in ANSUR from 2003 (8.6%) to 2011 (3.8%)[7] (figure 1). For every year between 2003 and 2012 there was a 14% reduction in the PR of syphilis seroprevalence (PR=0.86, 95% CI=0.85-0.87, p<0.01). There was also a decline in syphilis seroprevalence by age group from 2003 to 2012: 12-17 years (4.2% to 2.2%), 18-25 years (5.7% to 1.8%), and 26-49 years (5.9% to 1.7%) (p=0.001). Three of the five districts viz., Frances Baard (6.9% to 0.9%), John Taolo Gaetsewe (7.4% to 0.7%) and Namakwa (3.3% to 1.7%) showed significant decreases in syphilis seroprevalence over the 10 year period (p=0.001) (table 2).

	Year N (%)									
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Overall seroprevalence	823 (5.7)	1 534 (6.4)	1 501 (5.8)	1 841 (5.9)	1 416 (4.5)	1 536 (4.4)	1 138 (3.3)	681 (2.0)	722 (2.0)	353 (1.8)
Age Group										
12-17 yrs	55 (4.2)	149 (6.2)	115 (4.6)	132 (4.8)	92 (3.4)	130 (4.4)	99 (3.4)	56 (2.0)	69 (2.4)	32 (2.2)
18-25 yrs	377 (5.7)	699 (6.5)	625 (5.5)	747 (5.9)	525 (4.2)	526 (3.9)	453 (3.4)	294 (2.2)	279 (2.1)	134 (1.8)
26-49 yrs	391 (5.9)	686 (6.4)	1 501 (6.4)	962 (6.2)	799 (4.9)	880 (4.9)	586 (3.1)	331 (1.8)	374 (2.0)	187 (1.7)
District										
Frances Baard	362 (6.9)	547 (6.5)	578 (6.4)	611 (5.3)	554 (4.8)	621 (4.8)	402 (3.3)	187 (1.6)	146 (1.2)	107 (0.9)
John Taolo Gaetsewe	117 (7.4)	205 (4.7)	225 (4.1)	226 (3.6)	166 (2.5)	184 (2.3)	123 (1.6)	50 (0.6)	75 (1.0)	23 (0.7)
Namakwa	44 (3.3)	70 (3.5)	61 (2.9)	82 (3.6)	58 (2.7)	40 (1.8)	36 (1.7)	44 (2.0)	28 (1.2)	18 (1.7)
Pixley Ka Seme	155 (5.4)	264 (6.4)	248 (6.1)	359 (7.0)	323 (6.3)	369 (6.5)	319 (5.0)	225 (3.6)	253 (4.3)	99 (6.9)
Siyanda	145 (4.2)	448 (9.0)	389 (7.8)	563 (9.8)	315 (5.5)	322 (5.4)	258 (4.1)	175 (2.8)	220 (3.4)	106 (4.1)

Table 2: Syphilis seroprevalence obtained from the Corporate Data Warehouse and sorted by year, age and district among females of reproductive age tested for syphilis in the Northern Cape Province, South Africa, for the period 2003-2012.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Study	5.7	6.4	5.8	5.9	4.5	4.4	3.3	2	2	1.8
ANSUR	8.6	7	8.5	6.9	5.6	6.8	5.6	3.6	3.8	

Figure 1: Syphilis seroprevalence by year for the Northern Cape Province, South Africa, using Corporate Data Warehouse data (Study) for the period 2003-2012 and National Antenatal Sentinel HIV & Syphilis Prevalence Surveys (ANSUR)

Discussion

Overall, syphilis seroprevalence in the NCP showed significant decreases between 2003 (5.7%) and 2012 (1.8%). The estimates given for data obtained from the CDW are consistent with those from ANSUR data which show a decline in prevalence from 8.6% in 2003 to 3.8% in 2011.[7] This study demonstrates that routinely collected electronic laboratory data can accurately portray trends in the prevalence of syphilis in South Africa, and is a useful and relatively cost-effective surveillance tool that can be used to inform the planning and allocation of health resources at national and provincial levels.

However, this study has certain limitations. Firstly, the use of 'secondary data' is invariably associated with a limited number of variables and incompleteness of information collected. Secondly, analysis based on the NHLS CDW dataset is limited by the variables that are collected at source and by the quality of the data collected, which in turn depends on accurate completion of the laboratory requisition form and data capturing. Since record linkage techniques were used, only data with complete information and therefore a greater chance of linkage were included in the study, leading to potential selection bias. Thirdly, data from only one of the nine provinces in South Africa were used and therefore cannot be used to generalize syphilis seroprevalence in the country as a whole. Lastly, the study population included only women who attended public health facilities and excluded those who attended private health facilities and those who did not access health services. This could lead to a potential overestimation of the syphilis burden and also precludes making population generalizations concerning syphilis seroprevalence in South Africa.

Conclusions

There was a significant decline in syphilis seroprevalence in the NCP during the period 2003 to 2012 and this trend is largely consistent with that obtained from the South African ANSUR data. Routinely collected electronic laboratory data can therefore accurately portray trends in syphilis seroprevalence because it provides stable prevalence estimates through broader geographical coverage and a larger sample size. It is therefore recommended that the NHLS CDW be considered for syphilis seroprevalence monitoring and that a more detailed analysis of trend data at national and sub-national levels be conducted in order to compare the findings with available data so as to confirm trends is SSP in South Africa. It is also recommended that there be improved data collection at facility level to better understand the determinants of risk of syphilis infection e.g. demographics, pregnancy status, HIV status and other STIs. These types of analysis are important in terms of reaching the elimination goals.

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