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ABSTRACT

Background: **HIV/AIDS epidemic has become generalised in low resource settings in sub-Saharan Africa where 90% of all maternal-foetal transmission of HIV infection occurs. Global effort to scale-up pMTCT is underway, however, mechanisms to maximise screening of HIV- 1 positive women for Nevirapine treatment and other interventions, are not clear.**

Objective: **To identify socioeconomic and demographic characteristics associated with the prevalence of HIV- 1 infection among Tanzanian women.**

Design: **Cross-sectional study.**

Setting: **Four antenatal clinics in Dar es Salaam.**

Results: **HIV prevalence rate was 13.1 *(95% confidence interval (CI): 12.7% - 13.5%)* and it increased with increasing maternal age. Older age than *25,* mid-arm circumference less than *25cm,* geographic location, working in a public house, and partner's occupation were independently associated with higher prevalence of infection. Women in monogamous marriages were 77% less likely to be HIV infected compared to women with no regular partner. Similarly, women with more than five persons per household, and those who spent less on food had a significantly lower HIV prevalence.**

Conclusion: **HIV infection is sufficiently widespread among women in Dar es Salaam suggesting that screening based on socioeconomic and demographic characteristics would miss a large proportion of the positives. There is need to increase facilities for counselling and testing using an opt-out approach for testing in all antenatal clinics in the city.**

INTRODUCTION

The United Nations estimated that approximately 42 million people in the world were living with HIV by the end of 2002; the vast majority, approximately 95%, lived in developing countries. Sub-Saharan Africa (SSA) has been hit especially hard, with almost 64% of all HIV infected patients living there and 90% of all maternal-foetal transmission occurring there (1). Because of the disproportionate concentration of HIV infected patients in SSA, and the inadequacy of resources to provide even the

most basic prophylactic medications or care and support to HIV infected subjects, the situation has been described as devastating (2). To date, almost 14 million people in this region have died of AIDS. Overall, in many countries of SSA, approximately 7.2% of the adult population aged between 15 and 49 years is currently infected, the majority of infections occurring among people under the age of 25 years (1).

A strong association between HIV infection and mortality has been reported in rural Africa (3). The Adult Morbidity and Mortality Project carried out in three areas in Tanzania has reported that HIV/AIDS is the leading cause of death among adult population between ages 15 and 49 (4). In Tanzania, the epidemic is of substantial proportions in all regions but with large variations among them. The National AIDS Control Program (NACP) estimates that two million people were HIV infected in the year 2003 (5). The main prevention strategies for HIV/AIDS in Tanzania have focused on campaigns for condom promotion with extensive information, education, and communication. Sentinel surveillance in prenatal clinics to monitor the spread of the epidemic has indicated that more than 10% were infected (range 4.2% - 32%) (5) , while 9.7% of blood donors have been found to be infected; with females (12.3%), more than males (9.1%) (5). Prenatal clinic surveillance has been faced with problems of small sample sizes and erratic reporting due to staff shortages or turnover and limited funding (6).

Recent interventions in prevention of maternal to child transmission of HIV infection suggest that it is becoming feasible to prevent these infections in developing countries. Reports from Thailand (7,8) and Africa (9,10) showed that short course anti-retroviral drugs could reduce HIV transmission by almost 50%. These developments have offered hope that programmes to deliver anti-retroviral drugs might have a substantial impact on perinatal transmission of HIV in SSA. However, before any widespread implementation of publicly supported programmes, accessibility and acceptability of HIV screening must become more widely available in those countries.

In this context, the need to conduct HIV prevalence studies to estimate the number of women requiring such antiretroviral drugs, to generate data for surveillance systems and to examine risk factors associated with the infection became more important. The key question is whether socioeconomic and demographic characteristics related to HIV infection rates could be used to focus the screening on women most likely to be HIV positive, thus reducing the cost of such a programme. In this paper, we present the results of a cross-sectional study to estimate the prevalence of HIV- 1 infection and to identify socioeconomic and demographic characteristics associated with the prevalence of HIV infection among pregnant women.

MATERIALS AND METHODS

Recruitment and study procedures: Before we initiated a randomised, double-blinded, placebo-controlled trial to assess the effect of vitamin supplementation on HIV infection among mothers and their children, we approached 14,040 pregnant women and invited them to participate in the study. These women, whose gestational age ranged between 12 and 23 weeks, were receiving antenatal care at four main clinics (Temeke, Mwananyamala, Ilala and Mwenge) in Dar es Salaam city. In these clinics, antenatal care is provided as part of maternal and child health services.

During the study period (April 1995 to July 1997), women who consented were interviewed to obtain information about their socioeconomic and demographic characteristics. These attributes included age, marital status, education, occupation, the number of people living in the household, the amount of money they usually spend on food per day, and their sources of income. We also measured their weight to the nearest 0.1kg, and their height and mid-upper arm circumference to the nearest 0.1cm.

Laboratory methods: For all consenting women, a blood specimen was taken for HIV testing by the Enzyme Linked Immunosorbent Assay (ELISA) technique (Wellcozyme, Murex Biotech Ltd, Dartford, UK), and reactive samples were confirmed by Western blot (Bio-Rad Laboratories Ltd, Hertfordshire, UK). The Western Blot results were interpreted according to the World Health Organisation criteria. Post-test counselling was offered to all women who were tested. Quality control measures were built in to the testing of laboratory specimens. We re-tested 5% of all samples and also re-examined all the samples of women who had been randomised into the trial. The diagnosis

of HIV status for all the clients was carried out in the Microbiology and Immunology Laboratory at Muhimbili University College of Health Sciences. The study was approved by the College Research and Publications Committee of Muhimbili University College of Health Sciences and the ethical committee of the National AIDS Control Program of the Ministry of Health and the Institutional Review Board of the Harvard School of Public Health, Boston MA, USA.

Statistical methods: Data collection forms were checked daily; incomplete forms and internal inconsistencies were identified and corrected. Data were entered using Foxpro software and analyses were done using Statistical Analysis Software (SAS, Cary, NC). Age-adjusted and multivariate prevalence rate ratios (PRR) of HIV infection among categories of socioeconomic and demographic variables were computed using binomial regression with log link function (12). The associations between HIV prevalence and the socioeconomic and demographic variables were examined by using age-adjusted PRR and the 95% Confidence intervals (CI) (13). Statistical and the significance of inter-group differences in the age-adjusted analyses were assessed by likelihood ratio tests (14). To estimate the independent associations of each variable under consideration, all significant variables with $p<0.05$ in age-adjusted analyses or otherwise hypothesised to be important determinants of HIV infection were considered as candidate variables in a stepwise multivariate binomial regression model (12). All variables with $p<0.10$ were retained in the final model.

RESULTS

Of the 14,040 women interviewed, 13,845 (98.6%) consented to participate in the cross-sectional study and had blood specimens taken for HIV testing. 13,798 women had definitive screening results. Of these, six did not have information about age. Since all our analyses are age-adjusted, all tables and analyses are based on the 13,792 women with definitive HIV results and age information. The mean age was 23.3 ± 5.2 years and the mean gestational age at interview was 18.1 ±3.1 weeks. Three quarters of the women had completed 5-8 years of education. Approximately 67% of the women were monogamously married.

HIV prevalence was 13.1% [1811/13792] (95% CI: 12.7%-13.5%). The prevalence varied somewhat from year to year (Table 1). Prevalence of HIV infection was not uniformly distributed among pregnant women who received antenatal care in the city of Dar es Salaam. Table 2 presents age-adjusted analyses of socioeconomic and demographic risk factors associated with prevalence rate ratio of HIV infection and Table 3 presents the results of the multivariate model. In age-adjusted analyses, women from three of the sites had higher prevalence rates of HIV infection than Mwenge. Multivariate analyses showed that HIV infection prevalence rate of 35% and 30% was higher among women from Temeke and Ilala compared to Mwenge while among women from Mwananyamala it was 11% lower (95% CI: - 3% - 27%), but not significantly so. The highest prevalence rate of 34% higher (95% CI: 37% - 474%), was observed at the Muhimbili clinic, although only 35 clients were recruited there.

Table 1

HIV prevalence among pregnant women in Dar es Salaam, Tanzania

Year	Total number of subjects	Percent total	Number of HIV+	Percent prevalence	95% CI[1]
1995	3720	27.0	525	14.1	13.3-14.9
1995	7824	56.7	969	12.4	11.9-12.9
1997	2248	16.3	317	14.1	13.1-15.1
Totals	13792	100.0	1811	13.1	12.7-13.5

[1] 95% Confidence Interval

Table 2

Age-adjusted comparisons of HIV prevalence rates in relation to socio-economic and demographic factors in 13,792 pregnant women in Dar es Salaam, Tanzania

Risk Factor	Number of subjects[1]	Number of HIV positive	Prevalence (%)	Age adjusted RR[2]	P-value 95% CI[3]	P-value[4]
Study site						<0.0001
Temeke	3954	563	14.2	1.3	1.2-1.5	
Mwananyamala	3992	489	12.2	1.2	1.0-1.3	
Ilala	3024	438	14.5	1.3	1.2-1.5	
Muhimbili	35	12	34.3	2.6	1.6-4.2	
Mwenge	2786	308	11.1	1.0	Referent	
Age (years)						<0.0001
<20	3620	220	6.1	0.4	0.4-0.5	
20-24	5417	749	13.8	1.0	Referent	
25-29	2920	555	19.0	1.4	1.2-1.5	
>30	1835	287	15.6	1.1	1.0-1.3	
Marital status						<0.0001
No partner	1544	201	13.0	1.0	Referent	
Divorced	45	13	28.9	1.6	1.0-2.5	
Widowed	7	1	14.3	0.7	0.1-4.4	
Married -monogamous	9179	1056	11.5	0.7	1.6-0.8	
Married-polygamous	704	117	16.6	0.9	0.7-1.1	
Cohabiting	2313	423	18.3	1.2	1.0-1.4	
Women's education						0.06
None	1223	119	937.0	1.0	Referent	
Adult education	119	13	10.9	1.3	0.7-2.6	
Primary (1-4 years)	294	31	10.5	1.3	0.7-2.2	
Primary (5-8 years)	7684	954	12.4	1.7	1.1-2.6	
Secondary (9-12 years)	2348	349	14.9	1.9	1.2-3.0	
High secondary (3-14 years)	61	5	8.2	0.6	0.3-1.5	
University	30	4	13.3	1.1	0.5-2.8	
Partner's education						<0.0001
None	212	17	8.0	1.0	Referent	
Adult education	119	13	10.9	0.3	0.7-2.6	
Primary (1-4 years)	294	31	10.5	1.3	0.7-2.2	
Primary (5-8 years)	7684	954	12.4	1.7	1.1-2.6	
Secondary (9-12 years)	2348	349	14.9	1.9	1.2-3.0	
High secondary (3-14 years)	499	70	14.0	1.7	1.0-2.8	
University	116	20	17.2	2.0	1.1-3.7	
Don't know	924	142	15.4	2.2	1.3-3.5	
No partner[5]	1596	215	13.5	2.2	1.4-3.5	
Women's occupation						<0.0001
Housewife	10559	1300	12.3	1.0	Referent	
Professional	305	37	12.1	0.8	0.6-1.1	
Business	2061	300	14.6	1.0	0.9-1.2	
Public house	102	26	25.5	1.8	1.3-2.5	
Employed	530	112	21.1	1.4	1.2-1.7	
Other	235	36	15.3	1.1	0.8-1.5	

Table 2 *continued*

Risk factor	Number of Subjects[1]	Number of HIV positive	Prevalence (%)	Age adjusted RR[2]	P-value 95% CI[3]	P-value[4]
Partner's occupation						<0.0001
Farmer	116	8	6.9	1.0	Referent	
Professional	624	87	13.9	2.0	1.0-3.9	
Business	4499	540	12.0	1.9	1.0-3.7	
Employed	3060	389	12.7	2.0	1.0-3.9	
Public house	234	39	16.7	2.6	1.3-5.4	
Driver	662	109	16.3	2.6	1.3-5.1	
Long distance truck driver	273	55	20.1	3.0	1.5-6.1	
Soldier	1077	156	14.5	2.0	1.0-4.0	
Other	1334	173	13.0	2.0	1.0-3.9	
Don't know	316	40	12.6	2.3	1.1-4.6	
No partner[6]	1596	215	13.5	2.6	1.3-5.1	
Source of income						0.01
Own income	52	16	30.8	2.1	1.4-3.2	
Partial support	3077	462	15.0	1.0	0.9-1.1	
Total support	10660	1332	12.5	1.0	Referent	
Money spent on food per person/day						<0.000
<500 Tsh	5517	659	11.9	0.7	0.6-0.8	
>500 Tsh	6403	954	14.9	1.0	Referent	
Unknown[8]	1871	198	10.6	0.8	0.7-0.9	
Household size						
1-5	11224	1559	13.9	1.0	Referent	
>5	2538	249	9.8	0.7	0.6-0.8	
Woman's mid-arm circumference						0.002
<20cm	51	11	21.6	1.8	1.1-3.0	
20-24.9 cm	5603	741	13.2	1.1	1.0-1.3	
>25 cm	8031	1048	13.0	1.0	Referent	
Women's height						0.0005
<150 cm	1990	205	10.3	0.8	0.7-0.9	
>150 cm	11741	1595	13.6	1.0	Referent	
Gestational age at recruitment						.05
<16 weeks	2832	392	10.3	0.8	0.7-0.9	
>16 weeks[7]	-	-	-	-	-	

[1] Number may not add to 13,792 because not all information was available for all women

[2] RR is the prevalence rate ratio

[3] 95% CI is the 95% confidence interval

[4] P-value is the form likelihood ratio test

[5] When women without partners were omitted, the P-value was 0.01

[6] When women without partners were omitted, the P-value was 0.001

[7] The P-value was unchanged when 33 subjects with unknown values in this group were omitted

[8] When this group was omitted, the P-value was still <0.0001

The prevalence of HIV infection increased with age. Multivariate analyses showed that compared to women aged 20-24 years, the prevalence of HIV infection was 57% lower (95% CI: 50% - 63%) in women below 20 years. It was significantly higher 45% (95% CI: 31% - 60%) and 42% (95% CI: 24% - 62%) (p <0.0001) among women in the age group 25-29 years, and those aged 30 years and above, respectively. Two thirds (67%) of the women were monogamously married and had the lowest prevalence of HIV infection (11.5%) (Table 2). Marital status was independently and significantly associated with prevalence of HIV infection (p = 0.0001). Compared to women with no regular partner, women in monogamous and polygamous marriage had 77% (95% CI: 49% - 89%) and 69% (95% CI: 31% - 86%) lower prevalence of HIV, respectively, and this association was stronger in the multivariate model than in the age-adjusted univariate analyses. Women with 5-8 years of education (75% of the study group) had a 22% (95% CI: 0-43%) higher prevalence of HIV infection, while the prevalence was 30% lower (95% CI: 29%-43%) among those with 1-4 years of education compared to having no education. The other educational levels were not significantly different from having no education, and overall this variable was not significant (p = 0.14).

Over three-fourths of the women (77%) reported that they were housewives. The multivariate analysis results in Table 3 shows that compared to housewives, women who worked in public houses (including hotels, bars, or restaurants) and those employed had 35% (95% CI: - 1% - 84%) and 19% (95% CI: -1%- 42%) elevated HIV prevalence, respectively. Several categories of partner's occupation were also associated with elevated HIV prevalence. Compared to women whose partners were farmers, women whose partners were either ordinary drivers, or long distance truck drivers or soldiers had twice the prevalence of HIV. Similarly, women whose partners worked in hotels, bars, or restaurants had twice as high prevalence of HIV infections (Table 3).

We next examined the association between source of income, expenditure on food and household size and prevalence of HIV infection. Approximately three quarters of women (77%) reported that they were totally dependent on their partners and others for support, 22.4% were partially able to contribute to the household income and 0.4% had their own income. Women who supported themselves had the highest prevalence (30.8%) and age adjusted univariate analysis showed that they were twice as likely to be infected compared to women without income support (RR = 2.1 95% CI: 1.4-3.2) (Table 2). This variable was not entered into the multivariate model because of confounding with woman's occupation.

About 18% of the women reported that they lived with an average of five or more people in their household. The age adjusted prevalence rate of HIV infection among women with five people or more living in their households was lower by 30% (95% CI: 20%-40%) than among women with smaller families. Approximately 40% of the women (5517/ 13792) reported that they spent less than 500 shillings on food per person/day; based on multivariate analysis, their prevalence rate of HIV was 19% (95% CI: 11% - 27%) lower than among women who spent 500 shillings or more per day. We also examined the relationship between prevalence of HIV infection with maternal height. Approximately 14% of women were short (height <150cm). A significantly smaller proportion of shorter women (10.3%) compared to 13.6% of the taller ones were HIV infected. Using multivariate analyses, the prevalence of infection was 17% lower (95% CI: 5% - 28%) among shorter women.

Overall, adjusting for socioeconomic status, mid-arm circumference, as a proxy of nutritional status or stage of current illness was inversely associated with the prevalence of HIV infection. Women with the thinnest arms less than 20 cm had a 66% higher (95% CI: -2% -282%) prevalence compared to those with arm circumferences greater than 25 cm. The prevalence of infection was also 14% (95% CI: 4%-24%) higher among women with mid arm circumference of 20-24cm compared to women with greater than 25 cm.

The utility of socio-demographic variables for predicting HIV infection was calculated by using the receiver-operating curve (ROC). The proportion of the area of the entire graph that lies beneath the ROC was 0.67 (0.5 is equivalent to randomness and 1.0 is perfect prediction). This indicates that the overall predictive value of the multivariate model was reasonably good, for example mammography typically has an AROC between 0.8 and 0.9 for detecting breast cancer (15) Using a cut-off of 0.1 to define the most likely to be infected, the sensitivity and specificity were 81.4% and 93.4%, respectively. Using a cut-off of 0.2, the sensitivity and specificity declined to 31% and 87%, respectively.

Table 3

Multivariate regression analysis of socio-economic and demographic factors associated with HIV infection among 13,792 women in Dar es Salaam, Tanzania[1]

Factor	Multivariate RR	95% CI	P-value[2]
Study site			<0.0001
Temeke	1.35	1.18-1.54	
Mwananyamala	1.11	0.97-1.27	
Ilala	1.30	1.13-1.50	
Muhimbili	2.54	1.37-4.74	
Mwenge	1.00	Referent	
Age (years)			<0.00001
<20	0.43	1.37-0.50	
20-24	1.00	Referent	
25-29	1.45	1.31-1.60	
>30	1.42	1.24-1.62	
Marital status			<0.0001
No partner	1.00	Referent	
Divorced	1.37	0.83-2.25	
Widowed	0.59	0.10-.38	
Married -monogamous	0.23	0.11-0.51	
Married -polygamous	0.31	1.14-1.69	
Cohabiting	0.36	0.16-0.79	
Women's education			0.06
None	1.00	Referent	
Adult education	1.16	0.57-2.34	
Primary (1-4 years)	1.30	1.02-1.66	
Primary (5-8 years)	1.20	1.00-1.43	
Secondary (9-12 years)	1.03	0.82-1.29	
High secondary (13-14 years)	0.56	0.24-1.34	
University	1.16	0.47-2.88	
Partner's education			0.07
None	1.00	Referent	
Adult education	1.31	0.67-2.55	
Primary (1-4 years)	1.21	0.70-2.09	
Primary (5-8 years)	1.45	0.93-2.28	
Secondary (9-12 years)	1.60	1.01-2.54	
High secondary (13-14 years)	1.76	0.90-3.43	
University	1.81	1.13-2.89	
Don't know	1.81	1.13-2.89	
No partner	1.00	Referent	
Women's occupation			0.14
Housewife	1.00	Referent	
Professional	0.80	0.58-1.10	
Business	1.01	0.90-1.14	
Public house	1.35	0.99-1.84	
Employed	1.19	0.99-1.42	
Other	0.99	0.73-1.34	

Table 3 *continued*

Factor	Multivariate RR	95% CI	P-value[2]
Partner's occupation			0.0004
Farmer	1.00	Referent	
Professional	1.68	0.84-3.38	
Business	1.73	0.89-3.37	
Employed	1.75	0.90-3.40	
Public house	2.27	1.11-4.68	
Driver	2.18	1.10-4.32	
Long distance truck driver	2.61	1.30-5.24	
Soldier	2.05	1.04-4.03	
Other	1.80	0.92-3.54	
Don't know	1.80	0.88-3.69	
No partner	1.00	Referent	
Money spent on food per person/day			<0.0001
<500 Tsh	1.00	Referent	
>500 Tsh	0.81	0.73-0.89	
Household size			<0.0001
1-5	1.00	Referent	
>5	0.72	0.63-0.82	
Woman's mid-arm circumference			0.004
<20 cm	1.66	0.98-2.82	
20-24.9 cm	1.14	1.04-1.24	
>25 cm	1.00	Referent	
Women's height			0.005
<150 cm	0.83	0.72-0.95	
>150 cm	1.0	Referent	

[1] Women with complete data only
[2] Based on likelihood ratio test

DISCUSSION

We observed the prevalence rate of HIV infection between April *1995* and July 1997 was 13% among pregnant women in Dar es Salaam while in 2003 it was approximately 11% (unpublished data), suggesting a downward trend. We also observed heterogeneity in the socioeconomic and demographic characteristics. Maternal age greater than 25 years, geographic location, working in a public house, and partner's occupation were independently and significantly associated with a higher prevalence rate of HIV infection. We also noted that women in monogamous marriages were 77% significantly less likely to be infected compared to women with no regular partner. Similarly women below 20 years had a 57% lower prevalence rate of infection compared to 20-24 years age group.

Given that over 95% of women attend the antenatal clinics in Tanzania; and an even higher percentage in Dar es Salaam and the fact that 94% of women attend their first visit before 28 weeks gestation (16), it is reasonable to assume that our results are generalisable to all pregnant women across all of Dar es Salaam. One of the strengths of this study is its large sample size: we interviewed 14,040 women and had complete information for 13,792 subjects. In implementing such a large clinical trial, we screened a large population of pregnant women in four large clinics including three from the district hospitals of Dar es Salaam. This population provides a large data set that can give more reliable

estimates of HIV prevalence and risk factors associated with the HIV infection among pregnant women.

There was high acceptance of testing for HIV in this population, most likely a result of good training in counselling methods. Around 30 research assistants received six weeks of training, and three of those weeks were mainly directed to counselling. We organised regular meetings on a weekly and monthly basis to discuss counselling problems among counsellors and their trainer typically attended these meetings. Counselling of counsellors and role-plays were often organised to improve counselling, clinical and other research skills. Confidentiality was strictly observed in our study. Women had the choice not to give blood; as part of the informed consent process it was stressed to them that they were at liberty to say no, and that they would not be denied services at their respective clinic if they were to refuse to participate.

The findings we have presented could have been affected by selection bias. A small percentage of the women (1.8%) refused to be tested probably for fear of being told they were positive. In enrolling women, our cohort did not include women who had no access to health facilities, or those who came after 24 weeks of gestation. Given that HIV testing is associated with stigma, discrimination and guilt, there is a chance that some women may have avoided coming to our clinic for fear of being tested, or because they anticipated they might have problems in sharing their results with their relatives and partners (17). Our experience in this trial is that one in five of the HIV positive women disclosed their HIV serostatus to their partner or relatives within three months after HIV testing and the proportion reached nearly 40% after 18 months follow-up (17).

For a period of three years, starting from April 1995 to June 1997, the prevalence of HIV infection seemed not to increase. In previous years, however, there had been a rapid increase in HIV prevalence among women, from 3.6% in 1987 to 8.9% in 1991 reaching 12.5% by 1992. In recent years the prevalence of infection appears to have declined to approximately 11% probably because of increased government commitment since 1999, the wide use of information, education and communication through the mass media, including radio and newspapers as well as media campaign on safer sex practices. The slowing of the rate of increase in HIV prevalence might also be due to increased mortality among HIV positive individuals.

The prevalence of HIV infection in two of the district hospitals (Temeke and Ilala) was 14% while for Mwananyamala and Mwenge it was lower. At Mwenge, a military clinic that serves partners of military people, there was some reluctance in accepting to be tested among some of the women for fear that they would not be allowed by their partners to attend services offered at Muhimbili hospital given that their wives are allowed to be treated at their nearby military hospital. It is our opinion that the HIV prevalence figure for Mwenge clinic might have been an underestimate of the true situation because the military people are known to be at a higher risk than the general population. The other three district hospitals (Temeke, Ilala and Mwananyamala) may have received patients referred from other surrounding clinics. Women with fertility problems have been reported to have higher HIV prevalence than women without fertility problems (18). Those women who seek treatment at Muhimbili National Hospital are more likely to have complications that require specialised care. The high rate of HIV infection at Muhimbili National Hospital (34.3%) therefore may be explained by the fact that this is a referral hospital with women who have problems referred from private and the public hospitals.

High prevalence of HIV infection among women 20-29 years of age has been documented previously (5). Divorced, widowed and cohabiting women have also been found to have higher prevalence of HIV infection (19). We noted that women reporting to have their own source of income had an increased prevalence of HIV infection in the univariate analysis. One might think that these women should have a better say in sexual negotiation with men, and probably be more aware of risks of HIV infection and methods of prevention. These are also among the women who have the means to survive, and therefore should be less likely to use sex for monetary gains. It is not clear why the prevalence was so high. It is possible to suggest that they are engaging in unprotected sex with men who are of similar economic status since also men who are professionals and business people have shown high rates of infection 12%-14%. Women whose partners are long distance drivers have been associated with high-risk sexual behaviour. These women have also

been reported to have a disproportionate share of the burden of STDs and HIV because of low condom use (19-20). In addition, their negotiation skills for safe sex are minimal due to poverty.

Education is typically an important factor in improving the health status of women, particularly in preventing maternal mortality. In this study compared to women with no education, women with 1-4 and 5-8 years of primary education had a 30% and 20% higher prevalence of HIV infection. The marginally significant increase in prevalence of HIV among those with primary education might be a chance observation. The fact that there was lack of increase in prevalence of HIV in women with secondary education or higher suggests that this is not an important predictor of such an infection. The general feeling is that education was a risk factor earlier on in the epidemic and this has now changed following widespread educational campaigns.

Marital status has also been associated with HIV infection. As previously reported (22), the risk of acquiring HIV infection was higher among unmarried women and those living in a polygamous marriage in our study. In rural Tanzania, a higher prevalence of HIV has also been reported among educated women; those who had traveled, and also among women who were married to men currently employed in manual work, office work or business (23,24).

The recent results of the AZT short-course antiretrovirals and Nevirapine trials carried out in Thailand and Africa on maternal to infant HIV transmission are relevant to our results (7-10). It is hoped that short course AZT or Nevirapine would be made available, in countries such as Tanzania to HIV positive pregnant women. A necessary precondition is that women accept screening at prenatal clinics. This study has shown that with good training of the counsellors, at least in Dar es Salaam, 98% of women will accept screening, however, recently this figure has declined to approximately 80% (Table not shown).

A related question is whether the screening could be focused on particular sub-groups to increase the yield of HIV positives and reduce costs. These data suggest the contrary. Despite a significant increase in prevalence among unmarried women and older women (highly significant with our large sample size), HIV infection is sufficiently widespread and that screening based on socioeconomic and demographic characteristics would miss a large proportion of HIV positive women. Similar to previous findings in Mwanza, Tanzania (23) our results confirm that HIV risk is broadly distributed among pregnant women in Dar es Salaam and not confined to easily targeted subgroups. Therefore, it is strongly recommended that facilities for voluntary counselling should be made readily accessible and opportunities for screening for HIV be offered to all pregnant women regardless of their socio-demographic characteristics. In the event that government and donor effort fails to address the epidemic, then the social and medical implications of HIV infection among mothers, infants, and children will be insurmountable in a few years to come.

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