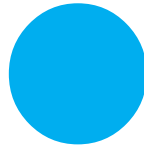
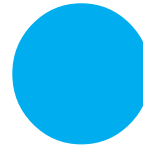




**World Health Organization
Regional Office for the
Western Pacific**



**Ministry of Health
Republic of Kiribati**



**University of New South
Wales, Australia**

STI/HIV

PREVALENCE SURVEYS OF SEXUALLY TRANSMITTED INFECTIONS AMONG SEAFARERS

AND

WOMEN ATTENDING ANTENATAL CLINICS IN KIRIBATI

2002-2003

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TABLE OF CONTENTS

Abbreviations and Acronyms	2
Executive Summary	3
Acknowledgements	4
Introduction	5
Study investigators	7
Objectives	9
Methods	11
Study populations and field procedure	11
Specimen collection, transportation and preparation	11
Polymerase chain reaction (PCR)	12
Antibody testing of sera	12
Syphilis	12
HIV	12
HBV	12
HSV2	13
STI syndromic case management and counselling for surveyed participants	13
Notification of results	14
Data analysis	14
Results	15
Characteristics of the study populations	15
Prevalence of sexually transmitted infections	18
Seafarers	18
Pregnant women	19
High-risk behaviour	19
Seafarers	19
Pregnant women	22
Discussion and Conclusion	23
References	25

ABBREVIATIONS AND ACRONYMS

CI	confidence intervals
ELISA	enzyme-linked immunosorbent assay
FTA-ABS	fluorescent treponemal antibody absorption assay
IDU	injecting drug users
HBV	hepatitis B virus
HIV	human immunodeficiency virus
HSV1	herpes simplex virus 1
HSV2	herpes simplex virus 2
MTC	Marine Training College
OR	odds ratio
PCR	polymerase chain reaction
PID	pelvic inflammatory disease
RPR	rapid plasma reagin
STI	sexually transmitted infection (s)
TPHA	<i>Treponema pallidum</i> haemagglutination assay
TPPA	<i>Treponema pallidum</i> particle assay
UNSW	University of New South Wales
VDRL	Venereal Disease Research Laboratory slide test
WHO	World Health Organization

EXECUTIVE SUMMARY

A cross-sectional sexually transmitted infection (STI) prevalence survey was conducted by the Ministry of Health, Kiribati, in conjunction with the University of New South Wales, Sydney, Australia and with technical and financial support of WHO. A total of 386 seafarers recruited in Tarawa from January 2003 to July 2003, and 269 pregnant women attending antenatal clinics, recruited in Tarawa from February 2003 to August 2003, participated in the survey. All eligible participants gave written informed consent.

Demographic, behavioural and clinical information of the participants was gathered by interviewer-administered questionnaires. Blood samples were collected from the women. Urine and blood samples were collected from the men. Urine was tested with polymerase chain reaction (PCR) for *C. trachomatis* and *N. gonorrhoeae*. Blood was tested for syphilis using rapid plasma reagin (RPR) serology as the screening test, and *Treponema pallidum* haemagglutination assay (TPPA) and fluorescent treponemal antibody absorption assay (FTA-ABS) as a confirmatory test. HIV testing was carried out using enzyme-linked immunosorbent assay (ELISA) and, if positive, a repeat ELISA and a western blot were undertaken for confirmation. Free treatment was provided to study participants diagnosed with an infection.

Among pregnant women attending antenatal clinics, no HIV infection was diagnosed. There were two cases of syphilis, and hepatitis B seropositivity was 9.2%. Among seafarers, 0.3% were positive for HIV infection and 22.7% were positive for hepatitis B infection. The most prevalent STI was chlamydiosis (9.3%) followed by syphilis (2.7%). There were no cases of gonorrhoea detected.

A high prevalence of chlamydial infection was observed among seafarers coupled with a low use of condoms with sexual partners both in Kiribati and overseas. Levels of infection in pregnant women are unknown with the application of syndromic management suboptimal in populations which are largely asymptomatic. The need persists for the development of an inexpensive, reliable, field diagnostic test for chlamydia, for prenatal screening in endemic populations.

This survey suggests that hepatitis B is endemic in Kiribati in individuals aged 17 years and older. Over twice the level of hepatitis B seropositivity was diagnosed in seafarers compared to the pregnant women surveyed. Kiribati supports a neonatal hepatitis B immunization programme only. There is a need to review the provision of hepatitis B screening and immunization in seafarers at the time of entry into either the Marine Training College or the seamen workforce.

The unacceptably high rates of treatable STI indicate that diagnostic, treatment and surveillance components of STI control programmes need to be strengthened in Kiribati. Further surveys of high-risk populations such as Koreas (sex workers) need to be undertaken. In particular, policies and prevention strategies looking at safer sex practices and 100 per cent condom usage need to be developed for high-risk sub-populations such as seafarers.

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Director, Kiribati Extension Centre, University of the South Pacific, Bairiki, Tarawa, Kiribati; Sister Tanimakin Nooti, Ministry of Health, Principal Nursing Officer, Public Health Division (Antenatal services); Mr Tebuka Toatu, Laboratory Superintendent, Tungaru Central Hospital, Bikenibeu, Tarawa Island, Kiribati; Mr Ioelu Tatapu, Health Information Officer; Professor Anthony Cunningham and Ms Janette Taylor, Westmead Millennium Institute, Sydney, Australia; Professor Adrian Mindel, Sexually Transmitted Infection Research Centre, Westmead Hospital, Sydney, Australia; Dr Sepehr Tabrizi and Associate Professor Suzanne Garland, Royal Women's Hospital, Melbourne Australia; Mr Serge Nesteroff, Institute of Clinical Pathology and Medical Research, Sydney, Australia; Dr Raymond Chan, South Western Area Pathology Service, Liverpool, Australia; Drs Alex Wang and Rowena Haynes, University of New South Wales; Dr Kwangsoo Park, Country Liaison Officer in Kiribati, World Health Organization; and Dr Nguyen Thi Thanh Thuy, Technical Adviser on HIV/STI surveillance, World Health Organization, Regional Office for the Western Pacific.

INTRODUCTION

Sexually transmitted infections (STI) including HIV and AIDS are a major public health problem in the Western Pacific Region causing serious health, economic and social consequences. Sexually transmitted infections consistently rank among the five most important causes of adults seeking health care and of healthy productive lives lost.¹ The latest World Health Organization statistics report estimated an annual incidence of 35 million new cases of treatable STI in the East Asia and the Pacific Region with an estimated 30 million cases of chlamydial.² The contribution of STI to maternal and perinatal morbidity and mortality in developing populations are well recognized.³⁻⁷ Likewise, HIV estimates by the end of 2000 in the Western Pacific was 1 million cases, with an estimated 15 000 additional cases of AIDS in 1999.⁸

Epidemiological studies have shown that persons with ulcerative and non-ulcerative STI are more susceptible to HIV.⁹⁻¹³ People with HIV and non-ulcerative STI have increased shedding of HIV-infected cells and greater efficiency in transmitting the virus.⁹ Sexually transmitted infections have been implicated as facilitating factors in the transmission of HIV;^{10,11} with the association between STI and HIV being strongest for those infections that cause genital ulceration.^{10,12,13} This association has also been established in treatable STI such as *N. gonorrhoeae*, *C. trachomatis* and *T. vaginalis*.⁴⁻⁷

The epidemiology of STI is poorly characterized in Kiribati, as in many other developing Pacific Island countries and areas.¹⁴ Apart from national reporting of AIDS and HIV infection since 1991, there is little systematic and no ad hoc surveillance of STI in Kiribati. There were 127 cases of gonorrhoea reported to the Ministry of Health, Kiribati in 2001, but the lack of a clinical case definition makes this number unreliable. Reporting of STI is limited by the lack of laboratory and public-health-information capacity. Kiribati is a country with a low prevalence of HIV. As of June 2001, the Ministry of Health reported from its National HIV Surveillance System 38 cumulative HIV infections for the period 1991-2001.¹⁵ Twenty-seven (71%) of the 38 cases of HIV infections have been males, 20 (53%) have been seafarers, 5 (13%) have been seafarers' spouses and 3 (8%) have been children. An Interim Action Plan for HIV/AIDS was prepared in 1999 and followed by the Kiribati STI and HIV/AIDS Strategic Plan 2000 (Ministry of Health and Family Planning of the Government of Kiribati) in 2000. The implementation of this plan has been hampered by a lack of funding and problems with garnering institutional support.

The lack of country-specific STI data is a regional problem. World Health Organization 1998 prevalence estimates for selected STI in Papua New Guinea were 20% for chlamydia, 4% for gonorrhoea and 4% for syphilis in the adult population aged >15 years, while for other Pacific island countries there were only regional prevalence estimates available of 11% for trichomoniasis, 13% for chlamydiosis, 8% for syphilis and 0.4% for gonorrhoea.¹⁶ There is no prenatal screening of STI in most urban centres of Western Pacific island nations. Recent epidemiological studies of women attending prenatal services have reported

endemic levels of STI. Studies from Vanuatu,¹⁷ Samoa¹⁸ and Fiji¹⁶ report the following high rates of chlamydial infection and trichomoniasis: Vila, Vanuatu (chlamydiosis 22.4%, trichomoniasis 27.5%); Apia, Samoa (29.7% chlamydiosis 29.7%, trichomoniasis 20.8%); and Suva, Fiji (chlamydiosis 19.5%, trichomoniasis 11.0%).

The HIV epidemic in the Pacific is diverse with the primary mode of spread being heterosexual. Melanesian countries have been most severely affected by HIV infection in contrast to the Micronesian and Polynesian countries. Four Pacific island countries and areas—Guam, French Polynesia, New Caledonia and Papua New Guinea—have reported the most cases with PNG reporting the greatest increase in the number of HIV infections in the Region (6503 cases).¹⁹ No cases of HIV infection or AIDS have been reported in three of the Pacific islands: American Samoa, Niue and Tokelau.¹⁹

Kiribati is a Micronesian island country located in the Western Pacific Ocean comprising of an archipelago of some 30 low-lying coral atolls surrounded by extensive reefs with a total land area of 800 square kilometers (km²).²⁰ Kiribati covers an area of 2.5 million km² and extends about 800 km from north to south and 3 218 km from east to west. Kiribati is typical of the Pacific island nations in the Region with a small population of an estimated 92 868 inhabitants (2002).²¹ Tarawa, the capital, has an estimated population of 33 000 inhabitants. Kiribati has an estimated annual population growth rate of 1.8%, fertility rate of 3.6 and crude birth rate of 30 per 1 000 population. In 1995, there were 5 023 live births with approximately two thirds of the births delivered in hospitals.

The population is predominantly Micronesian, with very small Polynesian and non-Pacific minorities. There are two hospitals in Tarawa and health clinics situated throughout the islands. Medical services are free but limited. Kiribati is classified by the United Nations as a Least Developed Country and the estimated gross domestic product per capita was US\$860 for 1999. The main sources of income are foreign aid, tuna fishing, exports of copra and seaweed and remittances from I-Kiribati seafarers working overseas. The major employer of Kiribati seamen reports about 1170 seamen from Kiribati working on overseas vessels and cruise lines of which about 40 are nautical officers (personal communication with South Pacific Marine Service, September 2003).

There are well over one million seafarers worldwide.²² Seafarers are a unique population that face multiple occupational (noxious agents exposure, toxic or dangerous cargo, weather and climatic changes), health (substance abuse, depression, STI, injuries) and psychosocial (separation and alienation from family and home, stress associated with shipboard living) risks daily.²²⁻²⁷ Earlier studies have identified sexual contact with commercial sex workers, abuse of alcohol and inconsistent use of condoms as factors contributing to seafarers' higher risk of contracting STI;^{25,28} while a study by Hawkes et al. (1994) suggested that men living away from home are more likely to pay for sex, practise unsafe sex and have multiple sexual partners.²⁹ A number of studies have demonstrated both high infection rates and poor knowledge about sexually transmitted disease, safe sexual practice and HIV/AIDS among seafarers.³⁰⁻³⁴ Seafarers, because of these factors, are likely to be a key transmitter population of STI into their local communities, particularly in countries such as in Kiribati, where the local population is isolated, less mobile and maintains a relatively undeveloped commercial sex industry.

As part of the overall strategy to decrease the transmission of STI and HIV it is important to determine the behavioural factors that drive the increase in risk exposure to STI and HIV infection. Often these studies have focused on injecting drug users and commercial sex-workers, as being two of the populations most at risk in any particular country. Less work

has been done on other transmission pathways into the general population, particularly, in the Pacific region. In Kiribati, the population of interest is seafarers, a highly mobile population who are away from their partners for protracted periods of time on a regular basis. This epidemiological information is needed to develop strategies and appropriate interventions for limiting the STI and HIV epidemics. An essential component of this strategy is to undertake baseline prevalence studies of STI and HIV and associated risk and behavioural factors in the population of interest.

WHO Western Pacific Regional Office is currently supporting second generation HIV surveillance, which concentrates resources where they will yield information that is most useful in reducing the spread of HIV and providing care for those affected.³⁵ This report details the findings of two STI prevalence surveys conducted on Tarawa Island during 2003 among trainee and active seafarers attending the Marine Training College (MTC); and pregnant women attending antenatal clinics. The majority of seafarers were recruited while undertaking routine training at the MTC prior to accepting a new contract. The seafarers were a healthy working population. Recruitment of pregnant women attending antenatal clinics was logistically more difficult because of the small number of new clients per week at antenatal clinics, often as low as 1-4 women. Although caution should be used in extrapolation of these results to similar population groups in Kiribati, the findings of the survey can be used in refining STI prevention and control measures and revising disease prevalence estimates among at risk populations.

STUDY INVESTIGATORS

The study was supported by the World Health Organization Regional Office for the Western Pacific, coordinated by the Ministry of Health, Kiribati and the University of New South Wales, Sydney, Australia. The study was implemented by the Ministry of Health with the assistance of the Tungaru Centra Hospital, Bikenibeu, Tarawa Island, Kiribati and in Australia with the assistance of the University of New South Wales. The study team is listed in Table 1.

Table 1: Study team for survey of seafarers and pregnant women in Tarawa, Kiribati, 2003

Name	Affiliation	Role
Dr Takeieta Kienene	Permanent Secretary, Ministry of Health, Republic of Kiribati	Principal Investigator
Dr Kabwea Tiban	Ministry of Health, Public Health Division, Bikenibeu, Tarawa Island, Kiribati	Co-Principal Investigator Kiribati / Public Health Physician/ study coordinator and clinician
Dr Elizabeth Sullivan	School of Women's and Children's Health, University of New South Wales	Co-Principal Investigator Australia / Epidemiologist / studies co-ordinator
Mr Tebuka Toatu	Tungaru Central Hospital, Bikenibeu, Tarawa Island, Kiribati	Laboratory Superintendent
Dr Sepehr Tabrizi	Royal Women's and Children's Hospitals, Melbourne Australia	Referral Laboratory, technical consultant
Associate Professor Suzanne Garland	Royal Women's and Children's Hospitals, Melbourne Australia	Referral Laboratory, sexual health physician, clinical consultant
Sister Tanimakin Nooti	Ministry of Health, Principal Nursing Officer, Public Health Division (Antenatal services), Bikenibeu, Tarawa Island, Kiribati	Study co-ordinator of antenatal study
Ms Janette Taylor	Coordinator, HSV Seroepidemiology Centre for Virus Research, Westmead Millenium Institute	Referral Laboratory

OBJECTIVES

The study's objectives were:

- (1) to provide baseline data to monitor trends and impacts of STI prevention and control programmes:
 - to determine the baseline prevalence of gonorrhoea, chlamydiosis, treponemal seropositivity, hepatitis B, herpes simplex 1 and 2 and HIV infection among a group of seafarers on Tarawa Island, Kiribati; and
 - to determine the prevalence of treponemal seropositivity, hepatitis B, herpes simplex 1 and 2 and HIV infection among pregnant women attending antenatal clinics on Tarawa Island, Kiribati;
- (2) to analyse demographic and behavioural factors related to the STI infections in specific populations;
- (3) to strengthen the capacity for epidemiological assessment and surveillance for STI in Kiribati; and
- (4) to strengthen the technical capacity of epidemiological and laboratory based study investigators.

Sexually transmitted infections included:

- *Neisseria gonorrhoeae* (gonorrhoea);
- *Chlamydia trachomatis* (chlamydiosis);
- Syphilis, as reflected by prevalence of treponemal seropositivity;
- human immunodeficiency virus (HIV);
- herpes simplex virus 1 and 2 (HSV); and
- hepatitis B virus (HBV).

Chlamydia and gonorrhoea were included in the prevalence survey for seafarers because they are primarily sexually transmitted, curable and routine testing is not available in Kiribati. In addition, chlamydiosis is often asymptomatic in men and women. Hepatitis B was included at the request of the seafarers. Hepatitis B testing is required prior to accepting a contract for work as a seafarer and if not included would have meant that study participants would have had to have a second blood sample collected and additional testing for HBV. There is no universal hepatitis B immunization programme in Kiribati for adults. Herpes simplex virus was included as it is considered a marker for risk of STI and neither testing nor epidemiological data is available in Kiribati for HSV. Funding was identified in Australia to support the HSV testing.

METHODS

1. STUDY POPULATION AND FIELD PROCEDURE

A cross-sectional study was undertaken to determine by laboratory confirmation the prevalence of the selected STI. A total of 386 seafarers, who were either trainees or experienced seafarers (seafaring employment ≥ 2 years) attending the Marine Training College in Betio, Tarawa Island, were recruited from January 2003 to July 2003. A sample of 269 pregnant women attending their antenatal clinic for routine monitoring of their pregnancy on Tarawa Island, participated in the surveys from January 2003 to August 2003.

The protocol of the study was reviewed and approval granted by the Human Research Ethics Committee (HREC), University of New South Wales, and the Ministry of Health, Kiribati. The seafarers' STI prevalence survey was organized by the study team in cooperation with the Kiribati Overseas Fishermen Union (KOFU) and Kiribati Overseas Seafarer Union (KOSU), Marine Training College and the South Pacific Marine Service.

Participation in the study was voluntary and informed consent was obtained from all eligible participants prior to data and sample collection. Consecutive recruitment of male seafarers aged 17-54 years attending the Marine Training College who present for the first time during the survey period. For seafarers, the STI and HIV prevalence study used *voluntary confidential testing* methodology. For the pregnant women, there was *voluntary confidential testing* for syphilis. Pregnant women aged 17-49 years attending their first visit to antenatal clinics or high-risk pregnancy clinic were consecutively recruited. Pregnant women were offered confidential or anonymous testing for HIV; women electing to have confidential testing had a second sample collected for anonymous testing of HIV. Pregnant women were offered anonymous testing for HSV. Confidential questionnaires were administered by trained interviewers to obtain demographic, behavioural and other information. Urine and blood specimens were also collected.

2. SPECIMEN COLLECTION, TRANSPORTATION AND PREPARATION

A 10-15 ml first-catch urine sample was obtained from each male participant and a 5-10 ml blood sample was collected from all participants. All specimen collection, preparation, storage and shipping were under supervision by the Laboratory Superintendent at the Tungaru Central Hospital, Tarawa Island, Kiribati. Sera was separated by centrifugation at 3000 rpm for 10 minutes. All urine and sera were stored at 0°C until transportation to the reference laboratory the to the Molecular Microbiology Laboratory of the Royal Women's Hospital, Melbourne, Australia and HSV Seroepidemiology Centre for Virus Research, Westmead Millennium Institute, Sydney, Australia. Shipment of frozen sera and urine packed with ice-packs were periodically despatched to Australia depending on flight availability.

POLYMERASE CHAIN REACTION (PCR)

Self-collected urine samples were utilized in this study. All men collected first-catch urine samples (10-15 ml) which were stored at 0°C until transportation to the Molecular Microbiology Laboratory of the Royal Women's Hospital, Melbourne, Australia. Thawed urine samples were tested on receipt at the referral laboratory. Amplification of *C. trachomatis* and *N. gonorrhoeae* sequences were performed using Roche COBAS Amplicor (Roche Diagnostics, Branchburg, New Jersey, United States of America). All positive *N. gonorrhoeae* specimens were confirmed by an alternate PCR assay using primers and probes directed at a 273 base pair region of *cpp* gene located on a 4.3 kb cryptic plasmid as previously reported by Tabrizi et al.³⁶ with modification of adaptation of assays to real-time assay, on LightCycler (Roche Molecular Biochemicals, Mannheim, Germany).

ANTIBODY TESTING OF SERA

Sera were tested at the national laboratory at Tungaru Centra Hospital, Bikenibeu, Tarawa Island, Kiribati using three Abbott tests: Determine Syphilis TP, Determine HIV-1/2 and Determine HBV test kits. Frozen sera were shipped to Australia for further testing.

SYPHILIS

Sera were screened in Kiribati using the Abbott Determine Syphilis TP (Abbott Laboratories, Tokyo, Japan, patent pending), an immunochromographic test for the qualitative detection of antibodies to *Treponema pallidum* antigens. Tests were performed according to the manufacturer's instructions. All positive tests were re-tested in Australia at the Institute of Clinical Pathology and Medical Research (ICPMR). All sera were tested by VDRL (VDRL-Cardiolipin Antigen, Dade Behring, Marburg, Germany) and a treponema-specific test, the *Treponema pallidum* Particle Agglutination test (Serodia-TP.PA, Fujirebio Inc, Tokyo, Japan). Any specimen found reactive in the VDRL test was titred in serial dilution. The Fluorescent Treponemal Antibody Absorption (FTA-ABS) test (sorbent from Zeus Scientific, Raritan New Jersey, United States of America; IgG conjugate from Dako Corp, Glostrup, Denmark) was used as a confirmatory treponemal test for any specimens found reactive in the TPPA test. All tests were performed according to standard methods.

HIV

Sera were screened in Kiribati for HIV infection using the Abbott Determine HIV-1/2 (Abbott Laboratories, Tokyo, Japan, patent pending). The Abbott Determine HIV-1/2 is an immunochromographic test for the qualitative detection of antibodies to HIV-1 or HIV-2. Tests were performed according to the manufacturer's instructions. Where tests were positive, they were retested in Australia using an ELISA test with confirmatory western blot.

HBV

Sera were screened in Kiribati for hepatitis B infection using the Abbott Determine HBV (Abbott Laboratories, Tokyo, Japan, patent pending). The Abbott Determine HBV is an immunochromographic test for the qualitative detection of antibodies to hepatitis B. Tests were performed according to the manufacturer's instructions.

HSV2

Sera were shipped to the HSV Seroepidemiology Centre for Virus Research, Westmead Millennium Institute, Australia. All specimens were tested for antibodies to HSV-2 using an indirect enzyme-linked immunosorbent assay (ELISA) specific to glycoprotein G (gG2) (Focus Technologies HerpeSelect 2 ELISA IgG) as described previously.³⁷ Equivocal ELISA results were resolved by western blot.³⁸ A subset of the sera (25%) were randomly selected and tested for antibodies for HSV-1. Depending on the HSV-2 serostatus of these sera they were tested either by the Dade Behring Enzygnost Anti HSV/IgG ELISA for the detection of total antibody to HSV or by western blot (if HSV-2 positive).

A subset of sera from 42 seafarers was tested in Australia at the South Western Area Pathology Service, Liverpool for antibodies to syphilis, HBV and HIV. All testing was performed strictly according to the manufacturers' instructions. For syphilis testing, sera were screened by an enzyme immunoassay (Murex ICE Syphilis, Abbott Diagnostics). All reactive specimens were then subjected to RPR (Macro-Vue RPR Card Test, Beckton Dickinson), TPPA (Serodia TPPA, Fujirebio Inc.) and FTA-Abs IgG (slides – Trepo-Spot IF, Biomerieux) testing. For HBV testing, sera were tested for HBsAg (AxSYM HBsAg (V2), Abbott Diagnostics) with all positives confirmed (AxSYM HBsAg Confirmatory, Abbott Diagnostics). For HIV testing, sera were screened by ELISA (AxSYM HIV-1/2gO, Abbott Diagnostics) and a particle agglutination assay (Serodia-HIV, Fujirebio). Confirmatory testing comprised p24 antigen assay (Vironostika HIV-1 Antigen Microelisa System, Biomerieux) and western blot assay (Genelabs Diagnostics HIV Blot 2.2, Genelabs Diagnostics).

3. STI SYNDROMIC CASE MANAGEMENT AND COUNSELLING FOR SURVEYED PARTICIPANTS

During the survey, participants received counselling on STI and HIV prevention. STI case management was provided. Treatment protocols were compliant with WHO STI Syndromic Case Management Guidelines. These guidelines had been modified by the Ministry of Health, Kiribati to suit local conditions in Kiribati and be sustainable post study. Seafarers were counselled and treated when they presented for their results. Pregnant women, if symptomatic, were treated at the time of their routine antenatal examination, based on clinical findings, according to the standard syndromic approach or at the follow-up visit when test results for syphilis were available. Patients were informed verbally of the potential side effect(s) of medications (amoxicillin, doxycycline, and ceftriaxone) to be used. All medications are routinely used to treat these infections. The following treatment regimens were used in the survey.

- Gonorrhoea: amoxicillin 3 gm oral stat with a single oral dose of 1 g of probenecid.
- Chlamydiosis: for pregnant women amoxicillin 500 mg orally, every eight hours for 7 days; and for male partners or seafarers, doxycycline 100 mg orally twice daily for 7 days.

-
- Syphilis: for primary, secondary and early latent, a single Benzathine benzyl penicillin G 2.4MU/1.8 g intramuscular injection; for late latent (>1 year) and unknown duration, Benzathine benzyl penicillin G 2.4MU/1.8 g intramuscularly weekly for three consecutive weeks; and for neurosyphilis, Procaine penicillin G, 2.4MU intramuscularly and probenecid 500 mg orally four times per day, daily for 10-14 days.
 - HIV: an intrapartum regimen of single oral dose of 200 mg Nevirapine at the start of labour for the mother and single oral dose in suspension of 2 mg/kg of Nevirapine at 72 hours to the infant was proposed but never implemented as no cases were diagnosed.

4. NOTIFICATION OF RESULTS

The results were notified to the Principal Investigator and kept with the maximum level of confidentiality. The Principal Investigator coordinated the provision of laboratory results to study participants and their clinicians. The STI and HIV results were reported on a population basis.

5. DATA ANALYSIS

Data were entered using Microsoft Access 2000 and analysed using SPSS (version 11.0 for Windows; SPSS Inc., Chicago, Illinois, United States of America), in the School for Women's and Children's Health, University of New South Wales. Outcome variables include prevalence of study STI, of any STI (at least one infection), and their 95% confidence intervals.

RESULTS

CHARACTERISTICS OF THE STUDY POPULATIONS (TABLES 2 AND 3)

All eligible seafarers agreed to participate in the study. Of the 386 eligible male seafarers who participated in the study, 386 had sample collection and testing, while 357 (92.5%) had both questionnaire and sample collection data available. Of the 269 pregnant women who participated in the study, 168 (62.5%) completed a questionnaire, 196 (72.9%) had a blood sample collected.

The demographic characteristics of the seafarers are shown in Table 2. Approximately one third (34.3%) of 357 seafarers were aged <25 years; with a mean age of 30.0 years (standard deviation [SD]: ± 9.4 years; range: 18-58 years). The majority (72.3%) of seafarers had attended secondary school, were married or cohabiting (59.9%) and lived on Tarawa (73.2%). The average age of seafarers who were MTC trainees was 22.4 years compared to 35.9 years for experienced seafarers. Just over a third of seafarers were trainees at the Marine Training College, while the two leading categories for seafarers were able-bodied seamen and ordinary seamen. Over three quarters (79.8%) of seafarers reported a regular female partner in Kiribati in the last 12 months.

Approximately 69 (42.6%) of the 162 pregnant women were aged <25 years, with a mean age of 26.8 years. The majority (65.5%) of pregnant women had attended secondary school, were married or cohabiting (94.6%) and lived on Tarawa (93.3%). Among the pregnant women, 34.4% were primigravidas, with 16.9% having had e"4 pregnancies. Almost half of the partners of the pregnant women were government workers or seafarers. Nearly one third (31.9%) of the 160 pregnant women reported working in a paid job (Table 3).

Table 2: Demographic characteristics of 357 male seafarers in Tarawa, Kiribati, 2003

Characteristics	No. in sample	Number	Percent
Age group (years)	344		
<20		16	4.7
20-24		102	29.7
25-29		84	24.4
30-34		50	14.5
35-39		22	6.4
?40		70	20.3
Marital status	342		
Married / defacto		205	59.9
Single		137	40.1
Education	344		
Primary/junior secondary school		79	23.0
Secondary school		258	75.0
University/ technical school		7	2.0
Seafarers classification	290		
Trainee seafarer		104	35.9
Seafarer (total)		186	64.1
Ordinary seaman		37	12.8
Able-bodied seamen		74	25.5
Steward		14	4.8
Motorman		19	6.6
Cook		9	3.1
Bosun		27	9.3
Fitter		5	1.7
Officer		1	0.3

Table 3: Demographic characteristics of 168 pregnant women in Tarawa, Kiribati, 2003

Characteristics	No. in sample	Number	Percent
Age group (years)	162		
<20		21	13.0
20-24		48	29.6
25-29		41	25.3
30-34		30	18.5
35-39		18	11.1
?40		4	2.5
Marital status	167		
Married / defacto		158	94.6
Single		9	5.4
Education	165		
Primary/ junior secondary school		46	27.9
Secondary school		108	65.5
University/ technical school		11	6.7
Occupation of partner involved in pregnancy	156		
Seafarer		36	23.1
Fisherman		9	5.8
Soldier /policeman		2	1.3
Businessman		6	3.8
Government worker		37	23.7
Company worker		31	19.9
Student		14	9
Other		21	13.5
Seafarers classification	35		
Ordinary seaman		5	14.3
Able-bodied seamen		20	57.1
Steward		1	2.9
Motorman		2	5.7
Bosun		3	8.6
Fitter		2	5.7
Officer		2	5.7

PREVALENCE OF SEXUALLY TRANSMITTED INFECTIONS (TABLES 4 AND 5)

SEAFARERS

Among the 386 male seafarers, with laboratory results for STI, the most prevalent STI was chlamydia (9.3%) (Table 4). Syphilis was diagnosed in 2.7% of cases. There was one (0.3%) case of HIV infection detected. There were no cases of *Neisseria gonorrhoeae* diagnosed. The highest prevalence of chlamydial infection were observed among seafarers aged 25-29 years (14.3%).

Of the 386 seafarers with results available for all STI (syphilis, chlamydia, HIV and HSV2), 109 (28.2%) had at least one infection, 13 (3.4%) had two concurrent infections. When hepatitis B was included, 171 (44.3%) had at least one infection, 30 (7.8%) had two concurrent infections, and 3 (0.8) had three concurrent infections.

Table 4: Prevalence of sexually transmitted infections among 386 male seafarers in Tarawa, Kiribati, 2003

Type of STI	Number tested	Number with infection	Prevalence per cent	95% confidence intervals
Chlamydia	386	36	9.3	6, 12
Gonorrhoea	386	0	0	0
Syphilis	336	9	2.7	1, 4
HIV	383	1	0.3	0, 1
HSV-2	376	76	20.2	16, 24
HSV-1	77	75	97.4	94,100
Hepatitis B	375	85	22.7	18, 27

PREGNANT WOMEN

Among the 196 pregnant women, syphilis was diagnosed in two cases (1.4%) (Table 5). There were no cases of HIV infection. There were no risk factors associated with having a diagnosis of syphilis.

Table 5: Prevalence of sexually transmitted infections among 269 pregnant women in Tarawa, Kiribati, 2003

Type of STI	Number tested	Number with infection	Prevalence Per cent	95% Confidence intervals
Syphilis	140	2	1.4	0, 3
HIV infection	193	0		
Hepatitis B	119	11	9.2	4, 15

SEROPREVALENCE OF HEPATITIS B

Among seafarers, HBsAg seropositivity was 22.7%, with the highest prevalences of HBsAg seropositivity observed in seafarers aged 20-29 years. Diagnosis of hepatitis B seropositivity was not significantly associated with age of seafarer.

Among pregnant women, hepatitis B seropositivity was 9.2%.

HIGH-RISK BEHAVIOUR

SEAFARERS

A high frequency of risky behaviours was noted among seafarers in the study. The majority (85.3%) of seafarers reported drinking alcohol, Karewe or Kaokioli while 58.1% smoked cigarettes and 1.5% reported having used drugs in the last 12 months. However, frequency of alcohol ingestion was not associated with presence of an STI. The average age of first sex with a woman was 18.3 years and ranged from 11 to 36 years. Seafarers reported on average 2.8 sexual partners in the last 12 months. Table 6 details selected demographic and risk factors and presence of one or more of the following: chlamydiosis, syphilis and/or HIV infection.

Table 6: Any STI (chlamydiosis, syphilis, HIV infection) by demographic and risk factors among 386 male seafarers in Tarawa, Kiribati, 2003

Characteristic	Any STI (chlamydiosis, syphilis, HIV infection)	
	Number	Per cent
Age groups (years)		
<25	11	9.3
≥25	33	14.6
Education		
Primary / junior secondary school	8	10.1
Secondary school	34	13.2
Marital status		
Married	25	12.2
Single	17	12.4
Marine work experience		
Trainee	11	10.6
Experienced	26	14.0
Age at first sex		
<18 years	16	12.3
≥18 years	25	12.6
No. of partners last 12 months		
1	11	7.1
Multiple	31	19.5
Ever diagnosed with STI		
Yes	2	13.3
No	42	12.7
Regular partner in Kiribati		
Yes	33	12.3
No	9	13.2
Regular partner on ship		
Yes	2	9.1
No	34	14.3
Casual sex partner		
Yes	23	18.4
No	20	10.7
Sex with sex worker		
Yes	10	15.9
No	20	11.4
Condom use last sex with regular partner in Kiribati		
Yes	7	17.9
No	34	13.3
Condom use last sex with regular partner on ship		
Yes	3	14.3
No	3	15.0
Condom use last sex with casual sex partner		
Yes	11	20.8
No	16	18.4
Condom use last sex with sex worker		
Yes	6	14.6
No	6	21.4

Approximately one in 25 seafarers (n=357, 5.6%) reported having had sex with a male in the last 12 months. This behaviour was not associated with a higher risk of treatable STI. About 40.1% reported having casual sex partners and of those only 37.9% reported condom use in their last sexual encounter. About 19.9% reported a commercial sex partner in the last 12 months and of those only 59.4% reported condom use with their last sexual encounter. Table 6 details selected partner type and condom use with last sex and presence of one or more of the following infections chlamydia, syphilis and or HIV infection.

Diagnosis of chlamydia was significantly associated with multiple partners in the last 12 months (odds ratio [OR] 3.5, 95% confidence intervals [CI] 1.5, 7.9), but was not significantly associated with age or experience of seafarer or condom use (Table 7). A diagnosis of syphilis was significantly associated with multiple partners in the last 12 months (OR 6.4, 95% CI 1.3, 32.5) and being an experienced seafarer (OR 9.6, 95% CI 1.1, 80.6).

The only factor significantly associated with presence of a treatable STI (syphilis, chlamydia) in a seafarer was multiple sexual partners in the last 12 months (OR 3.7, 95% CI 1.7, 8.1). Factors associated with any STI (syphilis, chlamydia, HIV and HSV2) in seafarers were age \geq 25 years and casual sexual partners in the last 12 months. The final logistic regression model showed that age more than 25 years (OR 1.9, 95% CI 1.1, 3.4) and having casual sex partners (OR 1.8, 95% CI 1.1, 3.0), were both significantly associated with infection with a STI ($\chi^2=7.8$, 2 degrees freedom, $p<0.021$).

Table 7: STI infection by risk factors among 386 male seafarers in Tarawa, Kiribati, 2003

Risk factors	Type of STI	No. of cases	Odds ratio (95% CI)
Casual sex partner	HIV CT Syph HSV2	45	1.8 (1.1-3.0)*
Age \geq 25 years	HIV CT Syph HSV2	74	1.9 (1.1-3.4)*
>1 partner last 12 months	HIV CT Syph	31	3.3 (1.6-7.1)*
>1 partner last 12 months	CT Syph	31	3.7 (1.7-8.1)*
>1 partner last 12 months	Chlamydia	25	3.5 (1.5-7.9)*
>1 partner last 12 months	Syphilis	7	6.4 (1.3-32.5)*
Marine work experience	Syphilis	8	9.6 (1.1-80.6)*
No condom use last sex with regular partner	HSV2	58	3.4 (1.0-11.5)*

* statistically significant ($p<0.05$)

PREGNANT WOMEN

Nearly one in four (23.3%) pregnant women smoked while 2.2% reported drinking alcohol. The average age of first sex for the pregnant woman was 20.1 years. All pregnant women reported sex with a regular male partner in the last 12 months. No women reported having a casual sex partner and only one reported having been paid for sex in the last 12 months. Only 2.6% pregnant women reported 'ever condom use' in the last 12 months.

DISCUSSION AND CONCLUSION

There was a high prevalence of chlamydial infection found in trainee and experienced seafarers in Kiribati. The level of chlamydial infection did not differ by whether the seafarer was a trainee or had worked abroad suggesting that chlamydiosis is likely endemic in the general community. This pattern of disease was not evident with syphilis where eight of nine cases were in experienced seafarers. The prevalence of chlamydiosis found in seafarers is similar to the prevalence (10.2%) found in a recent study of a highly mobile population of truck drivers in the Tongling, Anhui Province, China.³⁹ This survey did not test the population of pregnant women for chlamydial infection but recent studies in Vanuatu¹⁷ and Samoa¹⁸ of pregnant women have found rates of chlamydiosis of 22.4% and 29.7% respectively.

The endemic level of chlamydiosis detected among seafarers is of concern because the majority have regular female partners in Kiribati with whom they do not use condoms. The morbidity associated with chlamydial infection including pelvic inflammatory disease, infertility in women, and associated increase risk of HIV transmission is well described. It is likely that there is a significant rate of transmission of chlamydial infection to the partners of seafarers; and that these women are at higher risk than the general population for STI as has already been shown with HIV infection in this community. As there is no current testing facility for chlamydial infection in Kiribati and as women, particularly pregnant women, are often asymptomatic, the need persists for the development of an inexpensive, reliable, field diagnostic test for Chlamydia, for use in such endemic populations. The application of syndromic management to largely asymptomatic pregnant women populations can be enhanced by using customized clinical- and sociodemographic-risk-assessment tools based on local disease conditions. For pregnant women living in Tarawa, a key question that should be included in standard protocols is *husband's occupation* however, it likely will only marginally improve the positive predictive value of the algorithm and may still result in significant misdiagnosis and incorrect treatment.^{24,26,27}

Despite the survey finding a HIV seroprevalence of zero in pregnant women and 0.3% in seafarers, the STI picture suggests that the seafaring population is vulnerable to the introduction and rapid spread of HIV infection. The high prevalence rates of HSV-2 found among the seafarers surveyed in Tarawa reflects the high level of sexual activity by seafarers. In contrast, prevalence rates of non-viral STI were lower than expected with no cases of gonorrhoea and only nine cases of syphilis diagnosed. The Ministry of Health reported 251 etiologic cases of gonorrhoea in 2002 from its passive surveillance system of health stations and clinics. This is likely to present an inflated level of gonorrhoea as the default diagnosis for all STI is gonorrhoea. Notwithstanding this practice, the explanation(s) for the low prevalence of gonorrhoea are unclear but could possibly be an effect of health seeking-behaviour by seafarers. The symptomatic nature of gonorrhoea in males may result in seafarers seeking health care treatment while on board ships or en route home.

Prevalence of HIV infection (0.3%) was consistent with the national surveillance figures of about 1 in 300 seafarers.²¹ Two factors that could explain the low HIV infection rate in the seafarers are the low bacterial STI prevalence rates (which can facilitate HIV infection) and the low level (1.4%) of drug use among seafarers. Other studies of populations of men who are absent for protracted periods, have found women left behind are also more likely to engage in high-risk behaviour.⁴⁰ Because these surveys did not test for chlamydia, gonorrhoea or trichomoniasis, it is unclear if these high-risk behaviours are occurring in Kiribati. Nevertheless, similar studies suggest that itinerant men with wives and/or steady girlfriends at home have found low condom use is associated with increased transmission of STI and HIV to their partners and the general community.⁴¹

There was a low acceptance of condoms among the seafarers in the study for all sexual partners. Morris et al. (2000) has shown that mobile populations may be bridges of STI into a community but they may also be bridges for the spread of positive attitudes about condom use and safe sexual behaviour.⁴² Seafarers are an important target population for intervention and are also a well-educated and accessible population when entering and leaving Kiribati for overseas contracts or when training at the MTC. In a study by Booth-Kewley et al. (2001), which targeted marines for education about STI and developed a behavioural intervention programme, it was found that the intervention and control groups among the marines differed significantly in the percentage of time they had maintained safe sex practice in the year prior to follow-up.⁴³ Similar results were obtained by Boyer (2001) in studying army personnel dispatched to countries with high endemic rates of STI, with and without behavioural intervention.⁴⁴ This supports the development of targeted behavioural interventions for training and experienced seafarers in Kiribati.

This survey suggests that hepatitis B is endemic in Kiribati in individuals aged 17 years and older. Over twice the level of hepatitis B seropositivity was diagnosed in male seafarers compared to the surveyed pregnant women. Even accounting for the sex-related differences seen in males,^{45,46} the high levels found in the seafarers are of concern suggesting possible occupational or sexual exposure. The public health burden of hepatitis B in Tarawa is significant and there is a need to review the provision of hepatitis B screening and immunization in seafarers at the time of entry into either the Marine Training College or the seamen workforce.

Current surveillance of STI in Kiribati could be improved to facilitate better policy development, measurement of the disease burden and potential risks, and evaluation of STI programmes. Sentinel surveillance and passive case-reporting need to be strengthened and complemented by similar well-targeted STI surveys among specific population groups, such as sex workers and young adolescent women. There needs to be development of: sustainable STI and HIV/AIDS prevention programmes (i.e. risk reduction programmes that promote safer sex, including condom use); health promotion and information programmes (i.e. to raise community awareness of STI/HIV); and clinical services (implementation of syndrome management programmes, HIV management) which focus on high-risk sub-populations such as seafarers, adolescents and Kore Koreans.

REFERENCES

1. WHO, website: [http://www.who.int/hiv/pub/me/en/Guidelines for STI Surveillance 1999](http://www.who.int/hiv/pub/me/en/Guidelines%20for%20STI%20Surveillance%201999). (Accessed 4 July 2003).
2. WHO, STI website: http://www.wpro.who.int/themes_focuses/theme1/focus4/themes1_focus4a.asp. (Accessed 4 July 2003).
3. Wasserheit JN. The significance and scope of reproductive tract infections among third world women. *Int J Gynaecol Obstet*, 1989, Suppl 3:145-168.
4. Martin DH, Koustsky L, Eschenbach DA, et al. Prematurity and perinatal mortality in pregnancies complicated by maternal Chlamydia trachomatis infection. *JAMA*, 1982, 247(11):1585-88.
5. Goldenberg RL, Andrews WW, Yuan AC, MacKay HT, St. Louis ME. Sexually transmitted diseases and adverse outcomes of pregnancy. *Clinics in Perinatology*, 1997; 24(1):23-41.
6. Genc M, Ledger W. Syphilis in pregnancy. *Sex Transm Inf*, 2000; 76:73-9. 2.
7. Petrin D, Delgaty K, Bhatt R, Garber G. Clinical and microbiological aspects of Trichomonas vaginalis. *Clin Micro Rev*, 1998, 11(2):300-17.
8. WHO, HIV website: http://www.wpro.who.int/themes_focuses/theme1/focus4/themes1_focus4a.asp. (Accessed 4 July, 2003).
9. Laga M et al. Non-ulcerative sexually transmitted diseases as risk factors for HIV-1 transmission in women: results from a cohort study. *AIDS* 1993; 7: 95-102.
10. Plummer FA, Simonsen JN, Cameron DW, et al. Cofactors in male–female sexual transmission of human immunodeficiency virus type 1. *J Infect Dis*, 1991, 163:233-9.
11. Cohen MS. Sexually transmitted diseases enhance HIV transmission: no longer a hypothesis. *Lancet*, 1998, 351(suppl III):5-7.
12. O'Farrell N. Transmission of HIV: genital ulceration, sexual behaviour and circumcision. *Lancet*, 1989, 11:2(8672):1157.
13. Plourde PJ et al. Human immunodeficiency virus type 1 seroconversion in women with genital ulcers. *J Infect Dis*, 1994, 170:313-317.
14. The Work of WHO in the Western Pacific Region. Report of the Regional Director – 1 July 1998 - 30 June 1999. World Health Organization, 1999. http://www.wpro.who.int/rd_report50.asp (Accessed 4 June 2000).
15. National HIV Surveillance System, Ministry of Health, Republic of Kiribati, 2001.
16. Status and trends of STI, HIV and AIDS at the end of the millennium, Western Pacific Region, 1999. Manila, WHO, 1999.

-
17. Sullivan EA, Abel M, Tabrizi S et al. Prevalence of sexually transmitted infections among antenatal women in Vanuatu, 1999-2000. *Sex Transm Dis*, 2003, 30(4):362-6.
 18. World Health Organization. Antenatal Clinic STI survey, Apia Samoa. Manila: WHO, 2000.
 19. World Health Organization, Regional Offices for the Western Pacific and South-East Asia. HIV/AIDS in Asia and the Pacific Region, 2003.
 20. CIA, website: <http://www.cia.gov/cia/publications/factbook/geos/kr.html> (Accessed 4 July 2003).
 21. World Bank, website: <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/0,,pagePK:180619~theSitePK:136917,00.html#k>. (Accessed 4 July 2003).
 22. Tomaszunas, S. Health Care for Seafarers. *Lancet*, 1998, 351(9110):1148.
 23. Tomaszunas S, Weclawik Z. Accidents and injuries in Polish seafarers. *Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia* 1997;48(1-4):59-73.
 24. Saarni H, Pentti J. Free-time activities among seafarers on board Finnish cargo ships. *Bulletin of the Institute of Maritime & Tropical Medicine in Gdynia*, 1996, 47(1-4):33-43.
 25. Malone JD, Hyams C, Hawkins RE, Sharp TW, Danielle FD. Risk factors for sexually transmitted diseases among deployed US military personnel. *Sex Transm Dis*, 1993, 20: 294-298.
 26. Brodine SK, Mascola JR, Weiss PJ et al. Detection of diverse HIV-1 genetic subtypes in the USA. *Lancet*, 1996, 346: 1198-1199.
 27. Hawkins RE, Malone JD, Cloninger LA, Rozmajzl PJ, Lewis D, Butler J, Cross E, Gray S, Hyams KC. Risk of viral hepatitis among military personnel assigned to US Navy ships. *Journal of Infectious Diseases*, 1992, 65(4): 716-719.
 28. Hyams KC, Krogwold RA, Brock S, Wignall FS, Cross E, Hayes C. Heterosexual transmission of viral hepatitis and cytomegalovirus infection among United States military personnel stationed in the Western Pacific. *Sex Transm Dis*, 1993, 20: 36-40.
 29. Hawkes S, Hart GJ, Johnson AM, Shergold C, Ross E, Herbert KM, Mortimer P, Parry JV, Mabey D. Risk behaviour and HIV prevalence in international travellers. *AIDS*, 1994, 8(2): 247-252.
 30. Hansen HL, Brandt L, Jensen J, Balslev U, Skarphedinsson S, Jorgensen AF, David K, Black FT. HIV infection among seafarers in Denmark. *Scandinavian Journal of Infectious Diseases*, 1994, 26(1): 27-31.
 31. Sesar Z, Vlah V, Vukelic M, Cuculic M. Knowledge of seafarers about AIDS problems and their vulnerability to HIV infection. *Bulletin of the Institute of Maritime & Tropical Medicine in Gdynia*, 1995, 46(1-4): 19-22.
 32. Siebke JC, Wessel N, Kvandal P, Lie T. The prevalence of hepatitis A and B in Norwegian merchant seamen - a serological study. *Infection*, 1989, 17(2):77-80.

-
33. Towianska A, Dabrowski J, Rozlucka E. HIV antibodies in seafarers, fishermen and in other population groups in the Gdansk Region (1993-1996). *Bulletin of the Institute of Maritime & Tropical Medicine in Gdynia*, 1996, 47(1-4):67-72.
 34. Thomson MM, Najera R. Travel and the introduction of human immunodeficiency virus type 1 non-B subtype genetic forms into Western countries. *Clinical Infectious Diseases*, 2001, 32(12): 1732-1737.
 35. Guidelines for Second Generation HIV Surveillance, UNAIDS/00.03E - WHO/CSR/EDC/2000.5. Geneva, UNAIDS/WHO, 2000.
 36. Tabrizi SN, Fairley CK, Chen S, Giouzeppos O, Paterson B, Bowden FJ, Garland SM. Evaluation of patient-administered tampon specimens for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. *Sex Transm Dis*, 2000, 27:133-7.
 37. Ho DWT, Field PR, Irving WL et al. Detection of immunoglobulin M antibodies to glycoprotein G-2 by western blot (immunodot) for diagnosis of initial herpes simplex genital infections. *J Clin Microbiol*, 1993, 31: 3157-3164.
 38. Mindel A, Taylor J, Tideman R, Seifert C, Berry G, Wagner K, Page J, Marks C, Trudinger B, Cunningham A. Neonatal Herpes prevention – A minor public health problem in some communities. *Sex Trans Inf*, 2000, 76:287-291.
 39. Prevalence survey of sexually transmitted infections among female sex workers and truck drivers in China 1999-2000. Manila, WHO, 2001.
 40. Lurie MN, Williams BG, Zuma K, Mkhaya-Mwambure D, Garnett G, Sweat MD, Gittelsohn J, Karim SS. Who infects whom? HIV-1 concordance and discordance among migrant and non-migrant couples in South Africa. *AIDS*, 2003, 17(15): 2245-2252
 41. Gouws E, Frohlich J, Abdool Karim Q, Abdool Karim SS. Preparing for phase III HIV vaccine trials: experiences from rural South Africa (abstract no. ThOrD678). Presented at the 13th International AIDS Conference. Durban, South Africa 2000.
 42. Morris M, Wawer MJ, Makumbi F, Zavisca JR, Sewandambo N. Condom acceptance is higher among travellers in Uganda. *AIDS*, 2000, 14: 733-741.
 43. Booth-Kewley S, Andrews AM, Shaffer RA, Gilman PA, Minagawa RY, Brodine SK. One-year follow-up evaluation of the sexually transmitted diseases/human immunodeficiency virus intervention program in a marine corps sample. *Military Medicine*, 2001, 166 (11):987-995.
 44. Boyer CB. 2001. Prevention of Sexually Transmitted Diseases and HIV in Young Military Men: Evaluation of a Cognitive-Behavioural Skills-Building Intervention. *Sex Transm Dis*, 2001, 28 (6): 349-355.
 45. Zhou J, Tao G, Ebrahim SH, Wang S, Luo Z, Wang H. The relationship of hepatitis B virus infection between adults and their children in Guangxi Province, China. *J Hepatology*, 2000, 33(4): 628-31.
 46. Bar-Shany S, Green MS, Slepon R, Shinar E. Ethnic differences in the prevalence of antihepatitis C antibodies and hepatitis B surface antigen in Israeli blood donors by age, sex, country of birth and origin. *J Viral Hepatitis*, 1995, 2(3):139-44.

