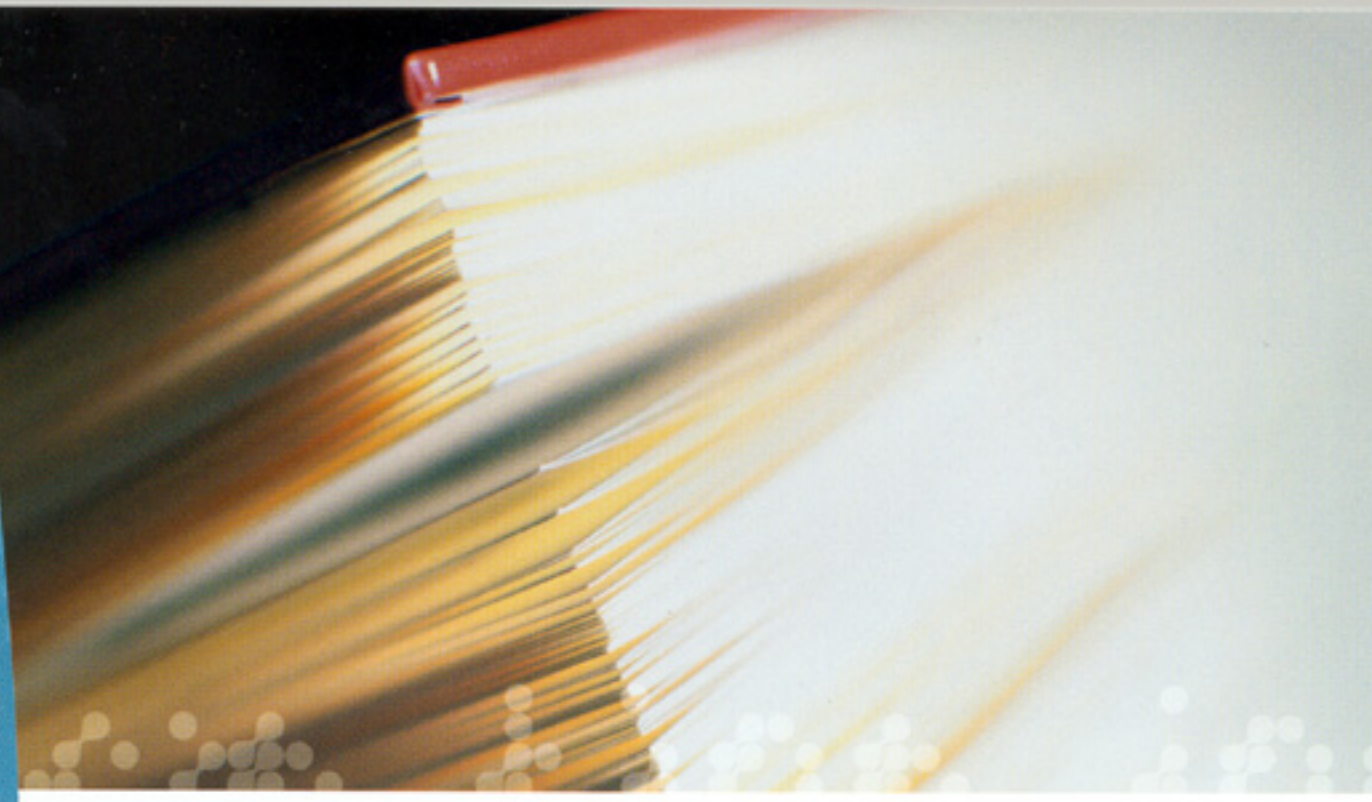


information

formation

recherche

coopération internationale

INFECTIOUS DISEASES SURVEILLANCE AMONG INJECTION DRUG USERS

EPIDEMIOLOGY OF HCV FROM 1997 TO 2003
A RETROSPECTIVE LOOK

INSTITUT NATIONAL DE SANTÉ PUBLIQUE DU QUÉBEC

Québec

INFECTIOUS DISEASES SURVEILLANCE AMONG INJECTION DRUG USERS

EPIDEMIOLOGY OF HCV FROM 1997 TO 2003
A RETROSPECTIVE LOOK

DIRECTION RISQUES BIOLOGIQUES, ENVIRONNEMENTAUX ET OCCUPATIONNELS

DECEMBER 2004

Institut national de santé publique Québec

AUTHORS

Élise Roy, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec
Programme de toxicomanie, secteur recherche, Faculté de médecine et des sciences de la santé,
Campus de Longueuil, Université de Sherbrooke

Pascale Leclerc, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec
Direction de la santé publique de Montréal

Carole Morissette, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec
Direction de la santé publique de Montréal

Michel Alary, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec
Unité de recherche en santé des populations, Centre hospitalier affilié universitaire de Québec

Raymond Parent, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec

Jean-François Boudreau, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec
Direction de la santé publique de Montréal

Groupe d'étude SurvUDI

IN COLLABORATION WITH

Caty Blanchette, Hôpital Saint-Sacrement, Centre hospitalier affilié universitaire de Québec

Christiane Claessens, Laboratoire de santé publique du Québec, Institut national de santé publique du Québec

Pauline Clermont, Direction de la santé publique de l'Abitibi-Témiscamingue

Andrée Côté, Direction de la santé publique de la Mauricie-Centre-du-Québec

Jocelyne Daigneault, Direction de la santé publique du Saguenay-Lac-Saint-Jean

Stéphane Dubuc, CLSC de Sherbrooke, Centre affilié universitaire

Jacques Dumont, Service de toxicomanie, Hôpital Saint-François d'Assise, Centre hospitalier universitaire

Marcel Gauthier, Direction de la santé publique du Saguenay-Lac-Saint-Jean

Lynne Leonard, Département d'épidémiologie et de médecine communautaire, Université d'Ottawa

Lina Noël, Direction des risques biologiques, environnementaux et occupationnels,
Institut national de santé publique du Québec

Andrée Perreault, Direction de la santé publique de la Montérégie

Louiselle Rioux, Direction de la santé publique de l'Outaouais

Jean Rochefort, Laboratoire de santé publique du Québec, Institut national de santé publique du Québec

This document has been realized with the financial collaboration of Health Canada

GRAPHIC DESIGN
MARIE PIER ROY

DOCUMENT DEPOSITED ON SANTÉCOM (HTTP://WWW.SANTECOM.QC.CA)
CALL NUMBER: INSPQ-2006-030

LEGAL DEPOSIT – 2ND QUARTER 2006
BIBLIOTHÈQUE ET ARCHIVES NATIONALE S DU QUÉBEC
NATIONAL LIBRARY OF CANADA
ISBN 2-550-47050-8 (PRINTED VERSION)
ISBN 2-550-47051-6 (PDF)

FOREWORD

The SurvUDI network was put in place in 1995 in the province of Quebec. It does epidemiological surveillance of human immunodeficiency virus and hepatitis C infections among injection drug users.

Recruitment is based in a large number of settings. Most are met in centers providing access to sterile injection equipment. Others are recruited for instance in detention centers, detox and rehab clinics.

Individuals who report having injected in the preceding six months are eligible if judged able to give an informed consent. A questionnaire is then administered and two oral fluid samples are taken to be tested for HIV (since 1995) and HVC (since 2003). The codification scheme allows for the detection of multiple visits by repeaters to the study. (Interested readers will find more details in: Continuing HIV Transmission Among Injection Drug Users in Eastern Central Canada: The SurvUDI Study, 1995 to 2000. Hankins C, Alary M, Parent R, Blanchette C, Claessens C and The SurvUDI Working Group. JAIDS 30: 514–521)

Three principal investigators are in charge of this network. They are Dr. Michel Alary, from the Unité de recherche en santé des populations, Centre hospitalier affilié universitaire de Québec, Dr. Élise Roy, from Sherbrooke University, Addiction programme, research, Medicine and health sciences faculty, Longueuil campus, and Dr. Carole Morissette from Montreal's Public Health Department. Each also works at Quebec's National Public Health Institute.

Mr. Raymond Parent is the coordinator of the study.

SurvUDI activities are financed by the Public Health Agency of Canada (Centre for Infectious Disease Control and Prevention). Additional funding is also provided by Quebec's Ministry of Health and Social services. A sub-analysis on HCV infections has been funded by Réseau sida et maladies infectieuses, Fonds de la recherche en santé du Québec (FRSQ).

In 2002, Health Canada authorities extended this type of surveillance to other Canadian provinces creating the I-Track network. SurvUDI (appendix 1) is now a part of this study.

* *This document will be update each year and be available on the Institut Web site.*

SUMMARY

SurvUDI is a network for the epidemiological surveillance of human immunodeficiency virus infection among injection drug users. The network was established in 1995, and covers eight districts in Québec, and Ottawa. Individuals who participate report injecting drugs during the six preceding months and are recruited mainly through centres that provide access to sterile injection equipment. A two-part study on hepatitis C (HCV) was appended to the SurvUDI network. This report presents the results of the epidemiological component; the psychosocial component will be discussed in a subsequent report.

Analyses for the epidemiological component concerned 1,380 individuals who participated in SurvUDI two times or more between 1997 and 2003. Gingival exudate samples obtained from participants and kept frozen were tested for hepatitis C antibodies. HCV prevalence rate was estimated, based on the first sample collected for each participant. Incidence was estimated for participants who were not infected at the initial interview. Factors independently associated with presence of the infection were identified using a multivariate logistic regression model; factors that independently predicted seroconversion were identified in a multivariate Cox regression. The latter analysis was limited either to 12-month intervals or less between two questionnaires.

Among the 1,380 participants, we observed an overall HCV prevalence rate of 60.4% (95% confidence interval (95% CI): 57.7-63.0%). Among the 543 participants uninfected at first interview, we noted 199 seroconversions over 733 person-years of follow-up, for an HCV incidence rate of 27.1 per 100 person-years (95% CI: 23.4-30.9 per 100 person-years).

We identified variables that independently predicted seroconversion for 359 participants (94 seroconversions over 267 person-years of follow-up). These variables are: age (adjusted odds ratio (AOR): 1.04 a year; 95% CI: 1.02-1.07), injecting for a year or less (AOR: 2.24; 95% CI: 1.09-4.59), injecting with a used needle borrowed from someone else (AOR: 1.82; 95% CI: 1.19-2.78), injecting cocaine most often (AOR: 1.90; 95% CI: 1.07-3.39), engaging in prostitution (AOR: 2.61; 95% CI: 1.64-4.16), and being recruited in Montréal, Quebec or Hull/Ottawa (AOR: 2.69; 95% CI: 1.06-6.80). All these variables referred to the last six months preceding the questionnaire except age, injection experience, and district of recruitment.

This study allows us to draw up for the first time a detailed portrait of the situation of HCV infection among IDU in Quebec and Ottawa. It demonstrates that these IDU are severely affected by this epidemic and that HCV incidence is very high. Significant efforts must be made to prevent infection among IDU. Results show that to attain this goal, IDU must be reached from the moment they begin injecting. We should act even earlier by preventing initiation of drug injection. Finally, services should be developed to meet the needs of the many IDU who have already contracted HCV infection.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1 INTRODUCTION

This study of hepatitis C among injection drug users in Quebec was appended to the SurvUDI network. It has two parts, one epidemiological, the other psychosocial. The current report only covers the epidemiological component; the psychosocial component will be the subject of a subsequent report.

The study objectives are as follows:

1.1 GENERAL OBJECTIVES

- To characterize the epidemiology of hepatitis C and HIV-HCV coinfection among Quebec IDU;
- To study Quebec IDU's intentions to get tested for hepatitis C.

1.2 SPECIFIC OBJECTIVES

Epidemiological component

1. To determine the prevalence rate of hepatitis C and HIV-HCV coinfection among IDU;
2. To determine the incidence rate of hepatitis C among IDU at their time of entry into the SurvUDI network;
3. To identify the factors associated with the presence of infection among IDU (prevalence);
4. To identify predictive factors for seroconversion (incidence).

Psychosocial component

5. To document the intentions of IDU concerning hepatitis C screening;
6. To identify attitudinal, normative and controlling factors that influence intention to consult for the purpose of hepatitis C screening.

The epidemiological component is based on data and samples collected previously through the SurvUDI network. A prospective data collection, also linked to SurvUDI, was required for the psychosocial component. Data collection began in November 2003 and extended to the end of September 2004.

2 METHOD

Established in 1995, SurvUDI is a network for the epidemiological surveillance of human immunodeficiency virus infection among injection drug users. Individuals who participated reported injecting in the past six months and were recruited mainly through centres that provide access to sterile injection equipment. Others are recruited in detention, detoxification or rehabilitation centres.

Each individual can participate in the study more than once but with a maximum of one visit in a six-month period. A code given to each participant identifies the various visits he or she makes, and allows us to follow repeaters' serological status and risk behaviours over time.

The goal of the hepatitis C epidemiological component is to measure the incidence of this infection. Analyses are based specificially on individuals who have participated in SurvUDI two times or more. Due to the statistical precision sought, we estimated that 1,400 repeaters would be needed.

We selected 1,400 of the most recent repeaters from a database updated on 30 June 2003. These individuals completed almost 4,200 interviews between October 1997 and June 2003.

We used gingival exudates samples collected previously from these participants; the samples were kept frozen at the Laboratoire de santé publique du Québec (LSPQ). The LSPQ tested the samples for HCV[1] antibodies using the method developed by Judd et al[1].

Our testing strategy was to begin by screening the first sample collected from each individual. This first series of tests measured HCV prevalence rate. We then tested the latest sample from all participants whose initial sample was negative. In this manner, we were able to identify subjects who had seroconverted during follow-up. Finally, all samples taken between the first and the last visits were tested to determine more accurately the time of seroconversion.

By crossing the results of HCV screening tests on samples collected during the first interview selected with those of the HIV screening tests conducted on these samples within the ordinary course of the study, we came up with a profile of HIV-HCV co-infection among the participants.

HCV prevalence rates by recruitment district were estimated. Participants were categorised by district of recruitment for the first questionnaire selected. Recruitment districts included: Montreal[2], Quebec City, Hull/Ottawa, and semi-urban areas[3]. The latter districts had to be grouped together for the analysis because of the small number of participants selected who had been recruited in various semi-urban districts. However, rates for all recruitment districts are presented separately in the appendix. Prevalence rates were also estimated by district of residence. Only the rates for districts where 30 or more recruited IDU lived are presented.

1. We will use HIV and HCV "testing" in this report instead of "antibody testing" to keep things lighter. Only antibody testing was performed.
2. Including subjects recruited in Montérégie and living in Montreal or on Montreal's neighbouring south shore.
3. Abitibi-Témiscamingue, Montérégie (except those residing in Montreal or on Montreal's neighbouring south shore), Saguenay-Lac St-Jean, Estrie and Mauricie-Centre-du-Québec.

We estimated HCV incidence rates by district of recruitment. In this analysis, each follow-up period delimited by two consecutive questionnaires was attributed to the recruitment district for the questionnaire at the end of the period in question. If a participant was recruited in several districts between 1997 and 2003, the at risk follow-up was divided among several districts.

Annual incidence rates were also calculated. Each seroconversion was attributed to a calendar year, determined by the mid-point between the last negative and the first test. Person-years of follow-up for both incident cases and other participants were distributed among the calendar years.

In addition to assessing HCV prevalence and incidence rates, we sought to identify the risk factors associated with the presence of HCV infection (HCV status), as well as factors predicting seroconversion. The questions for the SurvUDI study were designed especially to monitor sexual conduct and drug consumption. Questions referred to the last six months, except those related to frequency of injection, which referred to the last month.

Factors associated with HCV status were identified using Pearson's chi-square and Mann-Whitney tests, for categorical and continuous variables respectively. A multivariate logistic regression analysis was used to identify factors associated independently with the infection, and univariate and multivariate Cox regression analyses to test for factors predicting seroconversion. Some variables, such as sex, had a fixed value over time in Cox regressions while the value of others, such as injection with a borrowed used needle, could change from one questionnaire to another. For every period between two questionnaires, the variable kept the value indicated in the end-of-period questionnaire.

The purposeful selection of covariates method, recommended by Hosmer and Lemeshow[2,3], was used to select the two multivariate models. We considered risk factors below a threshold of 2.0 on univariate analysis for their effect on HCV status or seroconversion, as well as for their confounding effect on estimates for other variables. Interactions with sex were also tested.

We did not utilise all follow-up periods to identify factors predicting seroconversion. Since the questions asked covered mostly the six months preceding the interview and that participation in the study was not necessarily at six-month intervals, there are periods of follow-up for which we do not have information on participants' behaviours. This situation entails risks that behaviours be misclassified, thus causing a bias in the assessment of model parameters. To limit this bias while preserving sufficient statistical power, we selected only intervals of 12 months or less between two questionnaires for this analysis. By eliminating longer intervals, we lost a significant number of person-years of follow-up, but we believe that the behaviours included in the analysis are closer to reality in the follow-up retained.

3 RESULTS

3.1 HCV PREVALENCE

In all, we obtained laboratory results for samples taken during the first interviews for 1,380 of the 1,400 individuals. Among them, 833 had HCV antibodies, for an overall prevalence of 60.4%, with a 95% confidence interval of 57.7% to 63.0%. Table 1 presents HCV prevalence by district of recruitment.

Table 1 – HCV prevalence at first selected questionnaire, by district of recruitment of SurvUDI participants

District	HCV+ / total	Prevalence (%)	95% CI (%)
Montreal*	339/571	59.4	55.2 – 63.4
Quebec City	263/465	56.6	51.9 – 61.1
Hull / Ottawa	193/259	74.5	68.8 – 79.7
Semi-urban**	38/85	44.7	33.9 – 55.9
TOTAL	833/1,380	60.4	57.7 – 63.0

* Including subjects recruited in the Montérégie and living in Montreal or on Montreal's neighbouring south shore.

** Abitibi/Témiscamingue, Montérégie (except those who reported living in Montreal or on Montreal's neighbouring south shore), Saguenay/Lac St-Jean, Estrie and Mauricie/Centre du Québec.

Table 2 shows HCV prevalence rate by participants' district of residence. Only districts from which at least 30 IDU were recruited are included in this table.

Table 2 – HCV prevalence at first selected questionnaire, by district of residence of SurvUDI participants*

District	HCV+ / total	Prevalence (%)	95% CI (%)
Montreal**	250/386	64.8	59.8 – 69.5
Quebec	248/432	57.4	52.6 – 62.1
Ottawa	186/245	75.9	70.1 – 81.1
Montérégie**	19/54	35.2	22.7 – 49.4
Estrie	22/35	62.9	46.1 – 77.5

* Only districts from which more than 30 IDU were recruited are presented here.

** For this analysis, participants recruited in Montérégie and living on Montreal's neighbouring south shore are not included with Montréal but with the Montérégie area.

3.2 HIV AND HCV CO-INFECTION

Table 3 illustrates HIV and HCV co-infection among participants who were screened. In all, 14% of subjects had both infections. About one out of two participants (46.4%) had HCV infection but not HIV. Twenty-eight participants (2.0%) had HIV but not HCV. Finally, just over a third of participants (37.6%) had neither HCV nor HIV.

Table 3 – HIV and HCV co-infection among SurvUDI participants at first selected questionnaire

	VIH +	VIH -	Total
HCV +	192 (13.9%)	641 (46.4%)	833 (60.4%)
HCV -	28 (2.0%)	519 (37.6%)	547 (39.6%)
Total	220 (15.9%)	1,160 (84.1%)	1,380 (100%)

3.3 HCV INCIDENCE

Among repeaters selected for the hepatitis C component, 543[4] were not HCV antibody carriers at the first interview. These participants cumulated 733.0 person-years of risk behaviour observation follow-up and 199 of them seroconverted during this period. This figure represents an HCV incidence rate of 27.1 per 100 person-years, with a confidence interval ranging from 23.4 to 30.9 per 100 person-years. Table 4 shows HCV incidence rates by district of recruitment.

Table 4 – HCV incidence rate by district of recruitment among participants who were not infected at the first interview selected

District	Number of incident cases	Number of person-years of follow-up	Incidence rate (per 100 person-years)	95% CI (per 100 person-years)
Montréal*	80	304.4	26.3	20.8 - 32.7
Québec	77	271.8	28.3	22.4 - 35.4
Hull / Ottawa	33	82.2	40.1	27.6 - 56.3
Semi-urban**	9	74.6	12.1	5.5 - 22.9
TOTAL	199	733.0	27.1	23.4 - 30.9

* Including subjects recruited in Montérégie and living in Montreal or on Montreal's neighbouring south shore.

** Abitibi/Témiscamingue, Montérégie (except those who reported living living in Montreal or on Montreal's neighbouring south shore), Saguenay/Lac St-Jean, Estrie and Mauricie/Centre du Québec.

4. Only 4 of these 547 subjects not infected with HCV at first questionnaire were excluded due to missing HCV results.

3.4 ANNUAL HCV INCIDENCE

For the years where the number of person-years of follow-up was insufficient, we estimated an annual HCV incidence rate. These rates are presented in Table 5. Data suggest that incidence is slightly higher for 1999 and 2000 than for the preceding year and for following years.

Table 5 – Annual HCV incidence rate among participants who were not infected at the first selected interview

Year	Number of incident cases	Number of person-years of follow-up	Incidence rate (per 100 person-years)	95% CI (per 100 person-years)
1998	30	152.9	19.6	13.2 - 28.0
1999	57	168.6	33.8	25.6 - 43.8
2000	53	161.3	32.9	24.6 - 43.0
2001	36	148.1	24.3	17.0 - 33.7
2002	22	82.2	26.8	16.8 - 40.5

3.5 FACTORS ASSOCIATED WITH THE PRESENCE OF HCV INFECTION (HCV STATUS)

Risk factors associated independently with HCV status we identified are listed in Table 6. The following variables were also studied but were not retained: sex, use of borrowed used injection equipment other than syringes (such as cotton), homosexual relations with partners (excluding clients), homosexual relations with partners or clients, having smoked crack or freebase, frequency of condom use with same-sex partners and clients, and frequency of condom use with partners and clients of the opposite sex. All these variables except sex were considered for the last six months before the interview.

Table 6 – Factors independently associated with HCV status (multivariate logistic regression estimated for 1,341 subjects)

Variable	Adjusted odds ratio	95% CI
Age	1.08 per year	1.06-1.10
Injection experience	1.07 per year	1.05-1.09
Injection with a needle previously used by someone else*:		
no	1	
yes	1.40	1.07-1.84
Drug most often injected*:		
other drug	1	
cocaine	1.69	1.24-2.31
Frequency of injection (last month):		
2 times or less per week	1	
3 times or more per week	1.39	1.07-1.82
Prostitution*:		
no	1	
yes	1.64	1.18-2.27
Utilisation of a needle exchange programme *:		
no	1	
yes	3.85	2.05-7.22
District of recruitment:		
Semi-urban	1	
Montreal, Quebec, Hull/Ottawa	2.22	1.24-3.99

* In the six months preceding the interview.

3.6 FACTORS PREDICTING HCV SEROCONVERSION

We used data from 359 participants to identify the factors predicting seroconversion to HCV. In all, 547 subjects were not infected with HCV at first selected questionnaire. However, we excluded four subjects from the analysis due to missing HCV test results, 172 because they had always been seen at an interval exceeding a year, and 12 because of other missing data. Among the 359 participants selected, we observed 94 seroconversions over 267 person-years of follow-up.

Factors independently predicting HCV seroconversion are presented in Table 7. The following variables were also studied but were not retained: sex, use of borrowed used injection equipment other than syringes (such as cotton), having smoked crack or freebase, frequency of injection, homosexual relations with partners (excluding clients), homosexual relations with partners or clients, frequency of condom use with partners and clients of the opposite sex, frequency of condom use with same-sex partners and clients, and utilisation of a center providing access to sterile injection equipment. All these variables were for the last six months except frequency of injection, which focused on the last month, and sex.

Table 7 – Factors independently predicting HCV seroconversion (Cox multivariate analyse based on 359 subjects)

Variable	Adjusted odds ratio	95% CI
Age	1.04 per year	1.02-1.07
Injection experience:		
more than 1 year	1	
1 year or less	2.24	1.09-4.59
Injection with a borrowed used needle previously*:		
no	1	
yes	1.82	1.19-2.78
Drug most often injected*:		
other drug	1	
cocaine	1.90	1.07-3.39
Prostitution*:		
no	1	
yes	2.61	1.64-4.16
District of recruitment:		
Semi-urban	1	
Montreal, Quebec, Hull/Ottawa	2.69	1.06-6.80

* In the six months preceding the interview.

4 DISCUSSION

This study provides, for the first time, a clear picture of the situation of HCV infection among IDU in Quebec. Previously, little was known about this subject. A bit of data collected about a dozen years ago from the Saint-Luc cohort was available[4]. In 1992, HCV prevalence was 70% among 282 IDU, and incidence was 27 per 100 person-years. Other data were obtained from recent studies of Montreal street youth[5]. A prevalence rate of 32% was observed at study entry among 352 youth aged 14 to 23 who reported ever injecting drugs. During the first 31 months of the study, incidence was 23 per 100 person-years in youth who were injecting during follow-up. Data from the SurvUDI study describe the situation that prevailed between 1997 and 2003 among IDU from all age groups.

HCV prevalence in the SurvUDI network as a whole (60.4%) is very high. We noted a relatively significant variation in the rate throughout the different districts of recruitment and residence of the IDU. The highest rate was in the Hull/Ottawa area. Despite regional variations, results clearly show that the HCV epidemic is affecting Quebec IDU in all districts.

As mentioned previously, these prevalence rates are based on results of first samples collected between 1997 and 2003 for subjects who participated in SurvUDI at least twice during this time span. Can these results be generalised to all SurvUDI participants? To try to answer this question, we compared repeaters (at first selected questionnaire) with the 3,950 other participants recruited to the SurvUDI network from 1997 to 2003. Both groups of IDU were similar in age, injection experience, drug most often injected in the six months preceding the interview, and use of borrowed injection equipment other than needles during the same period. However, there was a greater proportion of women among repeaters (27.0% versus 22.7%), more repeaters reported injecting with a used needle in the six months before the interview (40.5% versus 36.1%), and, finally, HIV prevalence was higher among repeaters (15.9% versus 12.2%). Although the figures for HCV are similar to those for HIV, it is possible that the rate of 60.4% among repeaters may be higher than among the other participants. It is also important to note that the test used to screen gingival exudates has a sensitivity of 93.0% and a specificity of 97.5% (compared with the test used for venous blood samples)[6]. These sensibility and specificity levels, in the presence of high prevalence rates, mean that we are probably underestimating true prevalence in repeaters. Therefore, there are two biases that pull in opposite directions, one linked with the selection of repeaters and the other with the characteristics of the laboratory test employed. Taking both biases into account, we estimate that the true HCV prevalence rate among SurvUDI participants for the period observed is probably approximately 60%.

An analysis of the factors associated with the presence of HCV antibodies shows that older IDU and IDU who have been injecting longer are more likely to have developed these antibodies. The following behaviours are also associated with the presence of antibodies: injected with borrowed used needles, most often injected drug was cocaine, injected three times or more per week, engaged in prostitution, and used the services of a center providing access to sterile injection equipment. Finally, recruitment in an urban area is associated with presence of the infection. We should note that given the cross-sectional nature of this analysis, it is difficult to express an opinion on the causal relationship between a behaviour and presence of the infection, especially since the questions asked only about the six-month period preceding the questionnaire. Consequently, it is difficult to know whether a certain behaviour precedes or follows infection.

Results of the HIV and HCV co-infection analysis demonstrate that almost one out of two IDU has HCV infection but not HIV, and that 14% of IDU have both viruses. Therefore, HCV affects IDU much more than does HIV. We also identified about 30 individuals who had HIV but not HCV. In these cases, it is possible that HIV was transmitted sexually, a very unlikely mode of transmission for HCV However, we are unable to verify this possibility with our data. The HCV incidence rate of 27 per 100 person-years observed is of concern. It means that every year, one out of four IDU in Quebec is infected with HCV. Rates vary from one district to another, but the epidemic is active in all districts of Quebec.

Our analyses of predictive factors for seroconversion show that the risk of infection increases in a linear fashion with age, by 4% per year of age. They also demonstrate that injectors with the least experience (individuals injecting for a year or less) run the highest risk of seroconverting. These results suggest that to prevent HCV, interventions should target IDU as they start injecting.

The multivariate analysis also indicates that IDU who had injected with borrowed used needles ran a higher risk of being infected with HCV than other IDU. However, sharing other injection equipment was not identified as a factor predicting seroconversion. Given the prevailing risk associated with sharing needles, perhaps we did not have the statistical power necessary to detect the risk associated with sharing other equipment. However, we conducted a sub-analysis by selecting only subjects who had said, on all their questionnaires for the period covered, they had not injected with used needles in the previous six months. Among these subjects, use of used equipment was a factor predicting seroconversion (univariate risk ratio = 1.47), but this association was not statistically significant ($p = 0.16$). These results suggest there is an association that our statistical power was unable to detect.

Another predictive factor for seroconversion was drug most often injected. We observed that IDU who injected cocaine most often had a higher probability of acquiring the infection than those who inject mostly heroin or another drug. Cocaine injection is often associated with high frequency of injection. We could assume that high frequency of injection increases the risk of seroconversion. However, we tested frequency of injection (in the last month) in our analyses; even in univariate analysis, it was not associated with seroconversion. Rather, the increased risk of infection in IDU for whom cocaine was the drug most often injected may be linked with a different method of consumption. Perhaps cocaine injectors go through periods during which they consume more intensely, which lead to situations at greater risk for infection.

Prostitution is another predictive factor for seroconversion. The risk of sexual transmission of HCV is usually considered to be low[7,8,9] while that linked more specifically with prostitution is poorly documented. The association observed is difficult to explain. It could reflect intensive drug consumption, with prostitution the way of obtaining money needed to buy drugs. It could also be a sign of sexual practices that involve contact with blood, among members of social networks where HCV prevalence is relatively high.

Finally, based on the multivariate model, IDU recruited in urban areas are at higher risk of acquiring HCV. SurvUDI analyses conducted earlier showed significant differences between urban and semi-urban IDU[10]. In semi-urban districts, there were proportionately fewer frequent injectors (once or more a week), but more injections with used needles. There were also more IDU who injected mostly cocaine and fewer who injected mostly heroin. But despite the presence in the model of the variable injection with borrowed used

needles and drug most often injected, district of recruitment remains a factor that independently predicts seroconversion. This association is probably linked to the fact that prevalence is higher in urban settings, which indicates that the pool of infected individuals at risk of transmitting infections is larger than in semi-urban areas.

When interpreting the results of the multivariate analysis, it is important to remember that there are periods for which we have no information about the behaviours of IDU, which could have an impact on identifying factors predicting seroconversion. However, the fact of having restricted our analyses to intervals of 12 months or less should limit the impact. Moreover, we can assume that poor behaviour classification would have occurred for interviews where seroconversion was documented as well as for the others, and would have led us to consider existing associations as non-significant rather than the reverse. Therefore, we are confident that the predictive factors identified would remain the same even if we had data covering all time periods.

In conclusion, study results show that HCV affects IDU in all districts of Quebec and in Ottawa, and that incidence is very high. Consequently, measures must be taken everywhere to stop the progression of this epidemic. Significant efforts must be made to prevent infection for the 40% of IDU who do not currently have either HCV or HIV. Factors predicting seroconversion illustrate the impact of injecting with needles previously used by others. Actions taken to diminish this practice should be pursued. However, the fact that no association was observed between sharing other injection equipment and seroconversion should not suggest that it is not necessary to distribute these items. Moreover, our results illustrate the importance of targeting IDU as they start injecting, or even before they initiate injection, to reduce the risks of HCV transmission effectively. Lastly, services should be developed to meet the needs of IDU who, as data show, have already acquired HCV.

REFERENCES

1. Judd A, Parry J, Hickman M, et al. *Evaluation of a modified commercial assay in detecting antibody to hepatitis C virus in oral fluids and dried blood spots*. J Med Virol 2003; 71:49-55.

2. Hosmer DW, Lemeshow S. *Applied Logistic Regression*. Wiley, New York. 1989

3. Hosmer DW, Lemeshow S. *Applied Survival Analysis: Regression Modeling of Time to Event Data*. Wiley, New York. 1999

4. Lamothe F, Vincelette J, Bruneau J, Tepper M, Gully PR, Lachance N, Franco E. *Prevalence, seroconversion rates and risk factors for hepatitis B core, hepatitis C and HIV antibodies among intravenous drug users (IDU) of the Saint-Luc Cohor*t. Can J Infect Dis 1997;8(Suppl A):28A.

5. Roy E, Haley N, Godin G, Boivin J-F, Claessens C, Vincelette J, Leclerc P, Boudreau J-F. *Hepatitis C et les facteurs psychosociaux associés au passage à l'injection chez les jeunes de la rue*. *Rapport d'étape numéro 3*. Direction de santé publique de Montréal. Juin 2004.

6. Alary M, Morissette C, Roy E, Blanchette C, Claessens C, Clermont P, Côté A et al. *Le réseau I-Track SurvUDI. Rapport intérimaire - phase pilote 2002/2003*. Institut national de Santé publique du Québec. Juin 2004.

7. Vandelli C, Renzo F, Romano L, Tisminetzky S, De Palma M, Stroffolini T, Ventura E, Zanetti A. *Lack of evidence of sexual transmission of hepatitis C among monogamous couples: results of a 10-year prospective follow-up study*. Am J Gastroenterol 2004;99:855-9.

8. Boonyarad V, Chutaputti A, Choeichareon S, Bedi K, Theamboonlers A, Chinchai T, Poovorawan Y. *Interspousal transmission of hepatitis C in Thailand*. J Gastroenterol 2003;38:1053-9.

9. Marincovich B, Castilla J, del Romero J, Garcia S, Hernando V, Raposo M, Rodriguez C. *Absence of hepatitis C virus transmission in a prospective cohort of heterosexual serodiscordant couples*. Sex Transm Infect 2003;79:160-2.

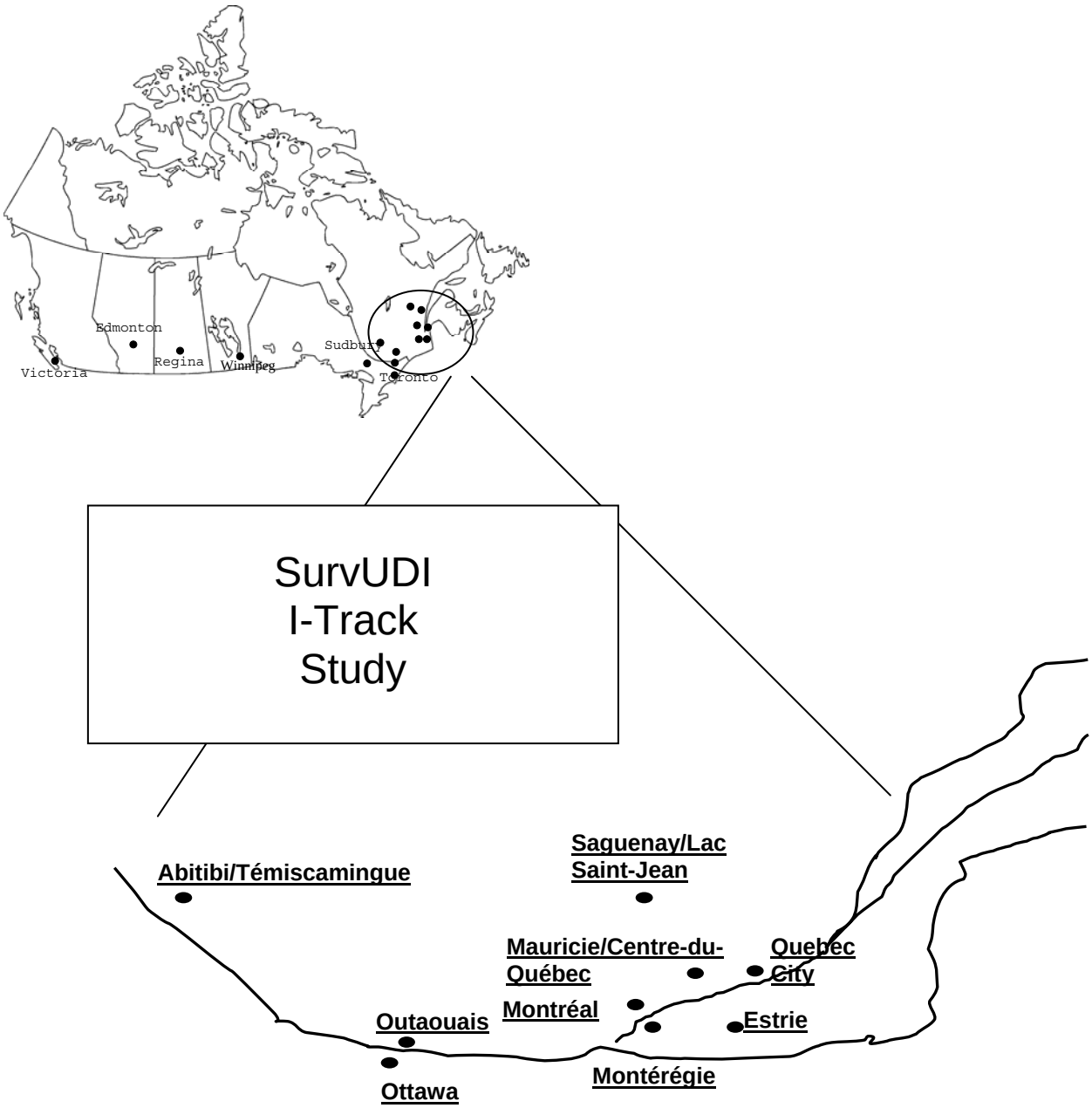
10. Parent R, Alary M, Noël L, Hankins C, Morissette C, and the SurvUDI working group. *High risk level for HIV infection among semi-urban injection drug users (IDU) recruited in the SurvUDI Study*. Can J Infect Dis 2003;14(Suppl A):49A.

APPENDIX 1

SURVUDI I-TRACK STUDY

APPENDIX 1 – SURVUDI I-TRACK STUDY

Figure 1 – SurvUDI I-Track Study



APPENDIX 2

HCV PREVALENCE RATE BY DISTRICT

APPENDIX 2 – HCV PREVALENCE RATE BY DISTRICT

The following table presents prevalence rate by district for each of the nine recruitment districts of the SurvUDI network. In this table, all individuals recruited on Montreal's neighbouring south shore area were included with the Montérégie, regardless of their area of residence.

Table A1 – HCV prevalence rate at first questionnaire selected, by recruitment district of participants to the SurvUDI network

District	HCV+ / total	Prevalence rate (%)	95% confidence interval (%)
Montreal	329/555	59.3	55.1 - 63.4
Quebec City	263/465	56.6	51.9 - 61.1
Hull	4/9	44.4	13.7 - 78.8
Abitibi	2/17	11.8	1.5 - 36.4
Ottawa	189/250	75.6	69.8 - 80.8
Saguenay	2/15	13.3	1.7 - 40.5
Montérégie	12/19	63.2	38.4 - 83.7
Sherbrooke	28/42	66.7	50.5 - 80.4
Mauricie	4/8	50.0	15.7 - 84.3
TOTAL	833/1,380	60.4	57.7 - 63.0

N° publication : 479