



WORLD HEALTH ORGANIZATION
Regional Office for the Western Pacific

STI

HIV



ANTENATAL CLINIC STI SURVEY

APIA, SAMOA

MINISTRY OF HEALTH, SAMOA

WORLD HEALTH ORGANIZATION - WESTERN PACIFIC REGIONAL OFFICE

JULY 2000

ANTENATAL CLINIC STI SURVEY APIA, SAMOA,

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Ministry of Health, Samoa

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EXECUTIVE SUMMARY



The Antenatal Clinic STI Survey was a laboratory-confirmed sexually transmitted infection (STI) prevalence survey. The aim of the survey was to determine the prevalence rates of gonorrhoea, chlamydia, trichomoniasis, treponemal seroreactivity and human immunodeficiency virus (HIV) among women attending the doctor-conducted Antenatal Clinic at the National Hospital. The HIV testing was the first formal seroprevalence surveying of HIV in Samoa.

The cross-sectional survey was conducted by the Antenatal Services, National Hospital and the Directorate of Preventive Health, Ministry of Health, Samoa, in conjunction with an Australian technical team from the University of New South Wales and the Royal Women's Hospital, Melbourne. During the period from October 19, 1999 to April 20, 2000, 472 pregnant women aged 15-48 years were recruited from the Antenatal Clinics at National Hospital, Apia. Of the women sampled, 47% were aged 25 years or younger. A tampon swab and a blood sample were collected from each participating woman. The tampon swabs were tested by polymerase chain reaction (PCR) for chlamydial infection, gonorrhoea, *Trichomonas vaginalis* and beta-globin. HIV was assayed with a commercially available enzyme-linked immuno-sorbent assay (ELISA) and a repeat ELISA for confirmation. Syphilis serology was performed using the rapid plasma reagin (RPR) as the screening test, with a *Treponema pallidum* haemagglutination assay (TPHA) as a confirmatory test. All specimens underwent laboratory testing at the Royal Women's Hospital.

The survey was voluntary, incorporating individual informed consent. All components of the survey, including the antenatal examination, laboratory testing and treatment, were free to study participants. Testing for gonorrhoea, chlamydia, trichomoniasis and syphilis was confidential and linked. Testing for HIV was unlinked anonymous testing. Treatment was provided to study participants who were either diagnosed syndromically and/ or by laboratory testing, as well as to their contacts.

There were 178 women with one or more STI. The most prevalent laboratory-confirmed STI was chlamydia, with 30.9% (n=132) of the women having an infection, followed by trichomoniasis, with 20.8% (89) and gonorrhoea, with 3.3% (n=14). There were four women with positive RPR results, of whom two (0.5%) had positive treponemal antibody tests. There were no positive HIV test results in the HIV seroprevalence survey of the 441 women.

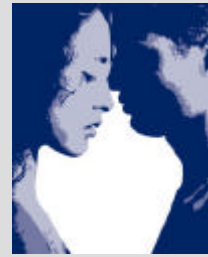
The prevalence of STIs in a moderate- to low-risk population of pregnant women in Apia is high. The prevalence rates of chlamydial and trichomonal infections are of concern, particularly in association with known poor pregnancy outcomes. Chlamydial testing is not available in Samoa. At the national level, current policies and programmes for STIs and HIV need to be reviewed, especially the capacity for surveillance of STIs, laboratory testing of STIs, prevention strategies for HIV and STIs, and implementation of syndromic management of STIs.

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INTRODUCTION



Sexually transmitted infections (STIs), excluding human immunodeficiency virus (HIV), rank among the most important causes of healthy productive life-years lost in developing countries¹. STIs are a major public health problem because of their impact on maternal and child health. In addition, the risk of heterosexual HIV acquisition and transmission may be greatly increased in the presence of curable STIs.

The association between STIs and HIV is strongest for those infections that cause genital ulceration²⁻⁴ but has also been demonstrated for infections such as gonorrhoea, chlamydiosis and trichomoniasis.^{5,6} Sexually transmitted diseases that cause genital inflammation have been shown to increase the efficiency of HIV transmission by as much as fivefold and there is increasing evidence that symptomatic genital infections carry greater risks than asymptomatic infections¹. The literature has shown that interrupting STI transmission at these initial points of spread, such as with male patients with chlamydial urethritis, and treating them, reduces the proportion of cases where HIV is detected and the amount of HIV in the ejaculate. Treatment of STIs and health education, including correct condom use, is the most efficient and cost-effective way to contain the HIV epidemic.

There is little information available about the epidemiology of STIs in the Pacific. In order to make STI and HIV policies and programmes more efficient, the Samoan Government, in collaboration with the World Health Organization, decided to conduct the first gold standard epidemiological study of STI prevalence.

Samoa is an independent island nation in the southern Pacific Ocean, located about 2900 kilometres north-east of New Zealand. The country is made up of nine islands, but the two largest, Upolu and Savai'i, make up 99% of the land mass. Apia is the capital, largest town and commercial centre of Samoa, with a population of 34 126 (1991 Census). Samoa has an estimated population of 235 302 in 2000, more than 90% native Samoans. Of the 161 298 (1991 Census), 69 349 were aged 10-29 years. The estimated growth rate for Samoa from 1996 to 2001 is 0.5%. It is also estimated that approximately 41% of the population are aged 15 years or younger. The population is still largely rural, with only 20.5% (32 196; 1991 Census) classified as urban, that is living in Apia.

The crude birth rate is 30/1000 population (1996). There were an estimated 5023 live births in 1995, of which 65% were delivered in government health facilities and 35% by traditional birth attendants.

There were an estimated 360 births to teenage mothers in 1995, 316 (88%) of them being delivered in hospital and 12% by traditional birth attendants. It is thought that there is underreporting of teenage pregnancy.

Youth represents 80% of the unemployed, of whom 62% reside in the Apia urban area. There is significant underemployment in the population aged 15-29 years, reflecting the limited job opportunities. The United Nations classifies Samoa as one of the world's least developed nations. It is dependent on agriculture and fishing, which is primarily subsistence. Primary school attendance is compulsory but not free, enrolments drop to 62% of all secondary school-aged children. Samoa's adult literacy rate is 98%.

Discussion of sexual issues has traditionally been taboo in the Samoan culture. There is also a marked gender division of roles and expectations in Samoa, which is a patriarchal society. Sexual activity appears to begin around puberty for a significant proportion of the population. Sexual activity for males may first begin with females or in some cases with other peer group males, then progressing primarily to females. Early sexual activity in females may not always be consensual. The cultural norm is female compliance with male expectations. There is a limited education/understanding of reproduction and sexuality among the majority of adolescents. Access to condoms and contraception in the villages is particularly limited by a lack of confidentiality, accessibility and affordability.

Homosexuality is most visible in the *fafafini* (transvestites) who have had a higher profile in recent years. Cross-dressing is illegal, as is solicitation and abortion. The *fafafini* role in society appears to be primarily as entertainers and not as organized commercial sex workers. Other expressions of male homosexuality are less accepted and visible in the community.

The existence of a very small, organized commercial sex industry in Apia is debatable. It appears one organized brothel may be operating primarily for tourists and seamen. It is thought to be run by older female ex-sex workers. Freelance sex workers primarily operate in the major hotels, but are also seen, as are male sex workers, when cargo ships and tourists are in town or festivals are on.





The predominant form of sex work is commoditized sex rather than commercial sex. It is casual, opportunistic, freelance sex, which takes place during festivals when young women and men from rural areas are in town and less supervised, or when cargo ships stop in Apia. It is thought that women or men generally receive alcohol, gifts or goods in kind, with money generally only from tourists or seamen. The other main venues for casual sex appear to be nightclubs, which are popular entertainment venues/meeting places for young people, but this is less likely to be commercial in nature. Availability of condoms is erratic but recent youth programmes have been making them available in nightclubs.

Health care delivery is primarily through four hospitals, with medical staff and nurse practitioners running health centres. There is one new private hospital in Apia. The tertiary referral hospital, National Hospital, is located in Apia. Of the 57 doctors practising in Samoa in 1996, only one was working in the STI area, one in the laboratory/pathology area, and three as practising obstetricians/gynaecologists. Ten of the 57 doctors were working in private practice. It is estimated that family planning coverage reaches 38.5% of the target child-bearing-age population of 34 429 (1996). The main contraceptive choices are depo provera, the oral contraceptive, and increasingly tubal ligation. There is one NGO family planning clinic in Apia, which does not provide STI screening or perform pap smears.

Formal usage of sexual health services is limited, with both traditional healers (*taulasea* and *fo fo*) and informal networks (such as knowing someone at the hospital) being used to access (prescription drug) treatments for STIs. Clinical STI services are provided primarily by the STI/Immigration Clinic and the general Outpatients Clinic at the National Hospital, as well as by some doctors in private practice. The STI Clinic sees an average of 4-6 clients per week. In 1997 it saw 96 new clients. Testing for syphilis, gonorrhoea, hepatitis B and HIV are available. There is no testing for chlamydial infection. All specimens are sent to the National Health Laboratory (hospital laboratory) for testing.

The epidemiology of STIs in Samoa is poorly defined. There has been a 50% increase in reporting of STIs since 1991, with 520 cases registered nationally in 1995. Of the registered STI cases, 29% (149) were seen at the AIDS/STI (Immigration) Clinic at the National Hospital and another 22% (115) at the Outpatient Department at the same hospital; a further 24% (125) were seen by private practitioners in Apia and 18% (96) on the island of Savai'i.

The most common STI seen at the AIDS/STI Clinic was gonorrhoea, making up 101 (75.4%) of 134 diagnosed STIs in 1996. There are deficiencies in STI reporting as seen by the inconsistencies in the 1995 figures for the AIDS/STI Clinic, with 119 diagnosed versus 149 registered cases.

Up to 1998, there had been nine reported cases of HIV infection, with seven deaths from AIDS since 1993. In 1996, there were four new cases of HIV infection. All HIV testing is done through the National Health Laboratory. There is no passive reporting of STIs by private medical practitioners. STI surveillance is comprised of reporting of general outpatient statistics of suspected or confirmed cases (depending on the laboratory support) from the hospitals and health centres to the Ministry of Health. There is a need for strengthening of the STI surveillance and information system. One strategy to improve STI surveillance is to conduct periodic baseline prevalence studies of selected STIs.

Screening, diagnosis and treatment costs for many STIs are expensive and are likely to exceed the country's per capita health budget. One possible cost-effective public health strategy would be the adoption of country-customized STI syndromic case management. However, in order to best apply syndromic case management, it is important to know the epidemiology of STIs in the community. In 1998, the World Health Organization funded the development of a generic protocol to conduct ad hoc laboratory-confirmed STI prevalence surveys in the Western Pacific Region. Samoa was one of four countries funded by WHO in 1999 to conduct an STI prevalence survey.

This document details the findings of the first STI prevalence survey in Samoa. The survey covered pregnant women attending the Tuesday and Thursday Antenatal Clinics at the National Hospital. It is important to consider that surveys of this type are limited in that they do not represent all major population groups and so will not be a true prevalence survey of STI pathogens in the whole community. However, if used within these limitations, they provide valuable data on the prevalence of selected STIs in the studied population. Such information can be used to refine STI policy and planning and revise disease prevalence estimates in population subgroups. This is the report of the findings of the survey conducted during 1999-2000 in Apia, Samoa.



STUDY INVESTIGATORS

The study was coordinated by the Ministry of Health. The principal investigators were Drs Semo Koro and Nuualofa Potoi. The study team was based in Samoa, with a technical support team in Australia (Table 1).

Table 1
Samoa Antenatal Clinic Health Study Team and Technical Support Group

Name	Affiliation	Role
Dr Semo Koro	Acting Director Clinical Services	Co-Principal Investigator/ Senior Obstetrician
Dr Nuualofa Potoi	Director of Preventive Services	Co-Principal Investigator
Sister Kaisarina Tooloa	Antenatal clinic	Antenatal clinic
Dr Asuau	Head	National Health Laboratory
Mr Faapulou Auva'a	Chief Technician	National Health Laboratory
Dr Mika Fepuleai	National Hospital	Head STD Unit
Brent Rivers	National Hospital	Pharmacy, supplies
Dr Elizabeth Sullivan	University of NSW	Study coordinator/ epidemiologist
Dr Sepehr Tabrizi	Royal Women's Hospital	Referral laboratory
Professor Sue Garland	Royal Women's Hospital	Referral laboratory

OBJECTIVES OF THE PREVALENCE STUDY

- (1) To determine the prevalence rates of gonorrhoea, chlamydia, trichomoniasis and HIV among women attending the Tuesday and Thursday Antenatal Clinics at the National Hospital, Apia;
- (2) to determine the prevalence rates of treponemal seroreactivity in women attending the First-visit Antenatal Clinic at the National Hospital, Apia;
- (3) to provide baseline data to monitor trends in the prevalence of gonorrhoea, chlamydial and trichomonal infections; and treponemal seroreactivity and HIV among antenatal mothers in Apia; and
- (4) to strengthen the capacity for epidemiological assessment and surveillance of STIs in Samoa.



For the purpose of this survey the prevalence rate is a measure of frequency of the specific STIs during the survey period (October 19, 1999 to April 20, 2000) in pregnant women attending the National Hospital, Apia, Samoa.

SEXUALLY TRANSMITTED INFECTIONS INCLUDED IN THE SURVEY

- (1) *Neisseria gonorrhoea* (gonorrhoea), *Chlamydia trachomatis* (chlamydiosis) *Trichomonas vaginalis* (trichomoniasis);
- (2) Syphilis: prevalence of treponemal seroreactivity;
- (3) HIV.

The four STIs, gonorrhoea, chlamydiosis, trichomoniasis and syphilis, were included in the prevalence survey because the infections are curable, are spread primarily by sexual transmission and are often asymptomatic in women. In the case of chlamydial infection, there had been no laboratory testing capacity for it in Samoa prior to the survey.

The prevalence survey only determined the prevalence of treponemal seroreactivity in the study population of antenatal women. This provides a measure of "lifetime exposure". An unknown proportion of the women identified as treponemal-seroreactive will have received treatment at some stage in the past (prescribed, coincidental or self-prescribed). This is therefore not a measure of the prevalence of syphilis (active infection) and, if misinterpreted as such, will overestimate the burden of infection in the population. Accurate diagnosis of infectious syphilis and latent syphilis require the recording of serial rapid plasma reagin (RPR) titres and treatment details. A significant proportion of high-level titres supports a high background prevalence of active infection.

METHODS

POPULATION

The cross-sectional study was carried out to determine by laboratory confirmation the prevalence of *Neisseria gonorrhoea*, *Chlamydia trachomatis*, *Trichomonas vaginalis*, *Treponema pallidum*, and HIV among 472 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic over a six-month period from October 1999 to April 2000.

During the period, all women presenting consecutively to the Antenatal Clinic were recruited. The hospital clinic is situated in Apia, the largest city in Samoa, and serves the peri-urban area.



Ethics approval for the study was granted by the Ministry of Health, Samoa, and by the Committee on Experimental Procedures involving Human Subjects, at the University of New South Wales, Australia.

Pregnant women attending the clinic were invited to participate in the study. Well-informed consent was obtained before inclusion in the study. Participation in the study was voluntary and written consent was obtained from all participants prior to data and sample collection.

A questionnaire was confidentially administered by one of the senior female registered nurses working in the Antenatal Clinic to obtain limited demographic information on maternal age, date of specimen collection and place of residence.

SPECIMEN COLLECTION, TRANSPORTATION AND PREPARATION IN APIA

Prior to the routine antenatal speculum examination, a tampon was inserted and immediately withdrawn by one of the three doctors who participated in the study and placed in 15 ml of transport medium (0.14 M NaCl, 3 mM KCl, 10 mM Na₂HPO₄, 2 mM KH₂PO₄).⁷ After the routine antenatal examination, a 5 ml blood sample from each patient was obtained in a serum separation gel tube (Sarstedt, Adelaide, Australia). Serum was separated by centrifugation at 3000 rpm for 10 minutes. The tampon and separated serum samples were stored at 4°C in the National Hospital Laboratory until transportation to the Molecular Microbiology Laboratory of the Royal Women's Hospital, Melbourne, Australia. All specimen collection, preparation, storage and shipping was supervised by the Chief Technician at the National Health Laboratory. All specimens were packed according to IATA regulations. Ice packs were included in all shipments. Specimens were shipped by air from Apia, Samoa, to Melbourne, Australia. Shipment times varied from one to four weeks, depending on specimen numbers.

SPECIMEN PREPARATION AND TESTING IN AUSTRALIA

Upon tampon specimen arrival at the Molecular Microbiology Laboratory, Royal Women's Hospital, Melbourne, cells were dislodged from tampons by manual ringing and squeezing and were pelleted by centrifugation. The DNA was extracted from a 20 ul aliquot of tampon cell pellet using a QIAamp DNA Purification Kit (Qiagen Inc., Valencia, CA, US) as per manufacturer's instructions.



Polymerase chain reaction (PCR):

Overall, three amplification reactions were performed on DNA extracted from each tampon specimen: (1) combined amplification of *C. trachomatis* and *N. gonorrhoeae* sequences using Roche COBAS Amplicor (Roche Diagnostics, Branchburg, NJ, United States of America); (2) amplification of *T. vaginalis* sequences; and (3) amplification of β -globin gene sequences as positive internal control.

PCR reaction for detection of *C. trachomatis* and *N. gonorrhoeae* by COBAS included mixing of 25 μ l of extracted tampon DNA and 25 μ l of specimen diluent (Roche Diagnostics), followed by a 10-minute room temperature incubation prior to amplification and detection of *C. trachomatis* and *N. gonorrhoeae*.⁹ All positive *C. trachomatis* results were confirmed by repeat testing and *N. gonorrhoeae*-positive specimens were confirmed using Roche 16S confirmatory assay (Roche Diagnostics).

PCR detection of *T. vaginalis* and β -globin gene sequences were performed using a rapid real-time PCR (LightCycler, Roche Molecular Biochemicals). Amplifications were performed in capillaries with a volume of 10 μ l, consisting of 2 μ l aliquot of extracted DNA and 1x Hot Start Reaction Mix (Roche Diagnostics), containing 2.5 mM MgCl₂ final concentration. The amplification reagent for *T. vaginalis* DNA sequences consisted of 0.5 μ M of each primer TVA5 - TVA6 directed at amplifying a 102 bp fragment of genomic DNA^{10,11} and 0.2 μ M of hybridization probes TV-F1AS 5'ttacactctgagttctttctcta 3' (3'fluorescein labelled) and acceptor fluorophore TV-F2AS 5' agtcttttttagattttgaaaca 3' (5'LC640 Red labelled and 3' phosphorylated to block polymerase extension during PCR). Both probes were purified by HPLC post synthesis (Genset, Singapore). The samples were heated at 95 °C for 10 minutes and cycled 45 times using parameters of 95 °C for 0 seconds, 50°C for 10 seconds and 72°C for 10 seconds. Fluorescence was acquired once each cycle at the end of the annealing segment. A cycle for fluorescence acquisition of a melting curve was appended to the end of the amplification cycle. This cycle included a programmed rate of 20°C/second to 95 °C, cooling at 20°C/second to 40°C, a 10-second hold at 40°C, and heating at 0.2°C/second to 80°C. During heating from 40°C to 80°C, the fluorescence from fluorescein was measured each second. Fluorescein data for each sample were plotted as derivatives of LC640/fluorescein fluorescence vs temperature. The presence of peak at a melting temperature of 51°C confirmed the presence of *T. vaginalis* sequences. All positive specimens were repeat-tested





The amplification reagent for β -globin gene sequences consisted of 0.5 μ M of each primer GH20-PC04,¹² 1x LightCycler-Fast Start Master Syber Green 1 (Roche Molecular Biochemicals) 2.5 mM MgCl₂. The samples were heated at 95 °C for 10 minutes and cycled 45 times using parameters of 95 °C for 0 seconds, 55°C for 10 seconds and 72°C for 10 seconds. Fluorescence was acquired once each cycle at the end of the extension segment. A cycle for fluorescence acquisition of a melting curve was appended to the end of the amplification cycle. This cycle included a programmed rate of 20°C/second to 95 °C, cooling at 20°C/second to 40°C, a 10-second hold at 45°C, and heating at 0.2°C/second to 95°C. During heating from 45°C to 95°C, the fluorescence was measured continuously. Fluorescein data for each sample were plotted as derivatives of fluorescence vs temperature. The presence of peak at a melting temperature of 88°C confirmed the presence of β -globin gene sequences, indicating the presence of adequate amplifiable DNA in the sample.

Positive clinical specimens by culture for *T. vaginalis* were used as positive and negative controls. Strict procedures were followed to avoid specimen contamination and carryover.

ANTIBODY TESTING OF SERUM

Each serum sample was separated into two aliquots upon receipt at the Melbourne Laboratory. One aliquot of the serum sample was tested by RPR, according to the manufacturer's instructions (Panbio, Baltimore, MD, United States of America). All positive RPR sera were re-tested the *Treponema pallidum* haemagglutination assay (TPHA, Omega Diagnostic, Scotland, United Kingdom) for confirmation of positives.

HIV tests were done on a delinked aliquot of serum, using IMX HIV 1 and 2 III Plus (Abbott Diagnostics, Abbott Park, IL, United States of America) according to the manufacturer's instructions. Positive serum samples were re-tested by IMX assay and, if positive, were then tested by a reference laboratory using Western blot.

PARTNER NOTIFICATION AND TREATMENT

During their antenatal visits, the women received counselling on antenatal care and STI and HIV prevention. Based on clinical findings, all women were treated at the time of examination, following the standard treatment used in Samoa. Untreated infections subsequently detected by laboratory tests were treated at follow-up visits. Gonorrhoeal infections were treated with a single intramuscular injection of 4.8 mega units (16 mls) of procaine penicillin and a single oral dose of 1 g of probenecid. or a 250 mg IM stat single dose of ceftriaxone. Chlamydial infections were treated with a daily oral dose of 2 g of erythromycin (500 mg 6 hourly) for a period of seven days. Syphilis was treated with three intramuscular injections of benzathine penicillin, 2.4 million units over a three-week period, or, if the patient showed a penicillin allergy, 500mg of erythromycin orally four times per day for 15 days. Trichomonal infections were treated with a single 2 g oral dose of metronidazole. Metronidazole was not prescribed in the first trimester.

Depending upon the time required to test the samples, women were informed of the results at their next routine antenatal visit or recalled for laboratory results and management at an earlier date. Adequate treatment was given according to the Samoa-modified WHO recommendations for syndromic case management. The women were asked to bring in their partners for treatment and counselling. There was no cost for treatment.

NOTIFICATION OF RESULTS

The results were notified to the Principal Investigator as they became available. This varied from weekly to monthly. The results were faxed care of the WHO office in Apia to maximise confidentiality. The results for HIV were delinked and were reported on a population basis. The Principal Investigator then notified the Antenatal Clinic and the laboratory of the results.



DATA ANALYSIS

The results of the study were analysed as follows:

- (1) number and proportion of persons with positive test results for each STI and HIV;
- (2) prevalence of each STI and HIV stratified by the study population and, where applicable, by five-year age group;
- (3) proportion of treponemal reactive sera by five-year age group;
- (4) to assess the association of variables of interest with a particular STI, odds ratios were calculated with 95% confidence intervals and/or chi square tests.

An estimated prevalence rate ratio and a 95% confidence interval were calculated for all variables. Associations were assessed by odds ratios (ORs) with exact 95% confidence intervals (CIs). Differences between proportions by maternal age were tested using the Pearson Chi-square test. Non-normally distributed data and continuous data were tested using Kruskal-Wallis and Mann-Whitney non-parametric tests. Factors were significantly associated at the $P=0.05$. The data were compiled and analysed using the statistical software SPSS (Chicago, IL, United States of America) version 10.5

RESPONSE RATE

A total of 472 pregnant women were consecutively recruited into the study during the six-month study period from October 1999 to April 2000. A total of 20 women who did not proceed to sample collection were classified as non-responders. From the 452 study participants, 427 (94.5%) tampon samples and 441 (97.6%) sera samples were received.



RESULTS

CHARACTERISTICS OF THE STUDY POPULATION

All 472 eligible women agreed to participate in the study but only 452 pregnant women had either a tampon or blood sample collected.

Of the 421 pregnant women whose place of residence was recorded, 31.4% came from Apia and 68.2% from other villages on the island of Upolu (Table 2). Nearly half (213, 47.1%) of the 452 pregnant women were aged under 25 years. Ages ranged from 15 to 48 years (mean 26.0 years, median 25.0 years, standard deviation 6.5 years).

Table 2 Demographic characteristics of 452 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000.

Characteristic	Number	Percentage
Age group (years) (n=452)		
15-19	71	15.7
20-24	142	31.4
25-29	115	25.4
30-34	71	15.7
35-39	38	8.4
>40	15	3.3
Residence (n=421)		
Apia	132	31.4
Villages Upolu	287	68.2
Other Island	2	0.5





PREVALENCE OF SEXUALLY TRANSMITTED INFECTIONS

Prevalence was zero for HIV infection, 0.4% for treponemal antibodies, 3.3% for gonorrhoea, 20.8% for trichomonal infection and 29.7% for chlamydial infection (Table 3). The prevalence of women with either chlamydial and/or gonorrhoeal infection was 30.9%.

Table 3 Baseline prevalence of STIs and seroprevalence of treponemal antibodies and HIV among 452 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000

Sexually transmitted infection	Baseline prevalence			
	Number tested	Number of women with infection	Prevalence %	95% confidence interval
<i>Trichomonas vaginalis</i>	427	89	20.8	17.0, 24.7
<i>Chlamydia trachomatis</i> and / or <i>Neisseria gonorrhoea</i>	427	132	30.9	26.5, 35.3
<i>Chlamydia trachomatis</i>	427	127	29.7	25.4, 34.1
<i>Neisseria gonorrhoea</i>	427	14	3.3	1.6, 5.0
Treponema/ antibody seroreactivity	441	2	0.4	0.1, 1.1
HIV	441	0	-	-

CURRENT INFECTION IN STUDY POPULATION WITH BOTH TAMPON AND SERUM SAMPLES

In all, 416 pregnant women (92.0%) had microbiological results available for all four bacterial STIs; the 36 missing results were due to samples not being collected or being non-viable after transportation to Australia.

Of these 416 women, 132 (31.7%) had at least one infection, 42 (10.1%) had two concurrent infections, 3 (0.7%) had three concurrent infections and 1 (0.2%) women had all four infections.

Being a young pregnant woman (aged <25 years) was independently associated with current infection (OR 3.0; 95% CIs 2.0, 4.5). There was no association with place of residence.

Age was significantly associated with current STIs (Table 4). Being a young pregnant woman was associated with current infection (OR 3.0; 95% CIs 2.0, 4.5).

Table 4 Univariate associations between demographic data and any STI among 416 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000

Variable	Pearson chi-square	P-value	Adjusted odds ratio	95% CI
Age <25 years ≥25 yr	29.6	<0.001	3.0	2.0, 4.5
Residence Urban Villages	0.18	0.89	1.0	0.6, 1.5

Note the 416 women had both tampon and serum samples collected.



PREVALENCE OF TRICHOMONAS VAGINALIS

Of the survey sample, 20.8% were diagnosed with a trichomonal infection. Of those, 46.1% (n=41, 9.6% of the overall study sample) were diagnosed with another STI in addition to trichomoniasis. Of the women with trichomonal infection, 57.3% were aged 25 years or younger. The prevalence of trichomonal infection by five-year age group is detailed in Table 5. The rate decreased with increasing age. Being a young pregnant woman was independently associated with current trichomonal infection (OR 1.6; 95% CIs 1.0, 2.6). There was no association with place of residence.



Table 5 Prevalence of *Trichomonas vaginalis* by five-year age group among 427 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000

Age group (years)	Study population by age group	Number of positive <i>Trichomonas vaginalis</i> test results	Percentage of total age group population
15-19	66	18	27.3
20-24	139	33	23.7
25-29	107	23	21.5
30-34	66	8	12.1
35-39	37	6	16.2
≥40	12	1	8.3
Total	427	89	20.8

Note: Denominator =427 because 25 tampon specimens were not collected or were not available for analysis.

PREVALENCE OF CHLAMYDIA TRACHOMATIS

Of the survey sample, 29.7% were diagnosed with chlamydial infection. Of those, 33.6% (n=42, 10.1% of the overall study sample) were diagnosed with another STI in addition to chlamydiosis. Of the women with chlamydial infection, 69.3% were aged 25 years or younger. The prevalence of chlamydial infection by five-year age group is detailed in Table 6. The age group at greatest risk of chlamydial infection was 20-24 years. Being a young pregnant woman was independently associated with current chlamydial infection (OR 3.5; 95% CIs 2.3, 5.5). There was no association with place of residence.

Table 6 Prevalence of *Chlamydia trachomatis* by five-year age group among 427 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000

Age group (years)	Study population by age group	Number of positive <i>Chlamydia trachomatis</i> test results	Percentage of total age group population
15-19	66	26	39.4
20-24	139	62	44.6
25-29	107	30	28.0
30-34	66	6	9.1
35-39	37	2	5.4
≥40	12	1	8.3
Total	427	127	29.7

Note: Denominator =427 because 25 tampon specimens were not collected or were not available for analysis.



PREVALENCE OF NEISSERIA GONORRHOEA

Of the survey sample, 3.3% were diagnosed with gonorrhoea and, of those, 92.3% of the (n=12, 2.9% of the overall study sample) were diagnosed with another STI in addition to gonorrhoea. Of the women with gonorrhoea, 92.8% (13) were aged 25 years or younger. The prevalence of gonorrhoea infection by five-year age group is detailed in Table 7.

Table 7 Prevalence of *Neisseria gonorrhoea* by five-year age group among 427 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000

Age group (years)	Study population by age group	Number of positive <i>Neisseria gonorrhoea</i> test results	Percentage of total age group population
15-19	66	3	4.5
20-24	139	10	7.2
25-29	107	0	0
30-34	66	1	1.5
35-39	37	0	0
≥40	12	0	0
Total	427	14	3.3

Note: Denominator =427 because 25 tampon specimens were not collected or were not available for analysis.



PREVALENCE OF TREPONEMAL ANTIBODIES

The number of pregnant women with a positive RPR was four. The prevalence of treponemal antibodies by five-year age group is detailed in Table 8. Treponemal antibodies were positive in two of the four samples tested by the TPHA method. The STS proportions reflect not only the incident syphilis but also the reactive serostatus of patients who did not have newly diagnosed syphilis. Of the survey sample, 0.5% were diagnosed with treponemal antibodies. The two patients with positive treponemal antibody tests had concurrent infection and were aged less than 25 years.

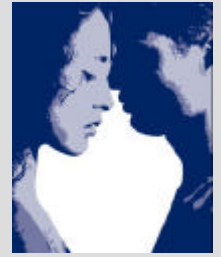
Table 8 Prevalence of treponemal antibodies by five-year age group among 441 pregnant women attending the National Hospital Tuesday and Thursday Antenatal Clinic, Apia, Samoa, from October 1999 to April 2000

Age group (years)	Study population by age group	Number of positive treponemal antibody test results	Percentage of total age group population
15-19	67	1	1.5
20-24	141	1	0.7
25-29	112	0	0
30-34	69	0	0
35-39	38	0	0
≥40	14	0	0
Total	441	2	0.5

Note: Denominator =441 because 11 sera samples were not collected.



DISCUSSION



The importance of having reliable STI prevalence estimates in the Asia and Pacific region is seen in the results of this STI prevalence survey in Samoa. The unexpectedly high burden of disease among a traditionally low-risk population of antenatal women argues for policy and community-level interventions in addition to the more traditional approaches of individually focused behaviour-change intervention. The high prevalence rate of bacterial STIs is of major concern, with 30% of women having chlamydial infections and 21% trichomonal infections. Chlamydial infection has long been associated with pelvic inflammatory disease (PID) and infertility, while trichomonal infection has been implicated in at least one study with atypical PID in infertile women.¹³ The prevalence rates found in Samoa are of a similar magnitude to those found in countries in African and Asia which having been experiencing HIV epidemics in the 1990s. Despite the survey finding an HIV seroprevalence of zero, the STI picture remains alarming and suggests a community at great risk for the introduction and rapid spread of HIV infection.

The survey was designed according to the WHO requirement to measure the prevalence of the STIs, and not to procure associated risk or behavioural information. Even though the survey was of a specific subpopulation of pregnant women in Apia, the study investigators believe that this sample gives reasonable representation of women of reproductive age in Samoa as a whole. It is important that interpretation of the findings takes into account the limitations of the data due to the lack of information on: whether the women were symptomatic or asymptomatic; whether the women had ulcerative or non-ulcerative genital infections; a post-treatment test of cure; risk and behavioural factors. If this information had been available it may have influenced recommendations arising from the findings of the survey.

The lack of the survey's information about the presence of symptoms restricts the usefulness of the data in developing and evaluating algorithms for a syndromic approach in the management of STIs. Research on reproductive tract infections has shown that, in any given population, the majority of women with gonococcal or chlamydial cervical infection will be asymptomatic, and that a significant number will also be asymptomatic for trichomonal infection.¹⁴ Case-finding of often asymptomatic, non-ulcerative female genital infections is difficult unless resources are available to establish and maintain laboratory testing facilities

In other countries with a high prevalence of STIs but inadequate resources to support widespread laboratory testing, a syndromic approach has been used for symptomatic individuals. The syndromic approach is most effective when it has been customized for the population and has been based on local epidemiological prevalence data and public health strategies. Despite the limitations in case-finding of subclinical and asymptomatic STIs, and the often poor treatment-seeking behaviour demonstrated by certain populations with STI symptoms, syndrome management has been found to be a cost-effective strategy in treating STIs.

Another suggested control strategy approach in high prevalence populations, such as the antenatal population in Apia, is the use of mass treatment, usually followed by syndrome management.¹⁵ This can be implemented as either epidemiologic mass treatment of the whole community (defined as those sexually active) or can be targeted at high-risk groups within the community, commonly known as core groups. The advantage of mass treatment over a syndrome management approach is that both asymptomatic and symptomatic individuals are treated, and that it captures the whole population, including those with low health care-seeking behaviour. The presumptive treatment with antibiotics in high-prevalence populations is thought to have both a treatment and, in some STIs, a prophylactic effect. The aim of mass treatment is a rapid and significant decrease in the disease reservoir. However, in isolation the strategy is ineffective. It must be followed up with sustainable STI control measures that include primary prevention and improved case management.

The application of this strategy to Samoa should be considered because of the high rates of both chlamydial infection (30%) and trichomonal infection (21%) in pregnant women. It is important to note that the rates in men remain unknown. There has been limited use of mass treatment internationally, but it has been effective in two studies in Africa. Wawer *et al*¹⁷ showed significant reductions in the prevalence of syphilis and trichomonal infections in the general population, while Steen *et al*¹⁷ showed significant reductions in the prevalence of chlamydial and gonorrhoeal infections and genital ulcers in targeted high-risk women in a mining community.^{16,17} This may be an effective strategy for use in Samoa because of its small population, reasonable road access and concentration of the population on the two small islands of Upolu and Savai'i. The treatment could be targeted at adults of reproductive age, 15-49 for women and 15-59 years for men. It would be useful to know the prevalence in males prior to implementation of a targeted mass treatment strategy. However, as noted earlier, this type of strategy could only be considered if there were both the resources and the capacity to not only implement the STI strategy but also sustain STI control measures that include primary prevention and improved case management, as





The prevalence rate for chlamydial infection in women attending the doctors' Antenatal Clinics was 29.7%, with a possible range of 26.5 to 35.3%. The upper value represents one in three pregnant women. This is a high rate of infection in a traditionally low-risk population of women. The rates were highest for women aged 20-24 years. There was no laboratory capacity to test for chlamydial infection in Samoa prior to this survey. Interestingly, the high rates of chlamydial and trichomonal infection are not repeated with gonorrhoea or syphilis, which are more traditional STIs and for which there is a local capacity to test and treat. The survey prevalence of gonorrhoea is 3.3%, one tenth that of chlamydial infection, suggesting that current testing and treatment has been much more successful in controlling the spread of gonorrhoea.

The PCR test for chlamydial infection does not indicate when the infection occurred. Some of the infections may, therefore, have been old and may not have related to current partners. The results of an ad hoc survey can be inflated by picking up old (prevalent) as well as new (incident) infections, and do not necessarily reflect the community rate of new infection. Nevertheless, the one-in-three infection rate among pregnant women has a significant implication for the community as a whole, as chlamydial infection is not only implicated in pelvic inflammatory disease, preterm labour, premature rupture of the membranes and perinatal mortality, but also as a major cause of infertility.

The high rate of bacterial STIs among the antenatal population suggests the need to review current antenatal screening so that curable STIs are treated at the earliest and safest time in the pregnancy. This would involve following up the partners of the women with infections and testing the treatment algorithm to make sure the antibiotics being prescribed are effective. The evaluation of syndromic case management in two studies^{18,19} of women attending Antenatal Clinics have shown variable results in using risk-assessment algorithms to detect chlamydial and/or gonococcal cervical infection. However, the use of risk assessment in conjunction with the application of specific clinical criteria in those with a positive risk assessment increased the positive predictive value of the algorithms. In Mwanza, Tanzania, in a population of 660 antenatal women with a cervical infection prevalence of 7.4%, it was found that the use of an algorithm of locally derived sociodemographic risk factors, in conjunction with a speculum and pelvic examination in the clinic setting, had a PPV of 36% for cervical infections.¹⁸ In Libreville, Gabon, in a population of 646 antenatal women with a cervical infection prevalence of 11.3%, it was found that the use of age and marital status and simple clinical signs within the clinic setting had a PPV of 17%.¹⁹

The rate of infection detected in the survey was not equal across all age groups, with younger mothers having a significantly greater risk of infection than older mothers. Women aged <25 years were three times as likely to have an STI than women 25 years or older. This may reflect a combination of factors, such as cultural expectations of a woman's role in sexual relationships; access to and affordability of family planning/sexual health services, contraception and condoms; or inadequate or inappropriately targeted pregnancy and STI harm minimization strategies.

The availability of antenatal assessment and care in Samoa is good. However, this needs to be broadened, or a similar model adopted for sexual health and family planning care, so that there is access to prevention information, screening and medical care where necessary. The use of mobile clinics should be encouraged to access rural areas. It is apparent from the high rates of STIs among young women (<25 years) that messages of safer sex are not successful. Prevention is important, but the availability of confidential, affordable clinical services is also essential in containing the transmission of STIs.

Confidentiality is another issue of major concern and needs to be addressed. Even although there were no confirmed HIV-positive test results in this seroprevalence survey, the high STI rates suggest the inevitability of there being HIV-positive results. It is critical that strategies be put in place to maintain the confidentiality of patients when HIV-positive results occur and to offer them the best medical care that can be supported by the Samoa health care system.

The limited surveillance of STIs in Samoa needs to be reviewed. Reliable surveillance data are important for the following reasons: they inform policy development; assist in prioritization of health issues; quantify the enormity of the disease burden and potential risks; and can be used to evaluate STI programmes. These can include health promotion harm-minimization programmes that promote the use of condoms and a safer sex message, or health information programmes to raise community awareness of STIs and HIV. Surveillance data can also be used to evaluate the implementation of syndromic case management programmes and the introduction of antenatal screening or testing capacity for specific STIs. The type of surveillance that is most suitable for Samoa needs to be determined. This may be sentinel surveillance, which could be clinic-based at the four hospitals; periodic ad hoc STI surveys of specific populations; laboratory-based surveillance; or passive reporting by medical officers and health workers.





The survey findings pose a number of significant questions as to how and where to proceed in a climate of limited resources. Samoa has a finite health budget that has a number of legitimate competing concerns, a small professional workforce and limited access to technology and new or expensive medication. Therefore, it is critical when recommendations are developed at the dissemination forum that there be due consideration of the sustainability of the measures adopted, including any local capacity-building. The following need to be considered at the dissemination forum, where their merit can be assessed and a strategic plan developed to address the high prevalence of STIs in Samoa.

ITEMS FOR CONSIDERATION

- (1) Review of policy and strategies for STIs and HIV by the Ministry of Health, which should include a review of surveillance, clinical services, laboratory services, health promotion, role of syndrome management and staff training and development;
- (2) review of conditions included in routine antenatal screening (eg. chlamydial and trichomonal infections);
- (3) review of access to confidential clinical services for sexual health and family planning, including the feasibility of free treatment, particularly the current set-up of the STI/Immigration Clinic;
- (4) review of general and specialist clinical services for the detection and management of STIs, including numbers and level of training of staff;
- (5) customization of syndromic case management for Samoa, taking into account the high prevalence rates of chlamydial and trichomonal infections;
- (6) consideration of the strategy of targeted mass treatment of chlamydial and trichomonal infections
- (7) review of the national drug list to include, where possible, single-dose drug therapy for STIs (eg. possibly chlamydial infection with azithromycin);
- (8) evaluation of current STI and HIV prevention strategies in health education and promotion for young people;
- (9) review of public education to promote awareness of STI symptoms and to improve treatment-seeking behaviour;

- 10) review of access to and availability and affordability of condoms to prevent STI transmission;
- 11) consideration of a community-based strategy to promote condom use in all casual and commercial sex;
- 12) review of policies and access to treatment for symptomatic individuals, screening for asymptomatic infections, and presumptive treatment of contacts of index cases;
- 13) review of access to and availability and affordability of contraception to prevent unplanned pregnancy;
- 14) review of strategies related to teenage pregnancy;
- 15) development of a surveillance strategy for STIs and HIV; and
- 16) ad hoc surveys (surveillance) of STIs. A behavioural and risk-factor STI prevalence survey of higher-risk males would better determine community prevalence rates and predictors of infection and also assist in looking at the cure rate of proposed drugs to be used in treatment of STIs.

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