SHORT REPORT

Predictors of the prevalence of bacterial STI among young disadvantaged Indigenous people in north Queensland, Australia

G C Miller, R McDermott, B McCulloch, C K Fairley, R Muller

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Objective: To identify sexually transmitted infections in rural and remote Indigenous communities in north eastern Australia and examine factors that may influence prevalence.
Methods: A cross sectional survey of 26 Aboriginal and Torres Strait Islander communities in northern Queensland was carried out. 3313 people (2862 Indigenous) aged 15 years and over resident in participating communities during the period March 1998 to December 2000. The main outcome measures were community and population prevalence of chlamydia and gonorrhoea and independently associated risk factors.
Results: A total of 238 cases of chlamydia, 66 cases of gonorrhoea, and 37 cases of co-infection were detected among Indigenous participants. Prevalence of chlamydia and/or gonorrhoea ranged from 23.0% among 15–19 year olds to 3.5% among those 40 years and older. In the adjusted analysis younger age, female sex, lower socioeconomic status, the use of alcohol and tobacco, and the structure of community health services were independently associated with a higher prevalence of bacterial STI.
Conclusion: This study highlights the need for improved STI control in north Queensland Indigenous communities through strategies to improve the reach and accessibility of primary healthcare services.

Access to health care among Indigenous Australians living in remote communities is limited and this has contributed to a high prevalence of bacterial sexually transmitted infections (STI),[1] pelvic inflammatory disease (PID), and infertility,[2] and places these communities at risk of a substantial heterosexual HIV epidemic. Regular screening has reduced the prevalence in some communities and further gains will be made by understanding the determinants of infection.[3] This report describes the results of the initial screening in 26 communities and the determinants of infection.

METHODS

The Well Person's Health Check (WPHC) is described in detail elsewhere and was a cross sectional survey conducted between March 1998 and December 2000 in 26 rural and remote Indigenous communities in northern Queensland, Australia.[4] Survey participants completed a comprehensive general health checkup that included a first void urine specimen which underwent polymerase chain reaction (PCR) testing (Roche Amplicor CT/NG, Branchburg NJ) for *Chlamydia trachomatis* (chlamydia) and *Neisseria gonorrhoea* (gonorrhoea).

Analysis

A number of individual (age, sex, alcohol and tobacco use) and community level characteristics thought to influence STI prevalence were analysed. Community characteristics included distance to the nearest secondary referral centre, road access, and the presence of a licensed liquor outlet, resident medical officer (MO), and a hospital. The population to Indigenous health worker (IHW) and registered nurse (RN) ratios, the availability and frequency of visiting specialist services (sexual health (SHS) and women's health (WHS)), and the availability of free condoms were also considered.

The socioeconomic indices for areas (SEIFA) were used to compare the socioeconomic status of participating communities. SEIFA is a composite socioeconomic measure, which incorporates household incomes, years of education, employment, home and car ownership, and other factors.[5]

Analyses were performed using SPSS V10[6] and STATA.[7] Community level data were linked to individual data. All analyses were adjusted to account for possible clustering at the community level. Variables that displayed a non-linear association with STI prevalence were categorised for analysis. Odds ratios and 95% confidence intervals were estimated

Table 1 Age specific prevalence among Indigenous participants by sex; chlamydia, gonorrhoea, and co-infection (chlamydia and gonorrhoea)

	Males				Females			
Age group	No	Chlamydia (%)	Gonorrhoea (%)	Co-infection	No	Chlamydia (%)	Gonorrhoea	Co-infection (%)
15–19	149	21 (14.1)	9 (6.0)	7 (4.7)	169	46 (27.2)	16 (9.5)	12 (7.1)
20–24	183	30 (16.4)	9 (4.9)	4 (2.2)	181	33 (18.2)	10 (5.5)	7 (3.8)
25–29	179	18 (10.0)	4 (2.2)	3 (1.7)	187	14 (7.5)	7 (3.7)	3 (1.6)
30–34	164	11 (6.7)	2 (1.2)	1 (0.6)	186	12 (6.4)	1 (0.5)	0
35–39	157	8 (5.1)	1 (0.6)	0	162	12 (7.4)	1 (0.6)	0
40+	529	14 (2.7)	4 (0.8)	0	571	19 (3.3)	2 (0.4)	0
All	1361	102 (7.5)	29 (2.1)	15 (1.1)	1456	136 (9.3)	37 (2.5)	22 (1.5)

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Table 2 Risk factors for bacterial STI (chlamydia and/or gonorrhoea) among Indigenous WPHC participants 15 years and older

			Unadjusted			Adjusted	
Independent variable	No	No of cases	Prevalence (%)	OR (95% CI)	p Value	OR (95%CI)*	p (exact two sided)
Sex							
Male	1361	116	8.5	1.00		1.00	
Female	1456	151	10.4	1.24 (0.96 to 1.60)	0.10	1.51 (1.15 to 1.93)	0.001
Age (years)							
15–19	318	73	23.0	8.11 (5.04 to 13.03)	<0.01	7.78 (4.77 to 12.67)	<0.001
20–24	364	71	19.5	6.59 (4.22 to 10.29)	<0.01	5.50 (3.41 to 8.85)	<0.001
25–29	366	37	10.1	3.06 (2.02 to 4.62)	<0.01	2.49 (1.53 to 4.05)	<0.001
30–34	350	25	7.1	2.09 (1.32 to 3.33)	<0.01	1.78 (1.04 to 3.05)	0.036
35–39	319	22	6.9	2.02 (1.10 to 3.69)	0.02	1.78 (0.92 to 3.46)	0.087
40+	1100	39	3.6	1.00		1.00	
Alcohol							
yes	1916	219	11.4	2.14 (1.53 to 3.00)	<0.01	1.74 (1.27 to 2.39)	0.001
no	896	48	5.4	1.00		1.00	
Smoking							
yes	1681	201	12.0	2.20 (1.70 to 2.83)	<0.01	1.46 (1.14 to 1.87)	0.003
no	1133	66	5.8	1.00		1.00	
SEIFA (CD scores)							
500–700	1297	153	11.8	1.00		1.00	
701–900	997	78	7.8	0.63 (0.39 to 1.02)	0.062	0.64 (0.38 to 1.07)	0.09
901+	523	36	6.9	0.55 (0.32 to 0.94)	0.03	0.47 (0.27 to 0.83)	<0.01
Categories†				1.20 (1.04 to 1.39)	0.011	1.16 (1.03 to 1.30)	0.015
Hospital							
no	662	40	6.0	1.83 (1.16 to 2.90)	0.01	1.75 (0.91 to 3.38)	0.093
yes	2155	227	10.5	1.00		1.00	
Resident population							
0–100	190	10	5.3	0.42 (0.14 to 1.25)	0.12	0.45 (0.14 to 1.45)	0.335
101–200	798	71	8.9	0.74 (0.36 to 1.51)	0.40	0.66 (0.32 to 1.38)	0.739
201–300	502	61	12.2	1.04 (0.53 to 2.06)	0.91	0.93 (0.49 to 1.78)	0.824
301–400	346	23	6.7	0.54 (0.22 to 1.29)	0.17	0.83 (0.28 to 2.49)	0.271
401–500	281	20	7.1	0.58 (0.30 to 1.11)	0.10	1.71 (0.57 to 5.09)	0.182
501+	700	82	11.7	1.00		1.00	
Resident MO							
yes	744	50	6.7	0.62 (0.39 to 0.98)	0.04		
no	2073	217	10.5	1.00			
pop:RN ratio							
0–200	910	94	10.3	1.00			
201–400	646	54	8.4	0.79 (0.35 to 1.78)	0.57		
401–600	552	48	8.7	0.83 (0.37 to 1.87)	0.65		
>600	367	31	8.5	0.80 (0.46 to 1.38)	0.43		
pop:HW ratio							
0–100	386	28	7.3	1.00			
101–200	1348	164	12.2	1.77 (0.96 to 3.27)	0.07		
201–300	495	30	6.1	0.82 (0.37 to 1.86)	0.64		
>300	394	31	7.9	1.09 (0.56 to 2.11)	0.79		
Distance to centre							
0–50 km	1209	120	9.9	1.11 (0.67 to 1.84)	0.68		
51–100 km	498	50	10.0	1.13 (0.40 to 3.15)	0.82		
101–200 km	266	21	7.9	0.87 (0.32 to 2.37)	0.78		
>200 km	844	76	9.0	1.00			
Road access							
yes	1889	187	9.9	1.16 (0.66 to 2.04)	0.59		
no	928	80	8.6	1.00			
Unsafe drinker‡							
yes	1146	143	12.5	1.52 (0.93 to 2.50)	0.081		
no	256	22	8.6	1.00			
Visiting SHS							
yes	1618	190	11.7	1.51 (0.85 to 2.69)	0.16		
no	445	36	8.1	1.00			
Visiting SHS (freq)							
1–4 visits	1452	158	10.9	1.00			
>4	611	68	11.1	1.03 (0.69 to 1.54)	0.90		
Visiting WHS							
yes	2379	233	9.8	1.22 (0.67 to 2.20)	0.52		
no	244	20	8.2	1.00			
Visiting WHS (freq)							
1–4 visits	1417	126	8.9	1.00			
>4	992	88	8.9	1.00 (0.59 to 1.70)	0.99		
Licensed liquor outlet							
yes	2043	197	9.6	1.07 (0.68 to 1.69)	0.76		
no	774	70	9.0	1.00			
Condom availability (health centre)							
yes	2547	250	9.8	2.65 (0.51 to 13.78)	0.25		
no	76	3	4.0	1.00			
Condom availability (community)							
yes	580	53	9.1	0.93 (0.63 to 1.35)	0.69		
no	2043	200	9.8	1.00			

*Adjusted for clustering at the community level.
†SEIFA score was categorised in units of 100 and each decrease of 100 units results in an estimated adjusted OR of 1.16.
‡Alcohol consumption at unsafe levels among those who had consumed alcohol in the week before the survey.

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using 2 × 2 tables and logistic regression. Interactions were investigated by fitting interaction terms into the regression model.

Variables with significant unadjusted odds ratios or thought to influence health service access were included in the model.

Analysis was based on 2817 Indigenous participants 15 years and older who provided urine samples. Bacterial STI is used to indicate a positive finding for chlamydia and/or gonorrhoea. There was little variation in models that examined each infection separately.

RESULTS

Most infections were identified among people aged 15–24 years (table 1). More than 90% (92% female and 96% male) of the infections detected in this survey were asymptomatic at the time of screening.[8]

In the unadjusted analysis (table 2), younger age, female sex, alcohol consumption, smoking, a lower SEIFA CD score, the absence of a hospital, and the absence of a resident medical officer were significantly associated with the presence of an STI. The absence of a resident medical officer and hospital in the community were highly correlated ($p<0.001$).

In the adjusted analysis (table 2) younger age, female sex, alcohol consumption, smoking, and a lower SEIFA score were significantly associated with the presence of an STI. The variables hospital and resident population were also included in the final regression model; however, these factors were not statistically significant.

A wave analysis was used to examine prevalence of infection by week of attendance to assess possible participation bias. Data from screens that ran for 3 weeks (three communities, n=499) and 4 weeks (two communities, n=490) were used. The prevalence of bacterial STI was calculated by week of attendance. A difference in prevalence for each week was observed in 3 week screens (week 1 = 9.9%, week 2 = 5.2%, week 3 = 19.7%; $p=0.001$) and 4 week screens (week 1 = 5.2%, week 2 =12.1%, week 3 = 7.7%, week 4 = 12.2%; $p=0.118$). For both 3 and 4 week screens prevalence was significantly less in the first compared to the final week (3 week $p = 0.009$, 4 week $p = 0.049$). The prevalence in the final week of both screens was greater than the overall prevalence (3 week 11.1% overall and 19.7% in final week, $p = 0.012$; 4 week 8.8% overall, and 12.2% in final week, $p = 0.33$).

DISCUSSION

This study is one of the first to analyse both individual and community factors associated with STI prevalence among individuals living in remote communities.

Young age, socioeconomic disadvantage, and the structure of locally available health services emerge as strong predictors of bacterial STI prevalence. These factors provide opportunities to reduce prevalence by focusing programmes on those individuals at highest risk, and by considering community factors associated with a higher STI prevalence. This study demonstrates that screening programmes should focus on younger individuals and that such programmes cannot rely on the presence of symptoms, as most infections detected were asymptomatic.

The association between STI and substance use has been noted in a number of studies and in Australian Indigenous communities petrol sniffing and alcohol abuse have been demonstrated as risk factors for STI.[9] We found the majority of survey participants drank alcohol and smoked tobacco, behaviours which are highly socially patterned. In this environment, where STI prevalence is also high, associations between the use of these substances and STI would be expected.

A number of community factors were associated with a higher prevalence of STI.

Most communities in this study occupied the SEIFA quintile of greatest disadvantage and within this group of poor communities there exists a gradient of risk that increases with increasing disadvantage.

Improving the socioeconomic status of these communities is a highly complex problem requiring long term strategies to which health services may only make a small contribution. Other factors such as those reflecting reduced access to health care are more amenable to short term solutions. Ease of access to a hospital and doctor appeared to be associated with lower STI prevalence and may indicate community confidence in accessing a particular type of health service. Issues related to perceived skills of local practitioners, confidentiality, family connections, and how health is prioritised often result in delayed presentations by Indigenous people with known conditions.[10] Consideration of these factors in the design of STI screening programmes is likely to improve access to health care and to reduce prevalence.

Possible participation bias is a limitation of this study. We used a wave analysis and assume later attendees, as a group, were less likely to access health services routinely, and more likely to have a disease prevalence that closest reflects non-attendees. A second comparative method used was an analysis of clinic PCR results over a 1 year period (2000–1) in 17 communities that participated in WPHC (1998–2000). The proportion of tests found positive through clinic testing was approximately twice that of WPHC testing (data not shown). The above estimates suggest that the prevalence reported here is probably an underestimate of the true prevalence of chlamydia and gonorrhoea in these communities.

Continuing high rates of pelvic inflammatory disease (PID) among north Queensland indigenous women[11] and the emerging HIV epidemic in nearby Papua New Guinea[12] highlight the need to reduce STI prevalence in these populations where HIV is currently uncommon.

The provision of accessible, acceptable primary healthcare services will help; however, solutions to the underlying social and economic issues that facilitate the relative disadvantage of remote Indigenous communities are also required if the differential between the health of Indigenous and non-Indigenous Australians is to be addressed.

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CONTRIBUTORS

GCM, principal author, study coordination, study design, data collection, data analysis; RMcD, contributing author, study design; BMcC, data collation, data analysis; CKF, contributing author; RM, contributing author, data analysis. Note: all authors listed have made a significant contribution to this work

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Authors' affiliations
G C Miller, Northern Zone Management Unit, Queensland Health, Queensland, Australia
R McDermott, B McCulloch, Tropical Public Health Unit Network, Queensland Health, Queensland, Australia
G C Miller, R McDermott, B McCulloch, R Muller , School of Public Health and Tropical Medicine, James Cook University, Queensland, Australia
C K Fairley, Department of Public Health, University of Melbourne, Melbourne, Australia

Correspondence to: Geoffrey Miller, Northern Zone Management Unit, Queensland Health, PO Box 1103, Cairns, Queensland, 4870, Australia; geoffreymiller@bigpond.com.au

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GLOBAL VIEWS

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Sexually Transmitted Infections receives an increasing number of articles relating to prevalence of STIs or the performance of various syndromic management protocols in different populations. While these are very important for policymakers and clinicians locally, they tend to have limited applicability to other populations. For this reason we will publish these articles, after peer review, in full on *eSTI*. The paper edition of the journal will feature full abstracts in the "Global views" section.

Rural sex work in Cambodia: work characteristics, risk behaviours, HIV, and syphilis

H Sopheab, P M Gorbach, S Gloyd, H B Leng

Objective: To identify prevalence and risks factors for syphilis and HIV among rural female sex workers (FSWs) in Cambodia and to describe differences between rural and urban FSWs.
Methods: Interviews and sera were collected from 114 FSWs and tested for HIV using the Serodia-HIV test and positives confirmed with the enzyme linked immunosorbent assay. Syphilis was tested for with the rapid plasma reagin with passive particle agglutination test for detection of antibody of *Treponema pallidum*. Study data were merged with data from a study of urban FSWs from Phnom Penh that applied similar questionnaires and sampling design to compare STI prevalence and behaviours.
Results: 42% of rural FSWs were HIV positive; 22% had past or current syphilis. In multivariate models HIV was significantly associated with age ⩾25 (OR = 6.1 95% CI: 1.0 to 36.6), a non-commercial partner in the past year (OR= 0.33, 95% CI: 0.11 to 0.93), and prevalence of past or current syphilis (OR = 2.9, 95% CI: 1.0 to 8.8). There was significantly higher active syphilis (14% *v* 4%), older mean age (25 *v* 21), fewer daily clients (2 *v* 5), lower monthly income ($61 *v* $174), and longer duration of sex work (2.3 years *v* 1.4 years) among rural than among urban FSWs.
Conclusions: These findings reveal a high burden of HIV and syphilis among FSWs in rural Cambodia. As FSWs age and become infected with STI/HIV they may move out of cities into less competitive but less savvy markets; their high mobility may contribute to the expansion of the HIV epidemic into rural Cambodia and lower risk populations.

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