ABSTRACT

Objective: To determine the prevalence of HIV-1 infection in childbearing women in Nova Scotia.

Design: An anonymous, unlinked seroprevalence study using "leftover" cord bloods. The study was done in 2 stages: I-Halifax Co. women delivering between February 1, 1992 and December 31, 1993; II - non-Halifax Co. women delivering between November 15, 1993 and December 15, 1994.

Results: Of 9,115 deliveries during stage I and 5,515 during stage II, specimens were tested from 8,864 (97.2%) and 5,219 (95%) respectively. Halifax Co. women were older, more often married and more often reported a STD than the non-Halifax Co. participants with 20% under age 20 reporting a history of STD. There was one EIA and WB positive result among Halifax Co. women (seroprevalence 1/10,000; 95% CI 0.03-6.29) and one EIA positive, WB indeterminate result among non-Halifax Co. women (seroprevalence 0/10,000; 95% CI 0-5.7).

Conclusion: There is a low prevalence of HIV infection among Nova Scotia childbearing women. However, a substantial number, especially those < age 20, reported a history of STD.

ABRÉGÉ

Objectif : Déterminer la prévalence des infections du VIH-1 chez les femmes enceintes de la Nouvelle Écosse.

Conception : Une étude anonyme et non reliée de séroprévalence sur le sang du cordon ombilical «en surplus». L'étude fut exécutée en deux étapes: I- les femmes du comté de Halifax (CH) accouchant entre le 1^{er} février 1992 et le 31 décembre 1993; II - les femmes à l'extérieur du comté de Halifax (ECH) accouchant entre le 15 novembre 1993 et le 15 décembre 1994.

Résultats : Sur 9 115 naissances dans l'étape I, et 5 515 naissances dans l'étape II, 8 864 (97,2 %) et 5 219 (95 %) spécimens respectivement ont été analysés. Les femmes du CH étaient significativement plus âgées, plus fréquemment mariées, et ont déclaré avoir des MTS antérieures et concomitantes plus souvent que les femmes de l'ECH avec 20 % âgées de moins de 20 ans ayant déclaré avoir des antécédents de MTS. Un seul spécimen chez les femmes du CH était positif pour le VIH par EIA et WB (séroprévalence de 1/10 000; LC à 95 % entre 0,03 et 6,2) et un spécimen EIA positif et WB indéterminé chez les femmes de l'ECH (séroprévalence de 0/10 000; LC à 95 % entre 0 et 5,7).

Conclusions : La séroprévalence chez les femmes enceintes de la Nouvelle-Écosse est peu élevée. Cependant un nombre important des femmes, surtout les moins de 20 ans, ont déclaré avoir une MTS.

Seroprevalence of HIV Infection in Childbearing Women in Nova Scotia

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Epidemiologic studies in the United States (U.S.) have shown that the greatest proportionate increase in AIDS diagnoses over the last decade has been among women.¹ The great majority (84%) occur in the 15 to 44 year age group and heterosexual contact represents the most rapidly increasing transmission category for women.² The highest rate of AIDS in U.S. women is found in the Northeast region with most cases occurring in urban areas.³

The proportion of AIDS cases in women is less in Canada than in the U.S. (7.4% versus 18% for 1994) but has been rising steadily since 1990.⁴ In Nova Scotia (NS), 8.7% of AIDS diagnoses have been in women (Table I) and both the number and proportion of new female cases per year has remained stable throughout the epidemic (D. MacDonald, Department of Health, NS: personal communication).

AIDS surveillance data is recognized as an incomplete reflection of the true magnitude of the epidemic. Since the late 1980s anonymous, unlinked seroprevalence surveys have been conducted to ascertain in as unbiased a fashion as possible the extent of human immunodeficiency virus (HIV) infection in a given geographic location and/or population group.⁵ Recent American data indicate that from 1989-1993, the annual prevalence of HIV infec-

tion among childbearing women remained relatively stable at 1.6-1.7/1000.² Several seroprevalence studies in childbearing women have been conducted in Canada with rates varying widely from 0.72/10,000 in Manitoba⁶ to 8.7/10,000 in Newfoundland.⁷ This report presents the results of the first anonymous, unlinked HIV seroprevalence survey in NS childbearing women.

METHODS

Ethical approval

The study was conducted according to Canadian guidelines.⁸ Approval was given by the Research Committee of the Grace Maternity Hospital (GMH). Stage II was approved by the Research Committee of Dalhousie University Faculty of Medicine and each of the participating hospitals. Informed consent was not required.

Survey design

The survey was done in two stages. Stage I, conducted at the GMH in Halifax, NS between February 1, 1992 and December 31, 1993, included only women living in Halifax County. The GMH performs approximately 5,600 deliveries per year (representing 48% of NS deliveries) and provides obstetrical services to 99.8% of Halifax County women. It also serves as the main tertiary care referral centre for high-risk pregnancies for the Maritime provinces. Halifax County (population 330,846) is the largest in NS (population 899,942) and has the largest urban population.

Stage II was carried out in 11 community hospitals providing obstetrical services to at least 100 women per year. Together, these facilities account for 43% of NS

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This study was supported by grant 6603-1351-AIDS from the National Health Research and Development Program (Stage I) and contract # H 4078-3-C210/01-SS (Stage II), Health Canada.

Presented in part at the 4th Annual Conference on HIV/AIDS of the Canadian Association for HIV Research, Toronto, June 1-3, 1994.

deliveries. In order to avoid identifying one hospital or, potentially, one patient, the participating hospitals were divided into four regions based on geographic closeness: Cape Breton, Northern NS, South Shore and Valley (Figure 1). One Northern NS hospital performing approximately 4.6% of NS deliveries per year did not participate. Stage II was conducted between November 15, 1993 and December 15, 1994 with hospitals submitting specimens over a 12-month period.

All Halifax County women delivering at the GMH were eligible for Stage I. All NS women delivering at one of the participating peripheral hospitals were eligible during Stage II. In addition, 654 non-Halifax County women delivering at the GMH during Stage II were included. For analysis, these women were assigned to the region of their home postal code. Participants were included only once during the study. Demographic data collected were age range (<20 years, 20-30 years, >30 years), marital status (married, including common-law, or single), first 3 digits of the postal code, and obstetric and sexually transmitted disease (STD) histories as recorded on the standardized admission history form.

Blood samples

Cord bloods are routinely collected at the time of delivery for Coombs testing. Leftover sera from these specimens represented the source of sera for the study. Specimens were transported to the Virology and Immunology Laboratory at the Victoria General Hospital (VGH) in Halifax on a regular basis and stored frozen until HIV testing was done. Specimens were run individually at three-month intervals.

Serologic testing

Screening was done using the enzyme-linked immunoabsorbent assay (EIA) technique (Abbott Diagnostic) for detecting antibodies to HIV-1. Repeatedly positive (2) EIAs underwent confirmatory testing by the Western blot (WB) technique using the Ortho-Cambridge Biotech HIV-1 WB as previously described.⁹ A positive WB reaction was determined by the presence of bands at two of the following regions: envelope, polymerase and/or core loca-

TABLE I
AIDS Diagnoses and Risk Category for NS Women

Year	Number in Risk Category					Total
	Blood/Blood Products	IDU*	Endemic†	Sexual Intercourse Blood‡	NIRS§	
1985						0
1986						0
1987	2					2
1988	1					1
1989	2					3
1990	1					1
1991	1					1
1992	1	1				2
1993	1				1	3
1994			1	1		2
1995				1	1	2
1996						0

* Partner with injection drug use (IDU)

† Partner from endemic area

‡ Partner received blood/blood products

§ Risk factor of partner unknown

- Halifax County
- * Cape Breton
- + Northern Nova Scotia
- O Valley
- X South Shore

Figure 1. Participating hospitals by region.

tions. Quality control steps included periodic testing of known positive and negative control specimens.

Blinding to subject's identity

Demographic data sheets and sera were collected on site and initially labelled with the patient's hospital unit or laboratory number as determined by the participating facility (nominal code). Prior to testing, all identifiers were permanently removed from the specimens and data sheets and a new identification code (sample code) generated in a sequential fashion according to receipt of the specimens in the lab. There

was no attempt to link nominal and sample codes. To preclude inadvertent identification of any mother or infant, demographic characteristics expected to contain small numbers of births were aggregated.

Data entry and analysis

Data was entered directly from data collection sheets into the data entry program Watfile on an IBM PCII/model 60 computer and later transferred to the Dalhousie University mainframe computer for analysis. Chi-square testing was performed to compare categorical variables ($p \leq 0.05$ considered statistically significant).

TABLE II
Characteristics of Study Population

Characteristic	Region										Total
	Halifax Co. N= 8864	(%)	Cape Breton N= 1455	(%)	Northern NS N= 1619	(%)	South Shore N= 944	(%)	Valley N= 1201	(%)	N= 14,083 (%)
Age Range (years)*											
< 20	623	7	185	13	150	9	85	9	112	9	1155 8
20-30	4866	55	909	63	1066	66	635	67	822	68	8298 59
> 30	3374	38	347	24	393	24	218	23	261	22	4593 33
Unknown	1	0	14	1	10	0.6	6	0.6	6	0.5	37 0.3
Marital Status*											
Married	7072	80	913	63	1221	75	734	78	960	80	10,900 77
Single	1779	20	523	36	385	24	202	21	233	19	3122 22
Unknown	13	0.1	19	1	13	0.8	8	0.8	8	0.7	61 0.4
Previous Pregnancy											
Yes	5654	64	888	61	1031	64	546	58	781	65	8900 63
No	3207	36	552	38	582	36	394	42	415	35	5150 37
Unknown	3	0	15	1	6	0.4	4	0.4	5	0.4	33 0.2
STD *											
Yes	688	8	37	3	86	5	42	4	57	5	910 7
No	8173	92	1391	96	1520	94	880	93	1125	94	13,089 93
Unknown	3	0	27	2	13	0.8	22	2	19	2	84 0.6

* Statistically significant differences: Halifax Co. vs. non-Halifax Co. participants

TABLE III
History of Previous or Current STD by Age Range

Age Range (years)	Region										Total
	Halifax Co.	(%)	Cape Breton	(%)	Northern NS	(%)	South Shore	(%)	Valley	(%)	(%)
<20	124	20	3	2	9	6	5	6	8	7	149 13
20-30	373	8	28	3	63	6	25	4	39	5	528 6
> 30	191	6	5	1	14	4	12	6	9	3	231 5
Unknown	0		1		0		0		1		2
Total	688	8	37	3	86	5	42	4	57	5	910 7

Crude overall seroprevalence rates were calculated along with 95% confidence intervals (CIs) based upon the Poisson approximation. Where no seropositive rates were observed, the upper boundary of the 95% confidence interval was calculated according to the 'rule of 3'.¹⁰

RESULTS

There were 9,115 deliveries to Halifax County women (Stage I) with specimens collected from 8,864 (97%). During Stage II there were 5,515 deliveries with specimens collected from 5,219 (95%). The acquisition rates per region for non-Halifax County deliveries were: Cape Breton - 94%, Northern NS - 92%, South Shore - 93% and Valley - 97%. There were no documented study refusals. The specimens not available for the study were absent due to technical reasons, i.e., insufficient amount or being inadvertently discarded.

The study population is described in Table II. Demographic information was

not available for non-Halifax County deliveries for which sera were not collected. For Halifax County women, there were no differences between those tested and those not tested with respect to age group, geographic distribution and obstetric and STD histories. However, women in the tested group were more likely to be married than those not tested. Compared to the non-Halifax County women in the survey, a greater proportion of Halifax County women were older, married and reported a previous or concurrent STD (all age groups). Compared to other non-Halifax County participants, the cohort from Cape Breton had a greater proportion of young or single women and a smaller proportion reporting a previous or concurrent STD. The other non-Halifax County groups were similar in terms of age and STD history but fewer South Shore women had a previous pregnancy history and, compared to women from the Valley Region, fewer Northern NS women were married.

Although, overall, 7.8% of Halifax County women reported a prior or concurrent STD, in the under 20 year age group 20% reported that history (Table III).

There was one EIA and WB positive result during Stage I giving an HIV prevalence of 1/10,000 (95% CI:0.03-6.29). This was in a 20 to 30 year old, first time pregnant, married woman with a history of a STD. In Stage II there was one indeterminate WB (a single anti-p24 band). This came from a specimen from a 20 to 30 year old, married, previously pregnant woman with no STD history and living in Northern NS. The HIV seroprevalence rate for non-Halifax County women was 0/10,000 (95% CI:0-5.7).

DISCUSSION

Since the late 1980s, there have been several anonymous, unlinked HIV seroprevalence surveys in Canadian childbearing women which provide an overview of the epidemiology of HIV infection in this

population. The seroprevalence rates have been quite variable, as has been experienced in the United States with its fairly large east-west and urban-nonurban differences.^{11,12} Our results show a low prevalence of HIV infection in both Halifax and non-Halifax County childbearing women. This is in keeping with the epidemiology of HIV in NS where only 56 HIV-infected women have been reported since 1985 (D. MacDonald, Department of Health, NS: personal communication, 1996). Our rate is lower than that reported for British Columbia: 2.7/10,000,¹³ Ontario: 2.8/10,000¹⁴ and Quebec: 6.1/10,000¹⁵ which account for the great majority of Canadian AIDS cases. It is considerably lower than the 8.7/10,000 noted in the Newfoundland survey.⁷ However, 7 of 13 positives in the Newfoundland study came from one region, considerably raising the overall rate and not reflecting the province as a whole. The NS survey did not reveal isolated pockets of infection as was found in the Newfoundland study. Although childbearing women may not be totally reflective of all sexually active women, given data suggesting that the reproductive activity and pregnancy outcome do not differ between seropositives and seronegatives,¹⁶ they are likely to represent a reasonable approximation.

We do not believe that bias was introduced by failure to collect specimens from 100% of deliveries. The only difference between tested and not-tested Halifax County women was in marital status which we suspect would not represent a marker for HIV infection independently of previous pregnancy and STD history which were similar for both groups. Unfortunately, data was not available for non-Halifax County women from whom specimens were not collected. However, there is no reason to believe that women at higher risk were systematically excluded from the survey. The nonparticipating Northern NS hospital initially chose not to do so because of concerns regarding the ethics of anonymous, unlinked serosurveys and their preference to obtain informed consent from each of the study participants. By the time agreement was reached on study methodology the project was well underway and it was elected to exclude this

centre. There is no evidence that women in that area are at greater risk of HIV infection than the study participants and to date there have been no reported AIDS cases among women from that community.

The indeterminant WB result from Northern NS is probably not reflective of HIV infection. Parity represents a risk factor for indeterminant WB reactions among non-converters¹⁷ and given that this result occurred in a previously pregnant woman in a low risk population, it likely represents a falsely positive EIA.

Zidovudine administered in the ante- and intrapartum and neonatal periods has been shown to significantly decrease maternal to fetal transmission of HIV with minimal short-term toxicity.¹⁸ Whether its administration is likely to be more or less beneficial in specific subgroups of HIV-infected childbearing women remains to be determined. Based on this finding, the Canadian Pediatric Society has recommended voluntary HIV testing for all pregnant women.¹⁹ The U.S. Public Health Service has recommended that all pregnant women be counselled and encouraged to be tested for HIV infection and that such testing be voluntary.²⁰ It is not clear from our results that, even given the benefit of prophylactic zidovudine, voluntary testing for all pregnant women in NS would be a cost-effective strategy. This is an important area for further study. In low prevalence areas, an alternative strategy may be a universal education policy whereby all pregnant women are informed about HIV and the availability of testing using patient-friendly educational materials. Physicians providing prenatal care should be advised of the need to educate their patients regarding HIV infection and the availability of testing. In order to develop effective, ethical and practical health-care strategies regarding the use of zidovudine to prevent vertical transmission of HIV, regional differences in HIV seroprevalence should be taken into account.

Although we found a low prevalence of HIV infection in this study, 6.5% of those sampled had a history of a previous or current STD. This no doubt represents an underestimate as this information was self reported and a rigorous attempt to deter-

mine STD history was not made. Of more concern is that 20% of Halifax County women under age 20 reported a previous or current STD. This underlines the need to continue with educational strategies to prevent STDs in sexually active women, particularly those in their teenage years and preferably before sexual activity begins. Given the concern regarding increasing numbers of women with HIV in Canada and the STD rate reported in our survey, periodic HIV seroprevalence surveys in women at risk would be useful to better define the changing epidemiology of this infection.

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Received: April 3, 1996

Accepted: September 20, 1996

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