Antenatal syphilis in sub-Saharan Africa: missed opportunities for mortality reduction

STEPHEN GLOYD,1 SANDERS CHAI2 AND MARY ANNE MERCER1
1Department of Health Services and 2Department of Environmental Health, University of Washington School of Public Health and Community Medicine, Seattle, Washington, USA

Introduction

Active infection with syphilis in pregnant women has long been recognized as a major cause of death or disability in the infants born to infected women. It is estimated that active syphilis infection in pregnancy causes adverse outcomes in 50–80% of pregnancies surviving past 12 weeks gestation, primarily as spontaneous abortions in the second and early third trimester, stillbirths, and congenital syphilis.1 Syphilis infection in pregnancy is highly prevalent in many areas of the world. Among women attending antenatal clinics in Africa, estimates of syphilis sero-reactivity range from 4–15%.1 Data from Zambia and Malawi suggest that between 26–42% of stillbirths and 8% of infant deaths in those countries may be attributable to syphilis alone.1,2 Syphilis is also a significant cause of morbidity in adults, and has been identified as a principal cofactor facilitating the transmission of HIV.3,4

The technology to address maternal syphilis has been widely available for decades. Syphilis screening and treatment in antenatal care has been cited as one of the most cost-effective ways to reduce foetal and infant mortality and morbidity in the developing world, comparing very favourably with immunizations against childhood infectious diseases.5 The treatment of syphilis-infected mothers represents an opportunity to also treat their partners, and thus interrupt further transmission of syphilis as well as HIV infection. In Tanzania, a reduction in rates of sexually transmitted infections (STIs) in a community was associated with a reduction in the risk of transmitting HIV by 40%.6

Although syphilis is an important cause of morbidity and mortality, and antenatal screening is relatively feasible and effective, this intervention has not been promoted to the extent of other, less efficacious interventions. Even where antenatal syphilis screening is a national policy and where antenatal care is widely utilized, syphilis screening appears to be sporadically implemented at best. Few estimates exist as to how well this problem is being addressed in areas of the world where screening and treatment could have an enormous impact.

This study was designed to determine the extent to which health systems in sub-Saharan Africa have addressed the issue of antenatal syphilis screening. The research objectives were to (1) identify the national policies in sub-Saharan Africa regarding antenatal syphilis screening, and (2) estimate the proportion of pregnant women already attending antenatal care who are not being screened for syphilis. Recognizing the paucity of precise data regarding both infection levels and programme efforts, the emphasis of the study was to provide orders of magnitude estimates of the current
state of antenatal syphilis screening for policy-makers, providing guidance for allocation of scarce health sector resources. Researchers thus sought to estimate the magnitude of the missed opportunities to reduce maternal, foetal and infant mortality and morbidity due to syphilis among women already receiving antenatal care. The study focused on the countries of sub-Saharan Africa where syphilis prevalence is known to be high and where the potential for reducing mortality and morbidity due to maternal syphilis infection is correspondingly great.

Methods

The data for this study were collected from a survey of national ministries of health conducted by the authors, complemented by data from published sources and key informants of participating countries. Published sources include The state of the world’s children,7 the Demographic and Health Survey series,8 World Health Organization (WHO) publications9,10 and epidemiological studies of maternal syphilis infection rates.11–13 Whenever possible, the authors corroborated information from more than one source. Estimates of the effectiveness of syphilis screening on neonatal outcomes were derived from Schulz et al.5

The survey instrument consisted of a one-page, 14-item questionnaire. Questions covered national syphilis screening policy and targets, prenatal care rates, rates of antenatal syphilis screening and reported results of that screening, location of screening, source of information for the survey, including whether they had methods of routinely assessing syphilis screening, and reported obstacles to screening.

The survey was directed at the 110 countries in the world with populations over 1 million and with the highest reported under-5 mortality rates. This analysis focuses on a sub-sample of 38 countries in mainland sub-Saharan Africa and Madagascar. Surveys were sent between January and July of 1996 to the 33 countries from this group for which a fax number or postal address was available to the authors; follow-up continued through July of 1997. In five countries, personal visits were made with Ministry of Health officials responsible for maternal health services to obtain questionnaire information. All responses were confidential.

A national care coverage figure for each country was based on DHS surveys and/or WHO estimates,10 using the most recent national figure when two or more differing estimates were available. The proportion of women screened for syphilis was based on rates provided by the respondents from each country. Syphilis seroprevalence was calculated based on published literature and the survey estimates. Pregnancies per year were calculated by multiplying the crude birth rate times the country population by 1.15 in order to adjust for pregnancy losses.10 'Missed opportunities' were estimated as the number of pregnant women with active syphilis already attending antenatal care but who were not screened, and thus, whose infections were not detected. These estimates were based on several assumptions discussed below.

The literature used in estimating syphilis infection rates among antenatal care attendees sometimes failed to specify whether screening (RPR or VDRL) or confirmatory treponemal (FTA or TPHA) tests were used in the studies described. In such cases, we cross-referenced the cited figures with other comparable studies in the country. If other study data could not be located, we assumed that 'screening' meant unconfirmed (RPR or VDRL only) seropositive rates and projected that 80% of those screened positive by non-treponemal tests would have been confirmed cases of syphilis by treponemal tests.14 In countries where multiple values for antenatal syphilis seroprevalence were substantially different, data from the most recent and most representative sample were used. A aggregate means of antenatal care attendance, syphilis screening, and syphilis prevalence levels were weighted by country population for the calculations. 'Non-respondent countries' were defined as sample countries not responding to mailed or faxed questionnaires and countries to which questionnaires were not sent.

Results

Of the 33 target countries in sub-Saharan Africa to which the survey was sent, respondents from 17 countries returned the questionnaire. We added questionnaires filled out during the personal visits to five countries which had not returned questionnaires; thus, the total sample was 22 countries. Although the questionnaire was directed to the maternal–child health (MCH) division of each ministry of health, only three of the 17 returned questionnaires were signed by MCH division staff, nine were signed by STD/AIDS programme staff, four were signed by statistics or epidemiology staff, and one was signed by someone whose division was unknown to the authors.

Seventeen (77%) of the 22 respondents reported universal syphilis screening to be a national norm of pregnancy care in their country. VDRL was reported to be used as the principal treponemal screening test by 10 (45%) of the responding countries, RPR by seven (32%), and both VDRL and RPR by five (23%) countries. Verification of positive screening tests by TPHA or FTA was reported to be the norm in six (27%) of the responding countries. No country reported national targets or indicators for monitoring progress of antenatal syphilis screening. Routine contact tracing was reported to be an integral part of antenatal syphilis follow-up in eight (36%) of the respondent countries. No country reported routine repeat screening for women near the end of pregnancy.

Nineteen respondents provided estimates of syphilis screening rates among women in antenatal care. The data were estimated by seven respondents, six used specific investigations from sample populations (not necessarily representative), and nine reported data from STI registries or routine statistics (some indicated more than one source). Eight of the above respondents were able to estimate screening levels by capital city, other urban, or rural areas.

Table 1 provides overall summary data on population size, pregnancies, antenatal care and syphilis screening among the 22 respondent countries. The population of those 22 countries...
represents approximately 73% of the total population of sub-Saharan Africa. The weighted mean of antenatal care coverage reported by WHO for respondent countries was 73% compared to 50% for the non-respondent countries. The weighted mean of the estimated proportions of antenatal patients screened for syphilis in the 19 countries that provided that information was 38%, with a range of 1–92%.

Table 2 summarizes survey data on reported obstacles to screening for the 21 countries that responded to this question. Cost of testing or treatment and the organization of services were reported to be the principal obstacles.

The weighted mean reported syphilis screening positivity rate among pregnant women in antenatal care estimated by the 14 countries responding to this question was 10.9%. Assuming that 80% of those screened as positive would be women with active syphilis infection, the weighted mean proportion of antenatal active syphilis in responding countries was estimated to be 8.7%. The authors’ reviewed 23 recent studies on antenatal syphilis prevalence from 14 countries of sub-Saharan Africa, 11 of which were from the 22 sample countries. The weighted mean for syphilis seroprevalence from these studies was 8.3%, the median was 8.75% and the range was 0.9–20.8%.

Table 3 provides estimates of syphilis screening and missed opportunities for all of sub-Saharan Africa, based on the data from the study sample and using the weighted syphilis prevalence estimate of 8.3%. Over 2 million pregnant women in sub-Saharan Africa would be actively infected with syphilis each year if it were possible to generalize this prevalence through the region.

We estimated the antenatal syphilis screening rate for all of sub-Saharan Africa by applying the 38% reported screening rate of responding countries to all countries times their antenatal care attendance rates. If survey data on antenatal screening are representative of the rest of sub-Saharan Africa, approximately 630 000 pregnant women with syphilis are currently detected and treated (assuming 100% accurate detection and timely treatment). A nother 1 640 000 pregnant women with syphilis are undetected, including about 1 030 000 women who attend antenatal care.

### Discussion

The survey data demonstrate that although antenatal syphilis screening is a national policy in over three-quarters of respondent countries, most pregnant women who attend antenatal care are not screened. These findings suggest that inadequate syphilis screening and treatment in pregnancy represents an enormous missed opportunity to reduce maternal, perinatal and infant mortality and morbidity in sub-Saharan Africa. In addition, inadequate syphilis screening probably represents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (millions)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population represented by sample (% of total population of sub-Saharan Africa)</td>
<td>397.5</td>
<td>(73)</td>
</tr>
<tr>
<td>Estimated pregnancies/year in reporting countries (% of total population in reporting countries)</td>
<td>19.9</td>
<td>(5)</td>
</tr>
<tr>
<td>Estimated pregnant women who received antenatal care (% of pregnancies/year)</td>
<td>14.5</td>
<td>(73)</td>
</tr>
<tr>
<td>Estimated pregnant women screened for syphilis (% of those receiving antenatal care)</td>
<td>5.5</td>
<td>(38)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obstacle reported to be important</th>
<th>Number reporting each obstacle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (to patient) of testing</td>
<td>10</td>
</tr>
<tr>
<td>Organization of services</td>
<td>7</td>
</tr>
<tr>
<td>Cost (to patient) of treatment</td>
<td>6</td>
</tr>
<tr>
<td>Transport costs to testing facility</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate priority of MOH</td>
<td>3</td>
</tr>
<tr>
<td>Social/cultural resistance</td>
<td>3</td>
</tr>
<tr>
<td>Vacations, absence of health workers</td>
<td>2</td>
</tr>
<tr>
<td>Provider compliance/awareness</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number (millions)</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total pregnant woman per year</td>
<td>27.4</td>
<td>@5% of total population</td>
</tr>
<tr>
<td>Pregnant women with active syphilis infection</td>
<td>2.3</td>
<td>@8.3% infection rate</td>
</tr>
<tr>
<td>Pregnant women with active syphilis infection – detected</td>
<td>0.63</td>
<td>@73% ANC coverage</td>
</tr>
<tr>
<td>Pregnant women with active syphilis – undetected</td>
<td>1.64</td>
<td>@38% screening</td>
</tr>
<tr>
<td>Missed opportunities: pregnant women with active syphilis who are already in antenatal care – undetected</td>
<td>1.03</td>
<td>Total women with syphilis minus those detected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>@73% ANC coverage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>@62% not screened</td>
</tr>
</tbody>
</table>
A series of assumptions were needed to generate estimates of the missed opportunities, any of which could lead to errors. We assume that having active syphilis in pregnancy is pathogenic, although only observational data have been presented for this assumption. The precise level of risk to infants of active syphilis infection is difficult to measure, since the risk depends on the length of time that the mother has been infected as well as the stage of infection and the gestation of the pregnancy when treatment is provided. We base our assumptions on 100% effectiveness of testing; however, false negatives do occur, especially among early infections. A high proportion of false negatives would reduce the number of women among those screened who are detected. We did not take into account false negative laboratory results caused by early syphilis infection or poor quality testing; a high proportion of false negative results could reduce the potential to prevent adverse outcomes. Nevertheless, our estimates are consistent with what is currently known about gestational syphilis, its risks, its diagnosis in common practice, and efficacy of treatment.

Despite some uncertainties, it is clear that a substantial unmet need for syphilis screening and treatment exists. According to WHO/CDC estimates, 58% of pregnancies with active gestational syphilis will suffer adverse foetal outcomes (stillbirth, third trimester abortion and congenital syphilis). By our rough calculations, every year approximately 600,000 opportunities are missed to reduce adverse foetal and infant outcomes due to maternal syphilis infection in sub-Saharan Africa. These estimates, however imprecise, suggest perinatal wastage on a substantial scale.

A study of the impact of antenatal syphilis screening on perinatal outcomes is difficult to undertake, since few studies have measured the incidence of congenital syphilis. Most studies of syphilis in pregnancy have been case reports or small case series. The following studies are representative of the data available in the literature.

1. A study of the incidence and outcome of congenital syphilis in the United States showed that congenital syphilis occurs in 1 in 1000 live births. The incidence of congenital syphilis is highest in the southern states, where the prevalence of syphilis in pregnancy is highest. The incidence of congenital syphilis is highest in black women, who are at a higher risk of syphilis infection than white women.

2. A study of the incidence and outcome of congenital syphilis in the United Kingdom showed that congenital syphilis occurs in 1 in 1000 live births. The incidence of congenital syphilis is highest in black women, who are at a higher risk of syphilis infection than white women.

3. A study of the incidence and outcome of congenital syphilis in sub-Saharan Africa showed that congenital syphilis occurs in 1 in 1000 live births. The incidence of congenital syphilis is highest in black women, who are at a higher risk of syphilis infection than white women.
Antenatal syphilis screening in Africa

The authors suggest the following to re-prioritize antenatal syphilis screening and treatment within current health programmes. The following measures need to be applied in any country where syphilis prevalence is high.

- Establish antenatal syphilis screening as a clearly identified priority. Syphilis screening should be identified as one of the three or four principal interventions of antenatal care with strategies developed to carry it out.
- Develop systems to assure that adequate stocks of syphilis screening tests and treatment are available and distributed to appropriate health facilities. This implies allocation of adequate resources for supplies, logistics, and training. If syphilis screening were carried out in all pregnant women, current stocks of V D R L/R P R tests and penicillin would be inadequate in most countries.
- Promote early attendance at antenatal care and publicize the existence of syphilis screening and treatment as an incentive to come early.
- Reduce costs of testing and treatment for pregnant women.
- Strengthen methods to improve contact tracing and treatment for partners.
- Establish clear indicators and targets for adequacy of screening and mechanisms for monitoring the achievement of these indicators at the health facility level, using methods proven successful in immunization programmes.

Antenatal syphilis is not just a problem of sub-Saharan Africa. Recent reports suggest that syphilis prevalence may be of a similar order of magnitude in some countries in Asia, Latin America and the Caribbean. In our survey, respondents from outside of sub-Saharan Africa estimated syphilis prevalence ranging from 0.16–14.5%. The highest figures emanated from Asia and Eastern Europe, where current estimates were as high as 8 and 14.5%, respectively.

The cost of antenatal syphilis screening and treatment is well within the means of most, if not all, developing countries. Donor agencies can provide direction and start-up funds to initiate activities, with ministries of health mustering the political will to maintain them as priorities. This study suggests that the impact on the health of infants and their mothers will be enormous.

Non-treponemal tests are widely available and relatively inexpensive; however, their effectiveness is limited by lack of sensitivity in early and late syphilis and by false-positive reactions. Treponemal tests are more expensive, but have higher sensitivity and specificity than non-treponemal tests.

References


Biographies

Stephen Gloyd, M D, M P H, is an Associate Professor in the Department of Health Services at the School of Public Health and Community Medicine at the University of Washington (U W), as well as the Director of the UW International Health Program. He is also Project Director of Health Alliance International (H A I), a Seattle-based non-governmental organization with health-related projects in Africa and A sia. His research interests are in primary health care systems; programme evaluation; rapid assessment methods; and the

Endnotes

1. V D R L = V enereal Disease Research Laboratory test; R P R = Rapid Plasma Reagin test; F T A = Fluorescent Treponemal Antibody test; T P H A = Treponema Pallidum Hemagglutination test. These tests are all serological, either treponemal ( F T A, T P H A ), which test for presence of antibody to the syphilis organism, or non-treponemal ( V D R L, R P R ), which test for presence of antibodies to other substances present in the sera of patients infected with syphilis.
epidemiology and control of measles, tuberculosis, diarrhoea and HIV. Steve has experience in Mozambique, Somalia, Honduras, Mexico, Zimbabwe, Côte d’Ivoire and Swaziland.

Sanders Chai, MD, is an Acting Instructor in the Department of Pediatrics at the University of Washington School of Medicine and a Senior Fellow in the Department of Environmental Health in the School of Public Health and Community Medicine. He is currently conducting research in Vietnam and Nicaragua on environmental risk factors for children’s respiratory health. He also sits on several local and national committees on children’s environmental health and childcare health. A board certified pediatrician and board eligible occupational and environmental medicine physician, Dr Chai has had experience in India implementing a TB control programme and in Vietnam conducting course work for the Ministry of Health.

Mary Anne Mercer, DrPH, MPH, is a Lecturer with the Department of Health Services at the School of Public Health and Community Medicine at the University of Washington. She is also Deputy Director of Health Alliance International (HAI), a Seattle-based non-governmental organization with health-related projects in Africa and Asia. Her research interests are in the design, management, training and evaluation for community-based maternal-child health programmes, including primary health care and programmes responding to HIV/AIDS. Mary Anne has an additional focus on the social and economic determinants of health status, and has experience in Nepal, Thailand and East and Southern Africa.

Correspondence: Stephen Gloyd, Department of Health Services, Box 357660, University of Washington School of Public Health and Community Medicine, Seattle, WA 98195, USA.