

**THE IMPACT OF MIGRATION ON DRUG AND HIV-RELATED RISK
BEHAVIOURS AMONG INJECTION DRUG USERS: EVIDENCE
FROM THE VANCOUVER INJECTION DRUG USERS STUDY**

by

BETH STEPHANIE RACHLIS

B.Sc., McGill University, 2002

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF

MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE STUDIES
(Health Care and Epidemiology)

THE UNIVERSITY OF BRITISH COLUMBIA
September 2007

© Beth Stephanie Rachlis, 2007

ABSTRACT

Background: Migration is one social factor responsible for the spread of HIV/AIDS. The objectives of this project were to describe migration patterns, including rates of and types of migration, among participants in the Vancouver Injection Drug Users Study (VIDUS); to identify factors associated with migration; and to determine the impact of migrating out of Greater Vancouver (GV) on drug use practices and HIV-related risk behaviours among this population.

Methods: VIDUS is an open prospective cohort of injection drug users (IDU). At baseline and semi-annually, participants complete an interviewer-administered questionnaire which elicits socio-demographic data, information regarding injection and non-injection drug use, sexual risk behaviours and enrollment into addiction treatment. All participants were residents of GV at the time of recruitment. Correlates of migration, defined as living outside GV during follow-up, were first identified for all participants with at least one follow-up between June 1999 - May 2005. In a separate analysis, risk behaviours were compared before and after a move had occurred for all eligible participants with more than one follow-up between May 1996 - November 2005.

Results: A total of 1603 IDU were recruited between May 1996 and November 2005. 1245 participants had at least one follow-up between June 1999 and May 2005. The proportion of IDU living outside of GV during follow-up ranged between 2.5% and 11.8% and a total of 149 locations where participants migrated to were cited, with the majority (53.7%) being within British Columbia. Migrating was negatively associated with various factors including frequent crack and heroin use, sex trade involvement, and current methadone use. Of 1122 participants with more than one follow-up visit between May 1996 and November 2005, 192 (17%) reported migrating out of GV while 930 (83%) participants did not report such a move and movers were significantly younger. A significant decrease in frequent heroin and frequent cocaine injection occurred only in movers. The proportion of participants living in unstable housing decreased significantly among movers while no change occurred among non-movers.

Conclusions: Our findings suggest that participants who migrated were less at-risk for HIV infection, given lower levels of reported risk-taking. Furthermore, it appears that risk-taking among IDU declines following periods of migration out of GV. These findings have practical implications for the types of services that are available for IDU living in communities outside of the urban areas.

TABLE OF CONTENTS

Abstract	ii
Table of Contents.....	iii
List of Tables	vi
List of Figures	vii
Acknowledgements	viii
Dedication	ix
Co-authorship Statement	x
CHAPTER 1: Background, Study Justification, and Objectives.....	1
1.1 Global HIV/AIDS	1
1.2 Injection Drug Use and HIV/AIDS.....	2
1.3 Migration and HIV/AIDS	6
1.4 Injection Drug Use, Migration, and HIV/AIDS.....	7
1.5 Study Objectives, Setting, and Thesis Organization.....	9
1.6 Summary	13
1.7 References	15
CHAPTER 2: Migration, Injection Drug Use, and Blood-Borne Infections	23
2.1 Introduction.....	23
2.2 Drug trafficking, the migration of drug use, and the spread of infectious disease	26
2.2.1 Spread of drug use along drug trafficking routes.....	26
2.2.2 Movement of drugs and drug use through a country and the related impacts on HIV transmission.....	28

2.2.3 Shifts in economic or drug use trends and spread of infectious disease.....	30
2.3 Drug use and HIV-related risk behaviours among migrants	33
2.3.1 Migrants and drug use.....	34
2.3.2 Migration and riskier drug-related activity.....	37
2.4 Mobility of injection drug users.....	41
2.4.1 Drug users are a mobile population	41
2.4.2 Mobility among IDU as a factor in the introduction and subsequent spread of HIV	43
2.5 Policy implications and conclusions	46
2.6 References	50
CHAPTER 3: Factors Associated with Migration in VIDUS.....	73
3.1 Introduction.....	73
3.2 Methods.....	76
3.3 Results	80
3.4 Discussion	82
3.5 References	89
CHAPTER 4: THE IMPACT OF MIGRATION ON RISK BEHAVIOURS IN VIDUS	99
4.1 Introduction.....	99
4.2 Methods.....	101
4.3 Results	104
4.4 Discussion	107
4.5 References	113

CHAPTER 5: Summary, Contributions, Recommendations, Future Research, and Conclusions	124
5.1 Summary of Study Findings	124
5.2 Unique Contributions, Impact, and Implications	128
5.3 Recommendations	130
5.4 Future Research.....	133
5.5 Conclusions.....	135
5.6 References	137
APPENDIX 1: Human Ethics Approval	141
APPENDIX 2: List of All Locations Participants Migrated To	143

LIST OF TABLES

Table 2.1. Drug-related risk behaviours of mobile populations	68
Table 3.1. Univariate and multivariate GEE of factors associated with migration between 1999 – 2005 (n= 1245)	96
Table 4.1. Socio-demographic characteristics associated with those who had migrated out of Greater Vancouver versus those who had never moved between 1999 - 2005	120
Table 4.2. Proportion of movers (n = 192) and non-movers (n = 930) reporting risk behaviours between 1996 – 2005	121
Table 4.3. Results of individual logistic growth curve analyses for each risk behaviour modeled as the outcome and adjusted for age, gender, and ethnicity ..	122

LIST OF FIGURES

Figure 2.1. Major opium producers and trafficking routes	72
Figure 3.1. Rates of migration for each follow-up period (Visit 6-17) between 1999-2005 (n= 1245)	97
Figure 3.2. Locations participants migrated to between 1999 - 2005 (n=1245)	98
Figure 4.1. Proportion reporting risk behaviours before and after a move was reported in movers vs. non-movers in VIDUS (1996 - 2005)	123
Figure 5.1. Potential service structure based on threshold level and community need	140

ACKNOWLEDGEMENTS

I thank my committee members, Dr. Bob Hogg, Dr. Thomas Kerr, Dr. Michael Hayes, and Dr. Sam Sheps for all their technical advice and moral support but also for always having the answers I was seeking.

I would particularly like to thank all the participants of the Vancouver Injection Drug Users Study (VIDUS) for their willingness to participate and tell their stories. As well, I thank the staff at VIDUS and at the BC Centre for Excellence in HIV/AIDS for all their support. In particular I must acknowledge Evan Wood, Deborah Graham, Caitlin Johnston, John Charette, Cody Callon, Sidney Crosby, Cristy Power, Vanessa Volkommer, Steve Kain, Trevor Logan, Kathy Churchill, Dave Isham, Nancy Laliberte, Sue Currie, Bonnie Devlin, Will Small, Carley Taylor, and Peter Vann for all their assistance. I especially thank Kathy Li, for her incredible patience and statistical expertise which was in essence, the backbone of this study. As well, I give special thanks to Angela Kaida, Elisa Lloyd-Smith, Sarah Fielden, Kate Shannon, Vicki Bright and Melanie Rusch for being an invaluable resource and for always keeping a watchful eye over me. An honorable mention must also go to Ed Mills for keeping me under his wing for so many years, as well as to Kimberly Brouwer for her exceptional assistance throughout this process.

I also thank the faculty, staff, and students in the Department of Health Care and Epidemiology at UBC for their continued guidance. In particular I must acknowledge Moira Thejomayen, Winona Kent, Virginia Anthony and Tarah Brachman for all their assistance.

Funding of this degree was generously provided by the Canadian Institute for Health Research, the Western Regional Training Centre, the University of British Columbia and salary support was provided by the BC Centre for Excellence in HIV/AIDS.

Finally, I'd like to thank my family and friends for their never-ending support. In particular, I thank my mother for being an exceptional role model and for teaching me that I can always make differences. For the dreamer in me, I owe special thanks to my father who also taught me to fight for what I believe even when it feels like I'm reaching for the impossible. Lastly, I give thanks to my older brother David who always knows how to pick me up when I fall down.

DEDICATION

I dedicate this dissertation to the participants of the Vancouver Injection Drug Users Study

CO-AUTHORSHIP STATEMENT

This is to certify that the work presented in this thesis was conceived, instrumented, written, and disseminated by the Master's student. The co-authors of the manuscripts that make up part of this thesis made contributions only as is commensurate with committee or collegial duties. The co-authors reviewed each manuscript prior to submission for publication and offered critical evaluations, however, the the student was responsible for conducting the analyses and preparing the intital drafts of all manuscripts. In addition, the candidate was responsible for revising the manuscripts based on the suggestions of the co-authors, submitting manuscripts for publication, and preparing final revisions based on the journal editor's and the comments of the external peer reviewers.

CHAPTER 1

BACKGROUND, STUDY JUSTIFICATION, AND OBJECTIVES

1.1 GLOBAL HIV/AIDS

According to the Joint United Nations Programme on HIV/AIDS (UNAIDS), in 2006 a total of 39.5 million individuals (34.1 million – 47.1 million) were living with the human immunodeficiency virus (HIV) globally, with the majority (approximately 63%) residing in Sub-Saharan Africa. An estimated 4.3 million (3.6 million – 6.6 million) were newly infected with HIV in 2006 alone. Worldwide, 40% of all new infections were among individuals aged 15-24. Additionally, more women are currently impacted than ever before with approximately 17.7 million (15.1 million – 20.9 million) women globally living with HIV/AIDS (UNAIDS, 2006). In the past two years, the number of individuals living with HIV increased in every region of the world with the most striking changes occurring in East Asia, Eastern Europe and Central Asia, where the number of people living with HIV/AIDS (PLWHA) in 2006 was almost 21% higher when compared to 2004 (UNAIDS, 2006).

New infections continue to occur at alarming rates in part because proven preventative tools are severely underused (Gayle, 2006; Montaner et al., 2006). As well, while access to highly active antiretroviral therapy (HAART) has increased in recent years (World Health Organization/UNAIDS, 2005), there are still many countries where coverage remains low (Montaner et al., 2006; U.S. Agency for International Development

et al., 2005) and it is estimated that fewer than one in five people at high-risk for HIV have adequate access to effective prevention and treatment (Gayle, 2006).

While HIV epidemics in some countries such as India are best described as a series of epidemics varying widely with respect to prevalence levels and risk factors for infection, epidemics in other regions are often characterized by a prevailing mode of transmission including sex between men, commercial sex work or injection drug use (UNAIDS, 2006).

1.2 INJECTION DRUG USE AND HIV/AIDS

It is estimated that there are approximately 13 million injection drug users (IDU) worldwide (Hamers et al., 1997; Aceijas et al., 2004; The United Nations Office on Drugs and Crime (UNODC), 2004). While sub-Saharan Africa continues to have the largest burden of HIV/AIDS, in other areas hardest hit by HIV including parts of Asia and Eastern Europe, IDU and their sexual contacts account for the highest number of new infections (McCoy and Rodriguez, 2000). In both Eastern Europe and Central Asia, approximately two-thirds or 67% of HIV infections in 2005 were attributable to the use of non-sterile injecting drug use equipment (i.e., syringes) (UNAIDS, 2006). In other areas of Europe and in the United States, IDU represent the second largest group of reported AIDS cases (Ward and Duchin, 1997-1998). In Canada, it is estimated that up to 100,000 individuals inject illicit drugs (Health Canada, 2001) and IDU represent a

significant proportion of Canadians living with HIV. Surveillance studies show varying prevalence rates among IDU: In Victoria, HIV prevalence is 16%, Montreal 23%, Ottawa 20% and Quebec 16% (Public Health Agency of Canada (PHAC), 2004). In Vancouver, IDU experienced an 18% annual HIV incidence rate in 1997 (Strathdee et al., 1997), and while the number of new infections has slowed in recent years for reasons including saturation in the local IDU community, increased awareness of HIV risks, and the expansion of key services including needle exchange programmes (NEPs) and methadone maintenance therapy (MMT), HIV prevalence is 35% (Tyndall et al. 2001; Kuyper et al., 2004). Furthermore, injection drug use is not solely an urban phenomenon in Canada and elsewhere. There is evidence that suggests many IDU live outside metropolitan areas in smaller communities that are often rural or semi-rural settings (Haw and Higgins, 1998; Day et al., 2006), although few studies focus on patterns of drug use in these non-urban environments.

The harms associated with illicit drug use are multidimensional spanning health, political, economic, geographic, social, legal, and cultural spheres of society (Deany, 2000). The specific health and social harms associated with injection drug use are extensive and include overdose, loss of social and/or economic functioning, criminal activity, and infectious disease, particularly HIV and hepatitis C (HCV). Transmission of HIV and HCV occurs largely through syringe sharing and the use of other contaminated injection equipment (Hamers et al., 1997; Strathdee et al., 1998; Freeman

et al., 1999; Wood et al., 2001). Furthermore, in addition to the role of unsafe injection practices in HIV transmission, IDU are also known to transmit HIV to their sexual partners, including those who do not inject drugs (Hamers et al., 1997; Gyarmathy and Neaigus, 2005).

Important social and political factors which enable HIV infection among IDU persist. NEPs and MMT have been proven to prevent HIV/AIDS among IDU and are generally endorsed by leading medical experts including those at the WHO (Human Rights Watch (HRW), 2005). However, many governments around the world either fail to provide or in some cases actually impede such harm reduction activities even though international drug conventions permit their establishment (HRW, 2005).

In Canada, while promising and innovative public health interventions such as Vancouver's supervised injection facility (InSite) face constant public scrutiny and an extraordinarily high standard of evaluation, the majority of funding from Canada's Drug Strategy continues to finance programs which have not been proven to be effective and remain under-evaluated (DeBeck et al., 2006). Moreover, even though findings from InSite have so far demonstrated positive outcomes such as reduced syringe sharing (Kerr et al., 2005) and overall improvements in public order (Kerr et al., 2006; Wood et al., 2004), the federal government recently deferred its decision to extend

the operation of the site beyond the 3-year pilot phase citing that the impacts of the facility are still largely unclear (Health Canada, 2006).

In Russia, where most HIV transmission is linked to injection drug use, the criminalization of IDU slows the establishment of effective HIV/AIDS programming (UNAIDS, 2006). Indeed, the over-reliance on criminal-justice interventions, including enforcement and the incarceration of IDU continues (Wood et al., 2005), although numerous studies from multiple settings demonstrate that risk for HIV is independently associated with incarceration (Zamani et al., 2006; Small et al., 2005; Small et al., 2005; Beyrer et al., 2003; Dolan and Wodak, 1999). This finding is due, in part, to the fact that proven prevention methods are generally not available in most prisons (Wood et al., 2005).

The treatment of drug users as “criminals” exacerbates both official and social marginalization of such individuals (Csete, 2007). Human Rights Watch has documented cases of unnecessary force by police, detention without trial and disproportionately long sentences for drug users carrying small amounts of drugs intended for personal use (Csete and Cohen, 2003). In Vancouver, Canada as elsewhere, local IDU often are afraid to carry syringes for fear that police would stop them and charge them for syringe possession (Csete and Cohen, 2003), further increasing their risk for HIV and other blood-borne infections. Additionally, severe “crackdowns” by

police in neighborhoods with high rates of drug use such as Vancouver's Downtown Eastside (DTES) often has the unintended effect of driving drug users away from the area further displacing them from health and harm reduction services (Wood et al., 2004; Csete and Cohen, 2003). But the impact of drug enforcement on drug users' ability to protect themselves from HIV/AIDS often goes unnoticed. As Csete (2007) comments: "It is hardly an accident that the fastest-growing AIDS epidemics in the world are in countries of the former Soviet Union and parts of Asia, where public-health approaches to address drug use are grossly underfunded compared with criminal law approaches (pg. 721)."

1.3 MIGRATION AND HIV/AIDS

Migration, defined as a movement in space and time across a specified boundary (Mayer, 2000), has been associated with the course of HIV epidemics globally (Quinn, 1994). However, research on population mobility and HIV/AIDS risk among migrant groups is limited and studies focusing on Canadian subpopulations are virtually non-existent. While, previous studies have shown mobility and HIV transmission to be linked; the act of migrating increases the number and variety of people in contact with one another, raising the likelihood of infectious disease transmission (Lyttleton and Amarapibal, 2002; Parrado et al., 2004). Therefore, mobile individuals are often described as 'bridge' populations spreading HIV from high-risk groups and/or high-risk areas into the general population (Freeman et al., 1999; Poudel et al., 2004;

Gyarmathy and Neaigus, 2005; Williams et al., 2005; Yang et al., 2005). Factors thought to exacerbate risk-taking behaviours and thereby increase HIV susceptibility include: isolation, a greater sense of anonymity, anxiety, poverty, dramatic changes in environment, language and cultural barriers, discrimination, and exploitation (Deren et al., 2003; Lagarde et al., 2003; Organista et al., 2004; Parrado et al., 2004). The process of migrating is generally stressful and adaptation to a new environment may be difficult (Soskolne and Shtarkshall, 2002), although it is important to mention here that the situational factors surrounding migration play a huge role in perpetuating risk for infectious disease transmission. Some research, for example, suggests that when individuals migrate with families or to a location that may be more stable or less conducive to risky activity, migration may act to reduce overall vulnerability rather than intensify it (Soskolne and Shtarkshall, 2002). However, migration may lead to displacement away from health and social services (Day et al., 2006). This, in particular, has important implications when mobility and injection drug use intersect, given that migration away from HIV preventative services such as NEPs may increase the potential for disease transmission among IDU.

1.4 INJECTION DRUG USE, MIGRATION AND HIV/AIDS

In recent years, there has been growing interest in environmental and ecological determinants of health among IDU. Numerous studies have demonstrated that neighborhood disadvantage can elevate HIV vulnerability in US inner-city areas (Fuller

et al., 2005; Rhodes et al., 2005), although the role of 'place' and how geographic residence contributes to HIV risk remains an area requiring further study.

Vancouver's DTES is Canada's poorest neighborhood and the centre of the city's drug problem. The area is characterized by extreme poverty, high crime, homelessness, poor housing and high rates of alcohol and drug abuse (Buxton, 2003). Furthermore, while it has been demonstrated repeatedly in North America that IDU generally have poor access to prevention programs, addiction treatment services and medical care (Wood et al. 2002a; Wood et al., 2004), migration may create additional barriers. For example, in Vancouver difficulty accessing syringes has been previously identified as a predictor of syringe sharing (Wood et al. 2002a; Wood et al. 2002b). Almost one quarter of 1500 IDU enrolled in the Vancouver Injection Drug Users Study (VIDUS) have reported having difficulty accessing sterile needles and being away from areas where NEPs are run was one of the most commonly reported reasons for syringe sharing. Further to access concerns for IDU seeking HIV prevention programmes, little is known about the coverage of such services in areas outside of Greater Vancouver.

While research on the migratory patterns of drug users in Canada has not been examined exhaustively, there is evidence to suggest that Canadian IDU are a mobile population. For example, data from the I-track study monitoring risk behaviours among Canadian IDU noted that while the majority of participants cited where surveyed as

their home residence, approximately 26% had lived elsewhere during the six-month period prior to being interviewed (Health Canada, 2004). Among VIDUS participants, 45.4% of participants have reported at least one move to the DTES while 48.0% have reported at least one move out of the community (Maas et al., 2007). Furthermore, it was recently demonstrated that residing in the DTES is an independent predictor of HIV seroconversion among local IDU (Maas et al., 2007). However, how, if at all, migrating out of the DTES and surrounding Greater Vancouver area impacts HIV susceptibility has yet to be explored.

1.5 STUDY OBJECTIVES, SETTING, AND THESIS ORGANIZATION

The overall objective of this thesis is to investigate migration and the impact that migrating out of the Greater Vancouver area (GV) has, in either positive or negative manner on the HIV-related risk taking behaviours among participants enrolled in VIDUS.

The Vancouver Injection Drug Users Study:

VIDUS is an open prospective cohort study that has enrolled and followed 1603 IDU recruited through self-referral or street outreach from Vancouver's DTES since its inception in May 1996. Individuals are eligible for participation if they are 14 years of age or older, had injected illicit drugs at least once in the month prior to enrollment, resided in Greater Vancouver and provided written informed consent. At baseline and

semi-annually, participants complete an interviewer-administered questionnaire which elicits socio-demographic data including age, sex and place of residence and information regarding injection and non-injection drug use, injection and sexual risk behaviours and enrollment into addiction treatment. Participants also provide blood samples, which are tested for HIV and HCV antibodies. All subjects receive a \$20 stipend to compensate for their time and cover transportation costs to the study office located in the heart of the DTES community. For participants who are away from the area or living outside of the city during follow-up, phone interviews are undertaken. Alternatively, VIDUS staff are able to travel to locations throughout the Greater Vancouver area for face-to-face interviews. This study receives annual approval from the Providence Health Care's and the University of British Columbia's Research Ethics Board. In June 1999, questions specific to migration were added to the follow-up questionnaire in efforts to prospectively examine migration patterns in this cohort. While VIDUS has since morphed into two distinct cohorts, ACCESS which includes all participants who have seroconverted and are now HIV-positive and VIDUS II which includes all individuals who remain HIV-negative, the data derived in this analysis comes from the original VIDUS cohort.

This thesis will seek to address 3 objectives:

- 1. To describe migration patterns among VIDUS participants, including rates of and types of migration.** Chapter 3 will identify the proportion of participants that have migrated, defined as living outside of the Greater Vancouver area (GV) throughout the follow-up period. In addition, I will identify all the locations participants report living in outside of GV and will categorize these locations as being in British Columbia (excluding GV), Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Yukon, Northwest Territories, Nunavut, Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island, the United States or Other. Furthermore, participants reporting a move to an Aboriginal reserve setting will be noted. Given that migration patterns are often linked to seasonal trends particularly for individuals who migrate for seasonal employment (Quinn, 1994; Organista et al., 2004; Parrado et al., 2004), I hypothesize in this analysis, that rates of migration will vary depending on the time of year. In addition, consistent with an earlier study (McCoy et al., 1996) which demonstrated that mobile IDU often move within a relatively limited geographic area, I hypothesize that the majority of locations that participants move to will be within the province of British Columbia.

- 2. To identify the characteristics of VIDUS participants who migrate out of Greater Vancouver.** Chapter 3 will identify the socio-demographic characteristics (age, gender, ethnicity, housing status) and risk factors (drug use, injecting practices, sexual behaviours) associated with migration out of the Greater Vancouver area using a longitudinal statistical analysis. Given that migration is often considered a selective process (Johnson et al., 2002) in that not everyone has the resources or the capacity to move, I hypothesize that participants who report migrating in this analysis will be more likely to be older and less likely to engage frequently in risky activity compared to participants who do not report migrating
- 3. To identify the impact of migrating out of the Greater Vancouver area on drug use practices (e.g., frequency of injection) and HIV-related risk behaviours.** In Chapter 4, I will compare the drug use patterns (type and frequency of use, injection practices) and HIV-related risk behaviours (i.e., housing) among participants who migrate out of GV in the time period before and the time period after a move is reported. Using frequency matching, I will compose a control group made up of participants who have never reported a move out of Greater Vancouver to formally test whether migrating impacts on drug use and risk-taking patterns. I hypothesize that given the concentrated drug scene situated in the DTES, migrating out of GV in this analysis, will result in significant declines

in risk-taking among those who move. For participants who do not move, no significant changes in behaviours will be seen over time.

This thesis is divided into 5 chapters. The first chapter provides some preliminary background information, and outlines the research justification, study population, and objectives. Chapter 2 is a literature review on the topic of migration and transmission of HIV among injection drug users globally that has been recently published in an international journal. Chapter 3 and 4 are research papers that examine socio-demographic and behavioural factors associated with migrating out of the Greater Vancouver area, as well as changes in risk-taking after migration has occurred. Finally, Chapter 5 offers a discussion of important findings, summarizes the unique contribution that this particular work adds to the literature, and outlines important implications as well areas for future research.

1.6 SUMMARY

In summary, migration is one factor influencing the spread of HIV through the coming together of large groups of individuals from diverse backgrounds and settings. However, the role that migration and/or the movement of vulnerable populations including IDU plays in risk-taking has not yet been thoroughly explored. Furthermore, injecting drugs is not solely an urban phenomenon and many IDU are known to reside outside metropolitan areas where the availability of prevention and treatment services

may be limited in number and scope. Therefore, it is not only the process of migrating that has important implications on HIV vulnerability but also the destinations that individuals migrate to and reside in that can influence risk-taking behaviours in a negative or positive manner. However, few research studies have focused on the patterns of drug use in these regions and therefore a solid understanding of how migration to these settings impacts vulnerability to infection or transmission of HIV among IDU is still largely unknown.

1.7 REFERENCES

- Aceijas, C., Stimson, G.V., Hickman, M., Rhodes, T., 2004. Global overview of injecting drug use and HIV infection among injecting drug users. *AIDS* 18, 2295-2303.
- Beyrer, C., Jittiwutikam, J., Teokul, W, Razak, M.H., Suriyanon, V., Srirak, N., Vongchuck, T., Tovanabutra, S., Sripaipan, T., Celetano, D., 2003. Drug use, increasing incarceration rates, and prison-associated HIV risks in Thailand. *AIDS Behav* 7, 153-161.
- Buxton, J. 2003. Vancouver Drug Use Epidemiology. Site Report for the Canadian Community Epidemiology of Drug Use. Available at www.vancouver.ca/foupillars/pdf/report_vancouver_2003.pdf. Accessed on November 10, 2005.
- Csete, J., 2007. AIDS and public security: the other side of the coin. *Lancet* 369, 720-221.
- Csete, J., Cohen, J., 2003. Human rights in Vancouver: do injection drug users have a friend in city hall? *Can. HIV AIDS Policy Law Rev.* 8, 7-10.
- Day, C., Conroy, E., Lowe, J., Page, J., Dolan, K., 2006. Patterns of drug use and associated harms among rural injecting drug users: comparisons with metropolitan injecting drug users. *Aust.J. Rural Health* 14, 120-125.
- Deany, P., 2000. HIV and Injection drug use: A new challenge to sustainable human development. UNDP HIV and Development Programme/UNDP Asia-Pacific Regional Programme on HIV and Development. Available at <http://www.undp.org/hiv/publications/deany.htm>. Accessed June 25, 2006.

- DeBeck, K., Wood, E., Montaner, J., Kerr, T., 2006. Canada's 2003 renewed drug strategy-an evidence-based review. *Can. HIV AIDS Policy Law Rev.* 11, 5-12.
- Deren, S., Kang, S.Y., Colon, H.M., Andia, J.F., Robles, R.R., Oliver-Velez, D., Finlinson, A., et al. 2003. Migration and HIV risk behaviours: Puerto Rican drug injectors in New York City and Puerto Rico. *Am. J. Public Health* 93, 812-816.
- Dolan, K.A., Wodak, A. HIV transmission in a prison system in an Australian state. *Med. J. Aust.* 171, 14-17.
- Freeman, R., Williams, M.L., Sanders, L.A., 1999. Drug use, AIDS knowledge and HIV risk behaviours of Cuban-, Mexican-, and Puerto Rican-born drug injectors who are recent entrants into the United States. *Subst Use Misuse* 34, 1765-1793.
- Fuller, C.M, Borrell, L.N, Latkin, C.A., Galea, S., Ompad, D.C., Strathdee, S.A., Vlahov, D., 2005. Effects of race, neighborhood and social network on age at initiation of injection drug use. *Am. J. Public Health* 95, 689-695.
- Gayle, H.D., 2006. Expanding access to HIV prevention. *AIDS Res. Ther.* 3, 2.
- Gyarmathy, V., Neaigus, A., 2005. Marginalized and socially integrated groups of IDUs in Hungary: potential bridges of HIV infection. *J. Urban Health* 82, iv101-112.
- Hamers, F., Batter, V., Downs, A.M., Alix, J., Cazein, F., Brunet, J.B., 1997. The HIV epidemic associated with injecting drug use in Europe: geographic and time trends. *AIDS* 11, 1365-1374.

- Haw, S., Higgins, K., 1998. A comparison of the prevalence of HIV infection and injecting risk behaviour in urban and rural samples in Scotland. *Addiction* 93, 855-863.
- Health Canada, 2006. "No new injection sites for addicts until questions answered says Minister Clement" news release. Ottawa, Canada. September 1, 2006.
- Health Canada, 2004. Health Canada: I-Track- Enhanced Surveillance of Risk Behaviours among Injecting Drug Users in Canada, Pilot Survey Report (2004) Available at http://www.phac.aspc.gc.ca/bid-bmi/dsd-dsm/nb-ab/2004/nb2804_e/html. Accessed on July 10, 2005.
- Human Rights Watch, 2004. HIV/AIDS at the 48th U.N. Commission on Narcotic Drugs (CND): Press Coverage of the 48th U.N. Commission on Narcotic Drugs. Available at www.hrw.org/campaigns/aids/2004/cnd.htm. Access on May 22
- Joint United Nations Programme on HIV/AIDS, 2006. Report on the global AIDS epidemic. Available at http://www.unaids.org/en/HIV_data/2006GlobalReport/default.asp. Accessed on August 30, 2006.
- Joint United Nations Programme on HIV/AIDS, 2006. Russian Federation (country update), 2006. Available at www.unaids.org/en/Regions_Countries/Countries/russian_federation.asp. Accessed on May 22, 2007.

- Kerr, T., Tyndall, M., Li, K., Montaner, J.S., Wood, E., 2005. Safer injection facility use and syringe sharing in injection drug users. *Lancet* 366, 316-318.
- Kuyper, L.M., Lampinen, T.M., Spittal, P.M., Hogg, R.S., Schechter, M.T., Wood, E., 2004. Factors associated with sex trade involvement among male participants in a prospective study of injection drug users. *Sex. Transm. Dis.* 80, 531-535.
- Lagarde, E., Schim van der Loeff, M, Enel, C., Homgren, B., Dray-Spira, R., Pison, G., Piau, P.J., Delaunay, V., M'Boup, S., Ndoye, I., Coeuret-Pellier, M., Whittle, H., Aaby, P., MECORA group., 2003., et al. 2003. Mobility and the spread of human immunodeficiency virus into rural areas of West Africa. *Int. J. Epidemiol.* 32, 744-752.
- Lyttleton, C., Amarapibal, A., 2002. Sister cities and easy passage: HIV, mobility and economies of desire in a Thai/Lao border zone. *Soc. Sci. Med.* 54, 505-518.
- Maas, B., Fairbairn, N, Kerr, T., Li, K., Montaner, J.S.G., Wood, E., 2007 Neighborhood and HIV Infection among IDU: Place of residence independently predicts HIV infection among a cohort of injection drug users. *Health Place* 17, 432-439.
- Mayer, J., 2000. Geography, ecology and emerging infectious diseases. *Soc. Sci. Med.* 50, 937-952.
- McCoy CB, Rodriguez F. Global overview of injecting drug use and HIV infection. *Lancet* 2000; 365; 1008-1009
- McCoy, V., Correa, R., Fritz, E., 1996. HIV diffusion patterns and mobility: gender differences among drug users. *Pop. Res. Policy Review* 15, 249-264.

- Montaner, J.S.G., Hogg, R.S., Wood, E., Kerr, T., Tyndall, M.D., Levy, A.R., Harrigan, P.R., 2006. The case for expanding access to highly active antiretroviral therapy to curb the growth of the HIV epidemic. *Lancet* 368, 531-536.
- Organista, K., Carrillo, H., Ayala, G., 2004. HIV prevention with Mexican migrants: review, critique and recommendations. *J. Acquir. Immune Defic. Syndr.* 37, S227-239.
- Parrado, E.A., Flippen, C.A., McQuiston, C., 2004. Use of commercial sex workers among Hispanic migrants in North Carolina: Implications for the Spread of HIV. *Persp. Sex. Reprod. Health* 36, 150-156.
- Poudel, K., Jimba, M., Okumura, J., Joshi, A.B., Wakai, S., 2004. Migrants' risky sexual behaviours in India and at home in far western Nepal. *Trop. Med. Int. Health* 9, 897-903.
- Quinn, T., 1994. Population migration and the spread of types 1 and 2 human immunodeficiency viruses. *Proc. Natl. Acad. Sci. USA* 91, 2407-2414.
- Rhodes, T., Singer, M., Bourgois, P., Friedman, S.R., Strathdee, S.A., 2005. The social structural production of HIV risk among injecting drug users. *Soc. Sci. Med.* 61, 1026-1044.
- Small, W., Kain, S., Laliberte, N., Schechter, M.T., O'Shaughnessy, M.V., Spittal, P.M., 2005. Incarceration, addiction, and harm reduction: inmates experience injecting drugs in prison. *Subst. Use Misuse* 40, 831-843.

- Small, W., Wood, E., Jurgens, R., Kerr, T., 2005. Injection drug use, HIV/AIDS and incarceration: evidence from the Vancouver Injection Drug Users Study. *Can. HIV AIDS Policy Law Rev.* 10, 5-9.
- Soskolne, V., Shtarkshall, R.A., 2002. Migration and HIV prevention programmes: linking structural factors, culture, and individual behaviour-an Israeli experience. *Soc. Sci. Med.* 55, 1297-1307.
- Strathdee, S.A., Patrick, D.M., Currie, S.L., Corenelisse, P.G., Rekart, M.L., Montaner, J.S., Schechter, M.T., O'Shaughnessy, M.V., 1997. Needle exchange is not enough: lessons from the Vancouver injecting drug use study. *AIDS* 11, F59-65.
- Strathdee, S.A., van Ameijden, E.J., Mesquita F., Wodak, A., Rana, S., Vlahov, D., 1998. Can HIV epidemics among injection drug users be prevented? *AIDS* 12, S71-79.
- Tyndall, M.W., Craib, K.J., Currie, S., Li, K., O'Shaughnessy, M.V., Schechter, M.T., 2001. Impact of HIV infection on mortality in a cohort of injection drug users. *J. Acquir. Immune Defic. Syndr.* 28, 351-357.
- United Nations Office on Drugs and Crime, 2004. *World Drug Report 2004*. Available at http://www.unodc.org/world_drug_report.html. Accessed on May 16, 2006.
- U.S. Agency for International Development, Joint United Nations Programme on HIV/AIDS, World Health Organization, U.S. Centre for Disease Control and Prevention, 2005. Coverage of selected services for HIV/AIDS prevention, care, and support in low- and middle-income countries in 2003. Available at www.futuresgroup.com/348HIVCoverage2005.pdf. Accessed on May 20, 2007.

- Ward, J. W., Duchin, J.S. 1997-1998. The epidemiology of HIV and AIDS in the United States. *AIDS Clin. Rev.*, 1-45.
- World Health Organization and Joint United Nations Programme on HIV/AIDS, 2005. Progress on global access to HIV antiretroviral therapy: An update on "3 by 5", 2005. Available at www.who.int/hiv/fullreport_en_highest.pdf. Accessed on May 20, 2007.
- Williams, M., Atkinson, J., Klovdahl, A., Ross, M.W., Timpson, S., 2005. Spatial bridging in a network of drug-using male sex workers. *J. Urban Health* 82, i35-i42.
- Wood, E., Montaner, J., Kerr, T., 2005. HIV risks in incarcerated injection-drug users. *Lancet* 366, 1834-1835.
- Wood, E., Spittal, P.M., Small, W., Kerr, T., Li, K., Hogg, R.S., Tyndall, M.W., Montaner, J.S., Schechter, M.T., 2004. Displacement of Canada's largest public illicit drug market in response to a police crackdown. *CMAJ*. 170, 1551-1556.
- Wood, E., Kerr, T., Small, W., Li, K., Marsh, D.C., Montaner, J.S., Tyndall, M.W., 2004. Changes in public order after the opening of a medically supervised safer injecting facility for illicit injection drug users. *CMAJ*. 171, 731-734.
- Wood, E., Spittal, P.M., Li, K., Kerr, T., Miller, C.L., Hogg, R.S., Montaner, J.S., Schechter, M.T., 2004. Inability to access addiction treatment and risk of HIV-infection among injection drug users. *J. Acquir. Immune Defic. Syndr.* 36, 750-754.

- Wood, E., Tyndall, M.W., Spittal, P.M., Li, K., Hogg, R.S., O'Shaughnessy, M.V., Schechter, M.W., 2002a. Needle exchange and difficulty with needle access during an ongoing HIV epidemic. *Int. J. Drug Policy* 13, 95-102.
- Wood, E., Tyndall, M.W., Spittal, P.M., Li, K., Hogg, R.S., Montaner, J.S., O'Shaughnessy, M.V., Schechter, M.T., 2002b. Factors associated with persistent high-risk syringe sharing in the presence of an established needle exchange programme. *AIDS* 16, 941-943.
- Wood, E., Tyndall, M.W., Spittal, P.M., Li, K., Kerr, T., Hogg, R.S., Montaner, J.S., O'Shaughnessy, M.V., Schechter, M.T., 2001. Unsafe injection practices in a cohort of injection drug users in Vancouver: could safer injecting rooms help? *CMAJ*. 165, 405-410.
- Yang, H., Li, X., Stanton, B., Liu, H., Liu, H., Wang, N., Fang, X., Lin, D., Chen, X., 2005. Heterosexual transmission of HIV in China: a systematic review of behavioural studies in the past two decades. *Sex. Transm. Dis.* 32, 270-280.
- Zamani, S., Kihara, M., Gouya, M.M., Vaziran, M., Nassirimanesh, B., Ono-Kihara, M., Ravari, S.M., Safaie, A., Ichikawa, S., 2006. High prevalence of HIV infection associated with incarceration among community-based injection drug users in Tehran, Iran. *J. Acquir. Immune Defic. Syndr.* 42, 342-346.

CHAPTER 2¹

MIGRATION, INJECTION DRUG USE AND BLOOD-BORNE INFECTIONS

2.1 INTRODUCTION

Migration, defined as a movement of people through space and time (Mayer, 2000), has an important impact on the spread of HIV and other blood-borne and sexually transmitted infections (STI). The process of migration brings together individuals from diverse backgrounds and settings. It is often associated with family separation, changes in cultural environments, poverty, social isolation, and a greater sense of anonymity. All these factors may contribute to increased risk for infection (Deren et al., 2003; Lagarde et al., 2003; Organista et al., 2004; Parrado et al., 2004). Globally, studies demonstrate that when highly mobile populations engage in high-risk behaviours there is a greater potential for diffusion of HIV along transportation routes and across borders (Beyrer et al., 2000; Mayer, 2000; Wood et al., 2000a; McMichael, 2004; Williams et al., 2005) and from high to low-risk areas (White, 2003; Williams et al., 2005), making the movement of individuals an emerging risk factor in the transmission dynamics of HIV/AIDS (Hawkes and Hart, 1993; Mayer, 2000).

Injection drug users (IDU) are recognized as a group at high-risk for the acquisition and transmission of HIV. There are an estimated 13 million IDU worldwide

¹ A version of this chapter has been published. Rachlis, B., Brouwer, K.C., Mills, E.J., Hayes, M., Kerr, T., Hogg, R.S., 2007. Migration and the transmission of blood-borne infections among injection drug users: Understanding the epidemiologic bridge. *Drug Alcohol Depend* 90: 107-119.

with the majority residing in Eastern Europe and Asia; in many regions injection drug use represents the dominant mode of HIV transmission (Hamers et al., 1997; Aceijas et al., 2004; The United Nations Office on Drugs and Crime (UNODC), 2004). HIV prevalence continues to rise among IDU with injection drug use accounting for approximately 5-10% of the cumulative HIV infections globally and as much as almost one-third of cases outside of Sub-Saharan Africa (The Joint United Nations Programme on HIV/AIDS (UNAIDS), 2004). Certain drug use behaviours contribute to HIV infection with the greatest risk coming from the use of contaminated needles and syringes (Hamers et al., 1997; Strathdee et al., 1998; Freeman et al., 1999; Wood et al., 2001). IDU appear to be a relatively mobile group, often moving between cities, smaller communities, and across international borders for reasons of work, security or access to narcotics (Drucker, 1990; Uriely and Belhassen, 2005; Dehne et al., 1999). This merits further study as there is the potential for IDU who engage in risky behaviour outside their home areas to transmit HIV to other IDU, their sex partners, and others in the population (Williams et al., 2005). Further, migration can compromise the delivery of treatment to those IDU already infected.

The objectives of this review are to examine: 1) the influence of drug trafficking and the spread of drug use on the diffusion of HIV, 2) the influence of migration on drug use and HIV-related risk behaviours among migrants, and 3) the mobility patterns of IDU and its role in the spread of HIV. As we believe this to be the first

comprehensive review focusing on migration and transmission of blood-borne infections among IDU, we used a broad definition of migration, which encompassed both short and long-term movement for a variety of purposes including mobility related to drug trafficking. The terms "migration," "mobility," and "travel" are used interchangeably. Because of the importance of HIV infection among IDU, we focus primarily on this infectious disease although the key concepts discussed relate more widely to blood-borne and STI in general.

To identify relevant information, we conducted electronic searches of relevant medical databases. Our search strategy combined terms which included "migrant", "migrat*", "mobil*", "travel*", "diffus*", "injection drug use", "IDU", "drug inject*", "inject* drug us*", "HIV", "AIDS", and "risk* behav*". Additional papers were sought by examining the bibliographies of key papers. As well, study reports and publications of official materials issued by relevant international agencies were obtained using web search engines with combinations of the same search terms listed above; this was in addition to a more specific search of international and bilateral agency websites including UNAIDS and the World Health Organization (WHO). However, there are potential quality problems with data presented in published government reports and other grey literature included in this review, and therefore this data should be interpreted with caution. In discussing injection drug use, this review primarily

concentrates on opiates, as they are the most common illicit drugs injected in most areas.

This review will focus first on the role of drug trafficking on the spread of drug use and subsequent spread of HIV. We also detail how the movement of drugs through a country and patterns of drug use, often influenced by shifts in economic or drug use trends, further impacts the diffusion of infectious disease (See Figure 1). The next two sections focus on drug use among migrating populations and the mobility of drug users in general. Risky injection and drug-related practices among mobile drug users are further detailed, highlighting the potential role that mobile IDU have in the introduction and subsequent spread of HIV. In the final section, we discuss the potential policy implications of addressing prevention and care issues in mobile IDU populations.

2.2 DRUG TRAFFICKING, THE MIGRATION OF DRUG USE, AND THE SPREAD OF INFECTIOUS DISEASE

2.2.1 Spread of drug use along drug trafficking routes

Injection of illicit drugs now takes place in more than 144 countries (UNODC, 2004). Despite decreases in some settings, heroin production and use in Afghanistan has increased, contributing to an overall rise in worldwide production (The National Drug Intelligence Center (NDIC), 2005; Drug Enforcement Administration (DEA), 2006). The

United Nations Office on Drugs and Crime estimates that 4100 metric tons of opium were produced in Afghanistan in 2005, representing 88% of world production (UNODC, 2005). In Central Asia, trafficking from production areas has shifted from the "Western Route" which runs through Iran and Turkey into Eastern Europe to the "Northern Route" which passes directly through the Central Asian region to Russia, the South Caucasus, and then to Europe (Renton et al., 2006).

With these changes in production patterns, comes new markets in production areas and along trafficking routes (Atlani et al., 2000) and there has been a rapid increase of injection drug use in all affected countries (Renton et al., 2006). For example, the number of drug users in Kazakhstan increased five-fold between 1990-2003. These increases were documented by the number of drug users registered by state narcology services (e.g., 10, 828 in 1990 to 50, 617 in 2003) (Renton et al., 2006); however, given that only a fraction are likely to be registered, the scale of drug use is likely underestimated. Within the opium cultivation center of the 'Golden Triangle' region in South-East Asia, composed of western Laos, northern Thailand and northern and eastern Burma, traffickers avoid law enforcement authorities by switching routes. They typically recruit a trafficking chain by supplying free or cheap drugs to its members (Beyrer et al., 2000; Deany, 2000). Thus, the massive outflow of drugs from this region creates new users along the way, especially in Burma, Thailand, Yunnan (and southern provinces in China), and Vietnam (Beyrer et al., 2000).

Often trafficking takes place in regions where there are porous borders (Lyttleton and Amarapibal, 2002; Organista et al., 2004; Rhodes et al., 2005). A striking example is in Mexico, which has experienced a rise in trafficking of cocaine, methamphetamines, and heroin over the past few decades. An estimated 70% of U.S. cocaine originating in South America now passes through the Central America-Mexico corridor (Brouwer et al., 2006a). Often, drug shipments are delayed in northern Mexican border towns before delivery to the U.S. "Spillover" from shipments results in increased drug availability and has been associated with increased experimentation and continued use in Mexican adolescents (Villatoro et al., 1998), creating a growing local drug consumption market (Magis-Rodriguez et al., 2002; Medina-Mora and Rojas- Guiot, 2003; Bucardo et al., 2005; Maxwell et al., 2006). This appears to be reflected by the fact that the two largest border cities, Tijuana and Ciudad Juarez, now have the first and second highest prevalence of adult drug use in the country with 14.7% and 9.2% of adults having ever used illicit drugs, respectively (Secretaría de Salubridad y Asistencia (SSA), 1998).

2.2.2 Movement of drugs and drug use through a country and the related impacts on HIV transmission

Drug-related trade and transport networks often intersect with HIV transmission (Stimson, 1993). For example, viral subtyping has confirmed that HIV spread in Central Asia closely followed trafficking routes and the subsequent increase in heroin injection in these areas (Beyrer et al., 2000). As one moves away from production regions (e.g., Afghanistan) where opium is abundant and is most often smoked, there is an economic

incentive to traffic refined heroin which is easier to transport (Deany, 2000). This is closely followed by a move towards injecting which is a more efficient way of obtaining a powerful "high" while minimizing drug wastage (The United Nations Drug Control Programme (UNDCP), 2000). Furthermore, while many traffickers "self-test" drug quality and purity, many do not carry their own injecting equipment largely due to strict drug laws, and so often share with local contacts (Beyrer et al., 2000; Deany, 2000).

Drug trafficking and subsequent HIV diffusion also occurs along border regions and in key port cities (Stimson, 1993; Beyrer et al., 2000; Rhodes et al., 2005). The Tijuana, Mexico-San Diego, U.S. border area in North America, is the busiest land border crossing in the world (The United States Department of Justice (USDOJ), 2004) and as mentioned above, drug use is on the rise in Tijuana. This area also has the second highest cumulative national AIDS incidence in Mexico, following only Mexico City (Consejo Nacional para la Prevencion y Control del VIH/SIDA (CONASIDA), 2004). While HIV is currently concentrated in a variety of at-risk groups, a recent modeling exercise estimated IDU to represent the second highest number of HIV-positive persons (following men who have sex with men [MSM]) (Brouwer et al., 2006b). Another border example is along the Black Sea Coast, a holiday destination in Eastern Europe that has created a geographical nexus for HIV diffusion. Krasnodar, for example, where the first major IDU-associated HIV outbreak in Russia was reported, is a northern Caucasus city with numerous transportation connections with several Black

Sea harbors (Dehne et al., 1999). In the Lang Son, Vietnam-Guangxi, China border area, HIV infection is largely driven by the migration of drug dealers and drug users along and across the 200-kilometer border, which is largely mountainous, remote, and difficult to control (Hammett et al., 2006). Molecular research demonstrated that subtype E HIV likely spread from northern Vietnam into southern China (Beyrer et al., 2000; Kato et al., 2001). HIV diffusion to other countries connected to the 'Golden Triangle' region have been identified (Beyrer et al., 2000). In India for example, IDU-driven HIV epidemics are occurring in northeastern states, along trafficking routes from Burma (Lindan et al., 1997; Beyrer et al., 2000). While outbreaks of HIV infection among local IDU in these regions were recognized in the late 1980s and early 1990s (Stimson, 1993), HIV is spreading to other sectors of society (Lindan et al., 1997) through chains of sexual contacts involving male IDU and their female sexual partners, and drug using sex workers and their clients (Ruxrungtham et al., 2004). From male clients, HIV is often transmitted to their wives and partners and to their children. In Vietnam between 1998 and 2002, HIV prevalence in pregnant women tripled from 0.09% to 0.28% (Ruxrungtham et al., 2004).

2.2.3 Shifts in economic or drug use trends and spread of infectious disease

Drug trafficking and the global distribution of specific narcotics influence drug trends which, in turn, influence risk behaviours and subsequent likelihood of HIV transmission (Aceijas et al., 2004). In the U.S., HIV epidemics among IDU differ

noticeably between cities with IDU in the Northeast having much higher seroprevalence than IDU living in cities towards the West Coast (e.g., 41% in New York City (NYC) versus 3.8% in Los Angeles (LA) in the early 1990s) (Holmberg, 1996; Montoya and Atkinson, 1996). Interestingly, HIV prevalence among MSM appears to be more evenly distributed (e.g., 29% in NYC and 23% in LA) (Holmberg, 1996). While several hypotheses may explain this phenomenon, recent evidence suggests that differences in heroin type injected in different parts of the country may be a critical factor (Ciccarone and Bourgois, 2003). For example, 'black tar heroin' (BTH) is a dark resinous substance of Mexican origin that is mostly imported into cities in the Midwest and West Coast, while heroin in East Coast cities is most often a white or light brown powder primarily trafficked from South America and South Asia (DEA; 1991-1993). The chemical properties of BTH necessitates more rinsing of syringes to prevent blockage, heating is required to enhance drug solubility, and to avoid rapid venous sclerosis, alternative routes of injection are used (subcutaneous and intramuscular). Collectively these behaviours reduce the likelihood of HIV transmission (Ciccarone and Bourgois, 2003).

Further, the method of drug preparation and production may, in some cases, have a direct link with HIV transmission among and between injecting networks (Rhodes et al., 1999). An HIV epidemic occurring in the Kaliningrad region of Russia was linked to a local home-made opiate which had been prepared with human blood

added to stabilize the solution (Liitsola et al., 1998); HIV incidence rose in this area from less than one to more than 100 per month between August and September 1996, with 80% of the cases associated with IDU. While a recent study suggests that the epidemic among IDU in the region was more likely due to recognized risk behaviours (e.g., needle-sharing) rather than from the opiate solution harboring viable HIV (Abdala et al., 2006), the identified source was a novel HIV-1 recombinant A/B strain with similarities to Ukrainian subtype A strains, suggesting that this subtype may have been introduced via drug trafficking. Further, cases of HIV infection in neighboring Lithuania was also linked to this particular epidemic and most likely arose from the mobility of IDU between the two countries (Liitsola et al., 1998)

As previously described, the economic incentive to refine heroin along trafficking routes quickly gives way to injecting, as has been observed in Asia (UNDCP, 2000). In China, a major shift from nasal to injection drug use was observed beginning in 1990 with one study citing an annual incidence in injection drug use of 20% by 1994 (Wu et al., 1996). It is now estimated that 80-90% of illegal drug users in the Yunnan and Guangxi provinces are IDU (Yu et al., 1999; Zhang et al., 2002). Estimates of HIV prevalence among IDU in southern China are estimated to be 75% in Yunnan province (Xiao et al., 2007) and between 65% to 74% of IDU in the northern border provinces of Vietnam are estimated to be HIV-positive (Quan et al., 2000; Nguyen et al., 2001; Hien

et al., 2004), although a myriad of factors may be contributing to these particular epidemics.

Economic instability and poverty can further drive the drug trade and subsequent spread of drug use and injecting (Stimson, 1993; Deany, 2000; Renton et al., 2006). Since the fall of the Soviet Union and the associated political volatility and fewer employment opportunities, informal economies have flourished (Borisenko et al., 1999; Atlani et al., 2000; Benotsch et al., 2004; Gyarmathy and Neaigus, 2005). While most drugs are domestically produced, states reporting the rapid spread of drug use are also in close proximity to drug supply routes, particularly those originating in Afghanistan and passing through Central Asia, Ukraine and Russia into Western Europe (Lindan et al., 1997; Beyrer et al., 2000; UNODC, 2004). Prior to 1995, there was little evidence of IDU-associated HIV transmission in the newly independent states. However, from 1994 to 1997 the number of drug users in treatment increased from 91,000 to 350,000 in Russia (Dehne et al., 1999) and the number of HIV cases among IDU jumped from zero to 2,200 (Rhodes et al., 1999).

2.3 DRUG USE AND HIV-RELATED RISK BEHAVIOURS AMONG MIGRANTS

The process of migration is governed by several push and pull factors and is largely driven by economic, political, and/or environmental factors (International Office for Migration (IOM)/UNAIDS, 1998; Mayer, 2000; White, 2003). Various causes such as

oppression and political conflict can also force people to move (Quinn, 1994; Haw and Higgins, 1998; IOM/UNAIDS, 1998; Soskolne and Shtarkshall, 2002), while the urge to enter the cash economy is another factor crucial in the movement of populations and subsequent geographic spread of HIV (Organista et al., 2004).

Migrating is often stressful, and adaptation to a new environment may be challenging (Paschane and Fisher, 2000; Sanchez et al., 2004). While the vulnerability of those migrating may vary depending on an individual's resilience and ability to adapt, the new environment will in most cases present demands that strain the migrant's adaptive resources (Paschane and Fisher, 2000). We detail below how such stressors and environmental conditions may increase drug use and HIV-related risk behaviours among mobile populations (Table 1).

2.3.1 Migrants and drug use

When examining drug use among migrants, it is important to note that migration is highly selective and often the consequence of positive and/or negative forces at the point of origin. These selection processes may consequently determine the degree to which migrants are "at-risk" for substance abuse: negative selection may result in increased risk while positive selection may yield a group who are less vulnerable to psychological stressors and more resistant to drug use (Johnson et al., 2002). Some literature, particularly the literature pertaining to Hispanic immigrants in

the U.S., has suggested that despite challenges posed by moving, foreign-born Hispanics have better health-related outcomes than U.S.-born Hispanics (Vega et al., 1998.; Ortega et al., 2000; Johnson et al., 2002; Warner et al., 2006), although with increased time in the U.S., patterns of substance use begin to approximate U.S.-born populations (Johnson et al., 2002). While research on rates of drug use prior to leaving one's home country are not widely available, data on age at onset of drug use suggests that foreign-born Hispanics are not likely to have used drugs prior to migrating (Vega et al., 2002), thus lower levels of use compared to U.S.-born Hispanics may still reflect a rise in drug use compared to before migration.

During the process of acculturation, individuals might experience various levels of stress associated with migration. Migrant workers in the U.S., for example, have demonstrated generally higher levels of psychiatric distress than the general population (Hovey and Magana, 2000; Hansen and Donohoe, 2003; Kim-Goodwin and Bechtel, 2004). The stress of being separated from family (Alderete et al., 1999; Magana and Hovey, 2003) and having a mobile lifestyle (Kim-Goodwin 2004) are often strong predictors for increased drug use among migrants; several studies suggest that recreational drug use is endemic in migrant camps in the U.S. (Weatherby et al., 1997; Kim-Goodwin and Bechtel, 2004; Denner et al., 2005). Furthermore, to increase work productivity, cocaine, speed, and/or caffeine pills are used to remain alert and be able to work longer hours (Apostolopolous et al., 2006).

Younger migrants are particularly vulnerable, such as immigrant adolescents and children of migrant workers. In a comparative study of migrant and non-migrant youth in rural south Texas, after adjusting for parent education, ethnicity, grade, and sex, migrant youth were significantly more likely to have ever used cocaine, marijuana, and inhalants compared to non-migrant youth. Moreover, for middle school students, migrant students were more likely to have ever injected illicit drugs compared to non-migrant youth (Cooper et al., 2005). In another cross-sectional study among youth in California, Hispanic immigrants engaged in a greater number of risk behaviours (i.e., alcohol and illicit drug use) compared to U.S.-born Hispanics and non-Hispanic whites, although levels of risk were most similar to the latter (Brindis et al., 1995). In contrast, according to a study of Hispanic students, immigrants viewed their current lives in comparison with life in their countries of origin where economic and social conditions were generally worse, but U.S.-born Hispanics were more likely to compare themselves with other adolescents in the U.S. and often concluded they had fewer resources. The authors suggested that as a result of the different frames of reference, U.S.-born Hispanic youth were more likely to experience distress and may use drugs more frequently than immigrant youth as a result (Suarez-Orozco and Suarez-Orozco, 1995). Research on peer-networks supports the hypothesis that drug and alcohol use may be a way to gain entrance to a more desirable social network (Warner et al., 2006).

In China, migrants are often young and poorly educated (Yang et al., 2005a) and represent one of the most potentially significant 'bridging' populations (Smith, 2005). Male migrants represent the largest proportion and are often away from home for most of the year, living in single-sex dormitories which are easy prey for drug dealers (Smith, 2005). Based on studies of HIV risk behaviour in China, temporary migrants are more likely than non-migrants to use illegal drugs (Smith, 2005). In a study conducted in Beijing, almost 50% of the clients in an involuntary drug treatment centre were migrants; the likelihood of drug use in this population was significantly greater than reported rates among permanent residents of the city. Furthermore, findings suggest that illicit drug use is more prevalent in places with more temporary migrants (Yang, 2005b).

2.3.2 Migration and riskier drug-related activity

Details regarding risky drug-related practices among migrant populations are not widely available; most literature focuses on the risky practices of IDU in general. However, in addition to increased drug use mentioned in the previous section, stress associated with migration may also increase the likelihood of engaging in risky injection activities. Recent observations indicate that migrants in the U.S. generally have limited access to health care services which often relates to economic constraints and language barriers (Organista et al., 2004; Parrado et al., 2004; Sanchez et al., 2004), although these findings may not generalize to other groups of migrants. Additionally,

prevailing social and cultural norms in the new setting may influence risk taking behaviour (Atlani et al., 2000; Rhodes, 2002; Parrado et al., 2004; Gyarmathy and Neaigus, 2005). For instance, while it is common in Mexican communities to use self-administered therapeutic injections for pain and infections (Pylypa, 2001), this practice continues after migration into the U.S. though migrants often have greater difficulties obtaining clean syringes as they are not as readily available (Organista et al., 2004). As clean needles are difficult to obtain, needle sharing becomes a problem and the risk of HIV transmission is compounded by those migrants who participate in therapeutic injections as well as those who inject illegal drugs. Of 363 migrant and marginally-housed Hispanics in central California, 28% reported injecting illegal drugs intravenously with approximately half reporting needle sharing (Organista and Organista, 1997; Denner et al., 2005). For undocumented and illegal migrants, the persistent fear of being caught by the police and/or immigration authorities creates barriers for those seeking health care (Apostolopoulos et al., 2006) and may further discourage individuals from carrying needles on their person, adding to their risk for syringe sharing.

Additionally the social dynamics of migration, whether an individual migrates alone or with a partner, may have a direct impact on the extent of social disruption (Soskolne and Shtarkshall, 2002) and resulting risk taking. For example, a commonly cited characteristic among migrant workers in Africa impacting sexual behaviour is

separation from a spouse or regular partner (Sanders and Sambo, 1991). Furthermore, sex ratios at the place of destination largely attributed to net migration can have a profound effect on migrant's sexual practices (Quinn, 1994), as has been particularly observed in areas where male migrant laborers are concentrated (e.g., mining communities in South Africa) and there is high demand for female commercial sex workers (CSW) (Brockhoff and Biddlecom, 1999). Drug suppliers may visit migrant camps and as was highlighted by Apostolopoulos et al. (2006), the same individuals that bring the drugs often bring the sex workers. In a study of Hispanic migrants in the U.S., those that injected drugs engaged in higher sexual risks than those who didn't use illicit drugs, including trading sex for drugs or money and less consistent condom use (Denner et al., 2005). The use of stimulants, including cocaine, is particularly important given its association with increased libido (Rawson et al., 2002) and having a high number of sexual partners, including those that inject drugs (Booth et al., 1993).

A lack of established social contacts may also have a protective effect against risk practices for drug users who migrate, as was demonstrated in one U.S. study where IDU reported much lower numbers of drug injection and sexual partners while traveling than when at home (Lee et al., 2002). A greater awareness of risk when with strangers and smaller social networks in new places were cited as explanations for the observed findings. However, in multiple U.S. studies IDU with newcomer status (i.e., migrants) have consistently reported riskier injection practices and were more likely to

share injecting equipment and inject in public places when compared to local IDU (Freeman et al., 1999; Paschane and Fisher, 2000; Deren et al., 2003). In Alaska, transitional migrants were up to 6 times more likely to share injection equipment compared to local homeless IDU (Paschane and Fisher, 2000). As well, in a large multi-center study, HIV serostatus was associated with both drug injection and sex while traveling (Williams et al., 1997).

In many parts of the world, sex work and drug use is linked: drug users resort to sex to fund their habit and rely on drugs to escape the pressures of their work (Grassly et al., 2003; Lowndes et al., 2003). China, Indonesia, Vietnam, several Asian republics, the Baltic states, and North Africa all have HIV epidemics driven by unsafe injection practices in addition to spread occurring through commercial sex work (Aceijas et al., 2004). Economic and political transitions in areas such as Ukraine, Moldova, and Russia have lead to major shifts in social norms which created increased opportunities for commercial sex work, particularly among women (Renton et al., 2006). However, there is a substantial overlap between sex workers and IDU; the number of Russian female IDU involved in sex work ranges from 10 to 30 percent (Gorbach et al., 2002). In Ukraine and Lithuania, a fraction (10-20%) of IDU trade sex for money and drugs, and most sex workers working the streets also report injection drug use (Atlani et al., 2000). Furthermore, a high proportion of sex workers throughout Eastern Europe and Asia are migrants stemming from smaller rural communities (Yang et al., 2005a; UNAIDS, 2006).

In the Latvian capital of Riga, for example, approximately one-sixth of sex workers come from rural areas abroad (Atlani et al., 2000). Through the intersection of injection drug use with risky sexual behaviours, combined with the rising number of those injecting and the increased ease of travel throughout the region, increased rates of STI have emerged. In virtually all parts of the former Soviet Union, reported syphilis rates have been increasing since 1991 (Borisenko et al., 1999; Renton et al., 2006).

Interestingly, the emergence of syphilis in Russia coincided with a similar epidemic in Finland which was reportedly enabled by tourism and the mobility of high-risk groups including IDU and commercial sex workers between the two countries (Borisenko et al., 1999; Atlani et al., 2000).

2.4 MOBILITY OF INJECTION DRUG USERS

2.4.1 Drug users are a mobile population

Injection drug users are a mobile population. Jones et al. (1988) reported that of 379 IDU who received treatment in Edinburgh between 1985-87, 26% had traveled to approximately 140 locations both within and outside of Scotland. Additionally, a later study found that 45% of sampled Scottish IDU had bridged national boundaries (Goldberg et al., 1994). Studies from North America have noted that mobility among IDU is common. A Canadian study monitoring risk behaviour among IDU noted that while the majority of participants cited the city where surveyed as their home residence, over 26% had lived elsewhere during the six month period prior to the study

(Health Canada, 2004). A large study of 49,621 IDU and their sexual partners from over 60 cities in the U.S. and Puerto Rico demonstrated that 48% had traveled outside their home cities in the previous two years (McCoy et al., 1996).

Circular migration patterns are also observed. Travel back to Vietnam is commonplace among Vietnamese IDU living in Australia, with one study reporting that 32% of 200 surveyed IDU had visited Vietnam with some frequency (Elliot et al., 2003). In North America, an "air bridge" has been identified linking Puerto Rico and New York which represents high reported rates of travel between the two regions, particularly among IDU (Deren et al., 2003). Other examples include seasonal migratory patterns such as Ukrainian IDU who often seek temporary work in Siberia (Dehne et al., 1999) as well as rural IDU in India who migrate to the cities in search of employment (Pal et al., 2003).

While further research is necessary to understand the main drivers of mobility, participants in one study cited social pressures including legal problems and entering drug treatment programs as their primary reasons for travel (Drucker, 1990). Drug tourism may be another factor driving the mobility of drug users wanting to conduct illegal activities (Drucker, 1990; Uriely and Belhassen, 2005).

There are, however, examples of factors restricting IDU mobility. Poverty may make travel abroad difficult as is often the case for marginalized IDU in Hungary (Gyarmathy and Neaigus, 2005). More common is a seasonally driven tendency to move within Hungary and Budapest to “milk poppies” during May and September (Gyarmathy and Neaigus, 2005). Fear of inspection by authorities or lack of travel documents may also discourage some IDU from crossing borders or moving beyond their home areas. Where social networks remain closed or limited, as has been previously described among Eastern Europe’s Roma populations (Kabakchieva et al., 2006), the diffusion of infectious diseases may be slowed. Haw and Higgins (1998) argue that HIV epidemics associated with IDU tend to remain more concentrated in specific geographic areas relative to other modes of transmission. As a result, HIV infection may remain in specific injecting networks.

2.4.2 Mobility among IDU as a factor in the introduction and subsequent spread of HIV

In a world where barriers limiting international travel are lowering, economic migration or other forms of mobility have played an increasing role in the transmission of diseases (Drucker, 1990; McCoy et al., 1996; Elliot et al., 2003). It only takes one or two IDU to import infection into a new social network, and there is substantial evidence indicating that HIV epidemics among IDU develop rapidly (Brettle, 1991; Goldberg et al., 1994; Hamers et al., 1997). Studies conducted in Scotland and Sweden in the early nineties demonstrate that HIV was introduced into networks of IDU in these regions

after a small group of IDU, in search of heroin, returned from southern Europe where the HIV epidemic had taken hold 2-3 years earlier (Brette, 1991; Goldberg et al., 1994). While abroad, several IDU shared injecting equipment with local users and became infected with HIV. Upon return back to their home countries, these mobile IDU introduced the virus into drug using networks there. More recently, spatial bridging has also been a factor in introducing HIV to networks of IDU in lower prevalence cities in the U.S. (Williams et al., 2005).

When injection drug use and mobility overlap, risk for infectious disease transmission to other populations may be substantially elevated. Drucker (1990) discusses the phenomenon of mobile IDU and suggests that when geographical boundaries are breached, needle sharing networks may become blurred and the morphology of some networks may be more fluid, offering opportunities for visiting or new members to participate in high risk activities (McCoy et al., 1996). Furthermore, when IDU travel to sell drugs the spread of HIV may be fostered via "sampling goods" which often involves needle sharing and drug-related sexual contact (Drucker, 1990).

Regional variations in HIV prevalence and incidence often occur within continents, countries, and even cities and smaller communities (Aceijas et al., 2004). While most research has focused on urban areas, in some settings HIV/AIDS is

increasing at a faster rate in rural areas (Graham et al., 1995), as is being observed in the U.S. Interestingly, a distinguishing feature of HIV epidemics in rural America is that most are not infected locally (Cohn et al., 1994; Graham et al., 1995; Lagarde et al., 2003). Many individuals migrate home for family support upon receiving an HIV diagnosis in the urban centers (Cohn et al., 1994; White, 2003). Further, Lansky et al. (2000) noted in their study of rural HIV, that drug involvement was generally associated with those infected elsewhere, while heterosexual contact was a growing factor for those infected locally. However, young, impoverished minority women who use crack cocaine and have multiple partners represent a growing proportion of rural HIV cases (Holmberg, 1996).

Mobility between cities and indigenous reserves is an important factor in the introduction and subsequent spread of HIV among Aboriginal individuals (Paschane and Fisher, 2000). In Canada, Aboriginal communities are disproportionately impacted by the AIDS epidemic; in Vancouver, Aboriginal IDU are becoming HIV-positive at twice the rate of non-Aboriginal IDU (Craib et al., 2003) and in 2001, more than one in every 100 Aboriginals over the age of 15 in British Columbia was living with HIV (Hogg et al., 2005). According to the Canadian Aboriginal AIDS Network (1998) as many as "79% of Aboriginal IDU visit their reserves with some frequency. While on the reserve, they may share needles or have unprotected sex with community members". Therefore, migration to and from these areas by Aboriginals increases the likelihood

that HIV will be introduced into previously unexposed populations (Wood et al., 2000b).

2.5 POLICY IMPLICATIONS AND CONCLUSIONS

Some 20 years of research demonstrates that HIV epidemics among IDU can be prevented, stabilized, and even reversed using a comprehensive harm reduction strategy including needle exchange programmes (NEPs), access to HIV testing and counseling, peer referral, and street outreach (Paone et al., 1995; Haw and Higgins, 1998; Des Jarlais et al., 2000; Wood et al., 2001). Yet in some regions, uptake of these strategies has been slow or entirely avoided while funding for a limited number of programs continues to drop (UNAIDS, 2006). The lack of a supportive policy environment is one of the greatest obstacles for controlling HIV among IDU, particularly in regions such as the Russian Federation where many social barriers exist, making programmes difficult to implement (Mashkilleyson and Leinikki, 1999). Additionally, the large role that commercial sex work has played in HIV transmission in some areas presents additional challenges as the potential for a heterosexually driven epidemic increases. Some research suggests that mobile IDU seeking services generally lack knowledge of and accessibility to social and medical services, including harm reduction strategies. For example, Vietnamese IDU residing in Australia generally have a poorer understanding of what services are available and how to access them and as a result show lower uptake of NEPs and are less likely to be in drug treatment (Elliot et

al., 2003). Rural IDU may be at greater risk of transmission due to limited services provision as well as social and geographical isolation (Graham et al., 1995; White, 2003; Day et al., 2006). Regional variations in Ontario, Canada demonstrate that IDU residing in the less populated regions were less likely to have ever been in treatment when compared to IDU living in and around the metropolitan areas (Millson et al., 2003).

Such implications suggests that policies need to be multi-faceted, recognizing the specific needs of migrant populations and working to increase their access to health services (Magis-Rodriguez et al., 2004; Organista et al., 2004; Sanchez et al., 2004; Day et al., 2006). Health promotion campaigns that address general well-being and mental health issues among migrant communities are necessary to tackle the stressors that often lead to substance abuse. Further, given that certain areas, including trafficking routes, are hotspots for drug use and related HIV diffusion, particular attention should be directed towards monitoring the movement of drug users in these regions. Structural interventions along border regions also offer opportunities to stabilize HIV diffusion in neighboring countries. For example, the cross-border project initiated in 2002 by Hammett and colleagues in Lang Son, Vietnam and Guangxi, China offers an excellent example of how high risk behaviours can be reduced and IDU-associated HIV prevalence stabilized (Hammett et al., 2006). Mobile clinics with HIV/STI testing and counseling and condom and needle distribution are one intervention that may be particularly useful for migrants living in communities in remote settings. The degree to

which various existing policies are inadvertently contributing to drug-related harm, such as legal practices which dissuade persons from using NEPs or from carrying their own equipment, need to be examined further in the context of migration (Longshore et al.,1998).

There are several limitations to consider when interpreting this review. As studies from several countries/regions were included, findings may not be generalizable to all populations. Furthermore, studies included often differed in their target populations and study designs, making comparisons and generalizations between studies difficult. The limited detail regarding the methodology used (i.e., sampling, biases) in non peer-reviewed data included in this review make it difficult to assess the reliability and quality of these findings. Selection effects across studies may make it difficult to determine whether it is migration or other social factors directly influencing risk behaviour. That is to say that in many cases, migration may simply be a correlate of risk-taking rather than a cause.

The spread of drug use is common along drug trafficking routes as well as in porous border regions where population movement and mixing is facilitated. HIV diffusion in these regions is evident as has been described in this review. While the process of migration is selective and governed by various push and pull factors, the new environment in most cases will present demands that challenge the migrant's

adaptive abilities. Further, the extent to which individuals engage in risk varies with background characteristics, individual resilience, adaptability, and patterns of migration. While the research in this area is nowhere near conclusive, studies from specific groups including Hispanic migrants in the U.S. and rural-to-urban workers in China have demonstrated generally high levels of drug use often tied to the stressors of migrating. Generally, IDU are relatively mobile whether travel is related to drug tourism or trafficking, employment seeking opportunities, or wanting to visit family and friends. When injection drug use and mobility overlap, risk for HIV transmission to other populations and geographic areas increases. Infectious disease diffusion may occur even more rapidly when injecting is coupled with risky sexual behaviours; as we described in this review paper, there is much overlap between drug use and the sex trade, making mobile IDU a particularly important population in the global spread of HIV infection.

2.6 REFERENCES

- Abdala, N., Grund, J.P.C., Tolstov, Y., Kozlov, A.P., Heimer, R., 2006. Can home-made injectable opiates contribute to the HIV epidemic among injection drug users in the countries of the former Soviet Union? *Addiction* 101, 731-737.
- Aceijas, C., Stimson, G.V., Hickman, M., Rhodes, T., 2004. Global overview of injecting drug use and HIV infection among injecting drug users. *AIDS* 18, 2295-2303.
- Alderete, E., Vega, W.A., Kolody, B., Aguilar-Gaxiola, S., 1999. Depressive symptomatology: prevalence and psychosocial risk factors among Mexican migrant farmworkers in California. *J. Community Psychol.* 27, 457-471.
- Apostolopoulos, Y., Sonmez, S., Kronenfeld, J., Castillo, E., McLendon, L., Smith, D., 2006. STI/HIV risks for Mexican migrant laborers: exploratory ethnographies. *J. Immigr. Min. Health* 8, 291-302.
- Atlani, L., Carael, M., Brunet, J.B., Frasca, T., Chaika, N., 2000. Social change and HIV in the former USSR: the making of a new epidemic. *Soc. Sci. Med.* 2000, 1547-1556.
- Benotsch, E., Somlai, A.M., Pinkerton, S.D., Kelly, J.A., Ostrovski, D., Gore-Felton, C., Kozlov, A.P. 2004., Drug use and sexual risk behaviours among female Russian IDUs who exchange sex for money or drugs. *Int. J. STD AIDS* 15, 343-347.
- Beyrer, C., Razak M.H., Lisam, K., Chen, J., Lui, W., Yu, X.F., 2000. Overland heroin trafficking routes and HIV-1 spread in south and south-east Asia. *AIDS* 14, 75-83.

- Booth, R.E., Watters, J.K., Chitwood, D.D., 1993. HIV risk-related sexual behaviours among injection drug users, crack-smokers, and injection drug users who smoke crack. *Am. J. Public Health* 83, 1144-1148.
- Borisenko, K., Tichonova, L.I., Renton, A.M., 1999. STIs in the Russian Federation. *Int. J. STD AIDS* 10, 666-668.
- Brettle, R., 1991. HIV and harm reduction for injection drug users. *AIDS* 5, 125-136.
- Brindis, C., Wolfe, A.L., McCarter, V., Ball, S., Starbuck-Morales, S., 1995. The associations between immigrant status and risk-behaviour patterns in Latino adolescents. *J. Adolesc. Health* 17, 99-105.
- Brockerhoff, M., Biddlecom, A.E., 1999. Migration, sexual behaviour and the risk of HIV in Kenya. *Int. Migr. Rev.* 33, 833-856.
- Brouwer, K.C., Case, P., Ramos, R., Magis-Rodriguez, C., Bucardo, J., Patterson, T.L., Strathdee, S.A., 2006a. Trends in production, trafficking and consumption of methamphetamine and cocaine in Mexico. *Subst. Use Misuse* 41, 707-727.
- Brouwer, K.C., Strathdee, S.A., Magis-Rodriguez, C., Bravo-Garcia, E., Gayet, C., Patterson, T.L., Bertozzi, S.M., Hogg, R.S., 2006b. Estimated numbers of men and women infected with HIV/AIDS in Tijuana, Mexico. *J. Urban Health* 83, 299-307.
- Bucardo, J., Brouwer, K.C., Magis-Rodriguez, C., Ramos, R., Fraga, M., Perez, S.G., Patterson, T.L., Strathdee, S.A., 2005. Historical trends in the production and consumption of illicit drugs in Mexico: implications for the prevention of blood borne infections. *Drug Alcohol Depend.* 79, 289-293.

- Canadian Aboriginal AIDS Network, 1998. Joining the Circle: An Aboriginal Harm Reduction Model. Available at www.niichro.com/hiv/hiv_7.html. Accessed on September 23, 2004.
- Ciccarone, D., Bourgois, P., 2003. Explaining the geographical variation of HIV among injection drug users in the United States. *Subst. Use Misuse* 38, 2049-2063.
- Cohn, S., Klein, J.D., Mohr, J.E., van der Horst, C.M., Weber, D.J., 1994. The geography of AIDS: patterns of urban and rural migration. *South. Med. J.* 87, 599-606.
- Consejo Nacional para la Prevencion y Control del VIH/SIDA, 2004. AIDS by the Numbers. Available at <http://www.salud.gob.mx/conasida/estadis.htm>. Accessed February 20, 2005.
- Cooper, S.P., Weller, N.F., Fox, E.E., Cooper, S.R., 2005. Comparative description of migrant farmworkers versus other students attending rural south Texas schools: substance use, work and injuries. *J. Rural Health* 21, 361-366.
- Craib, K., Spittal, P.M., Wood, E., Laliberte, N., Hogg, R.S., Li, K., Heath, K., Tyndall, M.W., O'Shaughnessy, M.V., Schechter, M.T., 2003. Risk factors for elevated HIV incidence among Aboriginal injection drug users in Vancouver. *CMAJ.* 168, 19-24.
- Day, C., Conroy, E., Lowe, J., Page, J., Dolan, K., 2006. Patterns of drug use and associated harms among rural injecting drug users: Comparisons with metropolitan injecting drug users. *Aust. J. Rural Health* 14, 120-125.

- Drug Enforcement Administration, 1991-1993. Domestic monitoring reports Jan-Dec for 1991-1993. Washington, DC: U.S. Department of Justice.
- Drug Enforcement Administration, 2006. Heroin-National Drug Threat Assessment-2006. Available at <http://www.dea.gov/concern/18862/heroin.htm>. Accessed August 16, 2006.
- Deany, P., 2000. HIV and Injection drug use: A new challenge to sustainable human development. UNDP HIV and Development Programme/UNDP Asia-Pacific Regional Programme on HIV and Development. Available at <http://www.undp.org/hiv/publications/deany.htm>. Accessed June 25, 2006.
- Dehne, K. L., Khodakevich, L., Hamers, F.F., Schwartlander, B., 1999. The HIV/AIDS epidemic in Eastern Europe: recent patterns and trends and their implications for policy-making. *AIDS* 13, 741-749.
- Denner, J., Organista, K.C., Dupree, J.D., Thrush, G., 2005. Predictors of HIV transmission among migrant and marginally housed Latinos. *AIDS Behav.* 9, 201-210.
- Deren, S., Kang, S.Y., Colon, H.M., Andia, J.F., Robles, R.R., Oliver-Velez, D., Finlinson, A., 2003. Migration and HIV risk behaviours: Puerto Rican drug injectors in New York City and Puerto Rico. *Am. J. Public Health* 93, 812-816.

- Des Jarlais, D., Marmor, M., Friedmann, P., Titus, S., Aviles, E., Deren, S., Torian, L., Glebatis, D., Murrill, C., Monterroso, E., Friedman, S.R., 2000. HIV incidence among injection drug users in New York City, 1992-1997: evidence for a declining epidemic. *Am. J. Public Health* 90, 352-359.
- Drucker, E., 1990. Epidemic in the war zone: AIDS and community survival in New York City. *Int. J. Health Serv.* 20, 602-615.
- Elliot, J., Mijch, A.M., Street, A.C., Crofts, N., 2003. HIV, ethnicity and travel: HIV infection in Vietnamese Australians associated with injection drug use. *J. Clin. Virol.* 26, 133-142.
- Freeman, R., Williams, M.L., Sanders, L.A., 1999. Drug use, AIDS knowledge and HIV risk behaviours of Cuban-, Mexican-, and Puerto Rican-born drug injectors who are recent entrants into the United States. *Subst. Use Misuse* 34, 1765-1793.
- Goldberg, D., Frischer, M., Taylor, A., Green, S.T., McKeganey, N., Bloor, M., Reid, D., Cossar, J., 1994. Mobility of Scottish injecting drug users and risk of HIV infection. *Eur. J. Epidemiol.* 10, 387-392.
- Gorbach, P.M., Ryan, C., Saphonn, V., Detels, R. 2002., The impact of social, economic and political forces on emerging HIV epidemics. *AIDS* 16, s35-s43.
- Graham, R., Forrester, M.L., Wysong, J.A., Rosenthal, T.C., James, P.A., 1995. HIV/AIDS in the rural United States: Epidemiology and health services delivery. *Med. Care Res. Rev.* 52, 435-452.

- Grassly, N.C., Lowndes, C.M., Rhodes, T., Judd, A., Renton, A., Garnett, P., 2003. Modelling emerging epidemics: The role of injecting drug use and sexual transmission in the Russian Federation. *Int. J. Drug Policy* 14, 25-43.
- Gyarmathy, V., Neaigus, A., 2005. Marginalized and socially integrated groups of IDUs in Hungary: potential bridges of HIV infection. *J. Urban Health* 82, iv101-112.
- Hamers, F., Batter, V., Downs, A.M., Alix, J., Cazein, F., Brunet, J.B., 1997. The HIV epidemic associated with injecting drug use in Europe: geographic and time trends. *AIDS* 11, 1365-1374.
- Hammett, T.M., Kling, R., Johnston, P., Liu, W., Ngu, D., Friedmann, P., Thanh-Binh, K., Viet-Dong, H., Kie-Van, L., Donghua, M., Chen, Y., Des Jarlais, D.C., 2006. Patterns of HIV prevalence and HIV risk behaviours among injection drug users prior to and 24 months following implementation of cross-border HIV prevention interventions in Northern Vietnam and South China. *AIDS Educ. Prev.* 18, 97-115.
- Hansen, E., Donohoe, M., 2003. Health issues of migrant and seasonal farmworkers. *J. Health Care Poor Underserv.* 14, 153-163.
- Haw, S., Higgins, K., 1998. A comparison of the prevalence of HIV infection and injecting risk behaviour in urban and rural samples in Scotland. *Addiction* 93, 855-863.

Hawkes, S., Hart, G.J., 1993. Travel, migration and HIV. *AIDS Care* 5, 207-214.

Health Canada, 2004. Health Canada: I-Track- Enhanced Surveillance of Risk

Behaviours among Injecting Drug Users in Canada, Pilot Survey Report (2004)

Available at [http://www.phac.aspc.gc.ca/bid-bmi/dsd-dsm/nb-](http://www.phac.aspc.gc.ca/bid-bmi/dsd-dsm/nb-ab/2004/nb2804_e/html)

[ab/2004/nb2804_e/html](http://www.phac.aspc.gc.ca/bid-bmi/dsd-dsm/nb-ab/2004/nb2804_e/html). Accessed on July 10, 2005.

Hien, N.T., Long, N.T., Huan, T.Q., 2004. HIV/AIDS epidemics in Vietnam: evolution and responses. *AIDS Educ. Prev.* 16, 137-154.

Hogg, R.S., Strathdee, S.A., Kerr, T., Wood, E., Remis, R., 2005. HIV Prevalence among Aboriginal British Columbians. *Harm Reduct. J.* 2, 26.

Holmberg, S.D., 1996. The estimated prevalence and incidence of HIV in 96 large US metropolitan areas. *Am. J. Public Health* 86, 642-654.

Hovey, J.D., Magana, C.G., 2000. Acculturative stress, anxiety and depression among Mexican immigrant farmworkers in the Midwest United States. *J. Immigr. Health* 2, 119-131.

International Organization for Migration/Joint United Nations on HIV/AIDS, 1998.

Migration and AIDS. *Int. Migr.* 36, 446-468.

Johnson, T.P., VanGeest, J.B., Cho, Y.I., 2002. Migration and substance abuse: evidence from the US national health interview survey. *Subst. Use Misuse* 37, 941-972.

Joint United Nations Programme on HIV/AIDS, 2004. Report on the Global epidemic.
4th report. Available at

http://www.unaids.org/bangkok2004/GAR2004_html/GAR2004_00_en.htm.

Accessed on September 15, 2006.

Joint United Nations Programme on HIV/AIDS, 2006. Report on the global AIDS
epidemic. Available at

http://www.unaids.org/en/HIV_data/2006GlobalReport/default.asp. Accessed on
August 30, 2006.

Jones, G., Davidson, J., Bisset, C., Brettle, R.P., 1988. Mobility of injection drug users as a
means of spread for the human immunodeficiency virus. *ANSWER*. A76, 1-4.

Kabakchieva, E., Vassileva, S., Kelly, J.A., Amirkhanian, Y.A., Difranceisco, W.J.,

Mcauliffe, T.L., Antonova, R., Mihaylova, M., Vassilev, B., Khoursine, R.,

Petrova, E., 2006. HIV risk behaviour patterns, predictors and sexually

transmitted disease prevalence in the social networks of young Roma (Gypsy)

men in Sofia, Bulgaria. *Sex. Transm. Dis.* 33, 485-490.

Kato, K., Kusagawa, S., Motomura, K., Yang, R., Siino, T., Nohtomi, K., Lwin, H.H.,

Tun, K.M., Thwe, M., Oo, K.Y., Lwin, S., Kyaw, O., Zaw, M., Nagai, Y., Takebe,

Y., 2001. Closely related HIV-1 CRF01_AE variant among injecting drug users in

Northern Vietnam: Evidence of spread across the Vietnam-China border. *AIDS*

Res. Hum Retroviruses 17, 113-123.

- Kim-Goodwin, V.S., Bechtel, G.A., 2004. Stress among migrant and seasonal farmworkers in rural southeast North Carolina. *J. Rural Health* 20, 271-278.
- Lagarde, E., Schim van der Loeff, M., Enel, C., Homgren, B., Dray-Spira, R., Pison, G., Piau, P.J., Delaunay, V., M'Boup, S., Ndoye, I., Coeuret-Pellier, M., Whittle, H., Aaby, P., MECORA group., 2003. Mobility and the spread of human immunodeficiency virus into rural areas of West Africa. *Int. J. Epidemiol.* 32, 744-752.
- Lee, D., Bell, C., Hinojosa, M., 2002. Drug use, travel and HIV risk. *AIDS Care* 14, 443-453.
- Liitsola, K., Tashkinova, I., Laukkanen, T., Korovina, G., Smolskaja, T., Momot, O., Mashkilleyson, N., Chaplinskias, S., Brummer-Korvenkontio, H., Vanhatalo, J., Leinikki, P., Salminen, M.O., 1998. HIV-1 genetic subtype A/B recombinant strain causing an explosive epidemic in injecting drug users in Kaliningrad. *AIDS* 12, 1907-1919.
- Lindan, C., Lieu, T.X., Giang, L.T., Lap, V.D., Thuc, N.V., Thinh, T., Lune, P., Mandel, J.S., 1997. Rising HIV infection rates in Ho Chi Minh City herald emerging AIDS epidemic in Vietnam. *AIDS* 11, s5-s13.
- Longshore, D., Reuter, P., Derks, J., Grapendaal, M., Ebener, P., 1998. Drug policies and harms: a conceptual framework. *Eur. Addict. Res.* 4, 172-182.
- Lowndes, C. H., Alary, M., Platt, L., 2003. Injection drug use, commercial sex work and HIV/STI epidemics in the Russian Federation. *Sex. Transm. Dis.* 30, 46-48.

- Lyttleton, C., Amarapibal, A., 2002. Sister cities and easy passage: HIV, mobility and economies of desire in a Thai/Lao border zone. *Soc. Sci. Med.* 54, 505-518.
- Magana, C.G., Hovey, J.D., 2003. Psychological stressors associated with Mexican migrant farmworkers in the Midwest United States. *J. Immigr. Health* 5, 75-86.
- Magis-Rodriguez, C., Gayet, C., Negroni, M., Leyva, R., Bravo-Garcia, E., Uribe, P., Bronfman, M., 2004. Migration and AIDS in Mexico: An overview based on recent evidence. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 37, S215-226.
- Magis-Rodriguez, C., Ruiz-Badillo, A., Ortiz-Mondragon, R., Loya-Sepulveda, M., Bravo-Portela, M.J., Lozada, R., 2002. Study of risk practices for infection with HIV/AIDS in drug injectors from the city of Tijuana, Baja California INSP-CENIDS. Available at <http://bus.insp.mx/compenen/svirtual/ppriori/09/0399/arti.htm>. Accessed January 5, 2005.
- Mashkilleyson, N., Leinikki, P., 1999. Evolution of the HIV epidemic in Kaliningrad, Russia. *J. Clin. Virol.* 12, 37-42.
- Maxwell, J.C., Cravioto, P., Galvan, F., Ramirez, M.C., Wallisch, L.S., Spence, R.T., 2006. Drug use and risk of HIV/AIDS on the Mexico-USA border: a comparison of treatment admissions in both countries. *Drug Alcohol Depend.* 82, s85-s93.
- Mayer, J., 2000. Geography, ecology and emerging infectious diseases. *Soc. Sci. Med.* 50, 937-952.

- McCoy, V., Correa, R., Fritz, E., 1996. HIV diffusion patterns and mobility: gender differences among drug users. *Pop. Res. Policy Review* 15, 249-264.
- McMichael, A., 2004. Environmental and social influences on emerging infectious diseases: past, present and future. *Phil. Trans. R. Soc. Lond. B. Biol. Sci.* 359, 1049-1058.
- Medina-Mora, M.E., Rojas-Guiot, E., 2003. Demand of drugs: Mexico in the international perspective. *Salud. Mental.* 26, 1-11.
- Millson, P., Myers, T., Calzavara, L., Wallace, E., Major, C., Degani, N., 2003. Regional variation in HIV prevalence and risk behaviours in Ontario injection drug users (IDU). *Can. J. Public Health* 94, 431-435.
- Montoya, I.D., Atkinson, J.S., 1996. Determinants of HIV seroprevalence rates among sites participating in a community-based study of drug users. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 13, 169-176.
- National Drug Intelligence Center, 2005. National Drug Threat Assessment 2005- Executive summary. Available at <http://www.usdoj.gov/ndic/pubs11/13745/heroin.htm>. Accessed on September 25, 2006.
- Nguyen, T.A., Hoang, L.T., Pham, V.Q., Detels, R., 2001. Risk factors for HIV-1 seropositivity in drug users under 30 years old in Haiphong, Vietnam. *Addiction* 96, 405-413.

- Organista, K.C, Carrillo, H., Ayala, G., 2004. HIV prevention with Mexican migrants: review, critique and recommendations. *J. Acquir. Immune Defic. Syndr.* 37, s227-s239.
- Organista, K.C., Organista, P.B., 1997. Migrant laborers and AIDS in the United States: a review of the literature. *AIDS Educ. Prev.* 9, 83-93.
- Ortega, A.N., Rosenheck, R., Alegria, M., Desai, R.A., 2000. Acculturation and lifetime risk of psychiatric and substance use disorders among Hispanics. *J. Nerv. Ment. Dis.* 188, 728-735.
- Pal, B.B., Khuntia, H.K., Acharya, A.S., Chhotray, G.P., 2003. Drug abusers: a new high risk population for HIV infection in Orissa. *Indian J. Med. Microbiol.* 21, 262-264.
- Paone, D., Des Jarlais, D.C., Gangloff, R., Milliken, J., Friedman, S.R., 1995. Syringe exchange: HIV prevention, key findings, and future directions. *Int. J. Addict.* 30, 1647-1683.
- Parrado, E.A., Flippen, C.A., McQuiston, C., 2004. Use of commercial sex workers among hispanic migrants in North Carolina: Implications for the Spread of HIV. *Perspect. Sex. Reprod. Health* 36, 150-156.
- Paschane, D., Fisher, D.G., 2000. Etiology of limited transmission diseases among drug users: does recent migration magnify the risk of sharing injection equipment. *Soc. Sci. Med.* 50, 1091-1097.
- Pylypa, J., 2001. Self-medication practices in two California Mexican communities. *J. Immigr. Health* 3, 59-75.

- Quan, V.M., Chung, A., Long, H.T., Dondero, T.J., 2000. HIV in Vietnam: the evolving epidemic and the prevention response, 1996 through 1999. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 25, 360-369.
- Quinn, T., 1994. Population migration and the spread of types 1 and 2 human immunodeficiency viruses. *Proc. Natl. Acad. Sci. USA* 91, 2407-2414.
- Rawson, R.A., Washton, A., Domier, C.P., Reiber, C., 2002. Drugs and sexual effects: role of drug type and gender. *J. Subst. Abuse Treat.* 22, 103-108.
- Renton, A., Gzirishvili, D., Gotsadze, G., Godinho, J., 2006. Epidemics of HIV and sexually transmitted infections in Central Asia. Trends, drivers and priorities for control. *Int. J. Drug Policy* 17, 494-503.
- Rhodes, T., 2002. The 'risk' environment: A framework for understanding and reducing drug related harm. *Int. J. Drug Policy* 13, 85-94.
- Rhodes, T., Ball, A., Stimson, G.V., Kobyschka, Y., Fitch, C., Pokrovsky, V., Bezruchenko-Novachuk, M., Burrows, D., Renton, A., Andruschak, L., 1999. HIV infection associated with drug injecting in the Newly Independent States, Eastern Europe: the social and economic context of epidemics. *Addiction* 94, 1323-1336.
- Rhodes, T., Singer, M., Bourgois, P., Friedman, S.R., Strathdee, S.A., 2005. The social structural production of HIV risk among injecting drug users. *Soc. Sci. Med.* 61, 1026-1044.

- Ruxrungtham, K., Brown, T., Phanuphak, P., 2004. HIV/AIDS in Asia. *Lancet* 364, 69-82.
- Sanchez, M., Lemp, G.F., Magis-Rodriguez, C., Bravo-Garcia, E., Carter, S., Ruiz, J.D., 2004. The epidemiology of HIV among Mexican migrants and recent immigrants in California and Mexico. *J. Acquir. Immune Defic. Syndr.* 37, s204-s214.
- Sanders, D., Sambo, A., 1991. AIDS in Africa: The implications of economic recession and structural adjustment. *Health Policy Plan.* 6, 157-165.
- Smith, C.J., 2005. Social geography of sexually transmitted diseases in China: Exploring the role of migration and urbanization. *Asia Pac. Viewp.* 46, 65-80.
- Soskolne, V., Shtarkshall, R.A., 2002. Migration and HIV prevention programmes: linking structural factors, culture, and individual behaviour-an Israeli experience. *Soc. Sci. Med.* 55, 1297-1307.
- Secretaría de Salubridad y Asistencia, 1998. National Survey of Addictions. Epidemiologic Data. Available at <http://www.salud.gob.mx/unidades/conadic/epidem.htm>. Accessed February 14, 2004.
- Stimson, G.V., 1993. The global diffusion of injecting drug use: implications for human immunodeficiency virus infection. *Bull. Narc.* 45, 3-17.
- Strathdee, S.A., van Ameijden, E.J., Mesquita F., Wodak, A., Rana, S., Vlahov, D., 1998. Can HIV epidemics among injection drug users be prevented? *AIDS* 12, s71-s79.

- Suarez-Orozco, C., Suarez-Orozco, M.M., 1995. Transformations: Immigration, Family Life and Achievement Motivation among Latino Adolescents. Stanford University Press, Stanford, CA.
- United Nations International Drug Control Program, 2000. Afghanistan Annual Opium Poppy Survey. Available at http://www.unodc.org/pdf/publications/report_2000_12_31_1.pdf. Accessed on September 5, 2006.
- United Nations Office on Drugs and Crime, 2004. World Drug Report 2004. Available at http://www.unodc.org/unodc/en/world_drug_report_2004.html. Accessed on November 16, 2006.
- United Nations Office on Drugs and Crime, 2005. World Drug Report 2005. World Drug Report. Available at http://www.unodc.org/unodc/en/world_drug_report.html. Accessed on January 10, 2007.
- Uriely, N., Belhassen, Y., 2005. Drugs and tourists' experiences. *J. Travel Res.* 43, 238-246.
- U.S. Central Intelligence Agency, 2000. "Major Narco Trafficking Routes and Crop Areas" GPO item 751981AI (R00350) 1-00
- U.S. Department of Justice, 2004. US customs service. Office history 2004. Available at: http://www.usdoj.gov/usao/cas/HTML/office_history.html. Accessed on August 17, 2005.

- Vega, W.A., Aguilar-Gaxiola, S., Andrade, L., Bijl, R., Borges, G., Caraveo-Andjuaga, J.J., DeWit, D.J., Heeringa, S.G., Kessler, R.C., Kolody, B., Merikangas, K.R., Molnar, B.E., Walters, E.E., Warner, L.A., Wittchen, H.U., 2002. Prevalence and age of onset for drug use in seven international sites: results from the international consortium of psychiatric epidemiology. *Drug Alcohol Depend.* 68, 285-297.
- Vega, W.A., Alderete, E., Kolody, B., Aguilar-Gaxiola, S., 1998. Illicit drug use among Mexicans and Mexican Americans in California: the effects of gender and acculturation. *Addiction* 93, 1839-1850.
- Villatoro, J.A., Medina-Mora, M.E., Juarez, F., Rojas-Guiot, E., Carreno, S., Berenzon, S., 1998. Drug use pathways among high school students of Mexico. *Addiction* 93, 1577-1588.
- Warner, L.A., Valdez, A., Vega, W.A., de la Rosa, M., Jay Turner, R., Canino, G., 2006. Hispanic drug abuse in an evolving cultural context: an agenda for research. *Drug Alcohol Depend.* 84, s8-s16.
- Weatherby, N.L., McCoy, H.V., Bletzer, K.V., McCoy, C.B., Inciardi, J.A, McBride, D.C, Forney, M.A., 1997. Immigration and HIV risk among migrant workers in rural Southern Florida. *Int. J. Drug Issues.* 27, 155-172.
- White, R. 2003. Commentary: What can we make of an association between human immunodeficiency virus prevalence and population mobility? *Int. J. Epidemiol.* 32, 753-754.

- Williams, M., Atkinson, J., Klovdahl, A., Ross, M.W., Timpson, S., 2005. Spatial bridging in a network of drug-using male sex workers. *J. Urban Health* 82, i35-i42.
- Williams, M., Zhao, Z., Bowen, A.M., Freeman, R.C., Elwood, W.N., Rusek, R., 1997. Introduction of HIV into drug injector networks outside AIDS epicenters. *Int. J. STD AIDS* 8, 629-635.
- Wood, E., Chan, K., Montaner, J.S.G., Schechter, M.T., Tyndall, M.W., O'Shaughnessy, M.V., Hogg, R.S., 2000a. The end of the line: has rapid transit contributed to the spatial diffusion of HIV in one of Canada's largest metropolitan areas? *Soc. Sci. Med.* 51, 741-748.
- Wood, E., Tyndall, M.W., Spittal, P.M., Li, K., Kerr, T., Hogg, R.S., Montaner, J.S., O'Shaughnessy, M.V., Schechter, M.T., 2001. Unsafe injection practices in a cohort of injection drug users in Vancouver: could safer injecting rooms help? *CMAJ.* 165, 405-410.
- Wood, E., Yip, B., Gataric, N., Montaner, J.S.G., O'Shaughnessy, M.V., Schechter, M.T., Hogg, R.S., 2000b. Determinants of geographic mobility among participants in a population-based HIV/AIDS drug treatment program. *Health Place* 6, 33-40.
- Wu, Z., Detels, R., Zhang, J., Duan, S., Cheng, H., Li, Z.R., Dong, L., Huang, S., Jia, M., Bi, X., 1996. Risk factors for intravenous drug use and sharing equipment among young male drug users in young male drug users in Longchuan Country, southwest China. *AIDS* 10, 1017-1024.

- Xiao, Y., Kristensen, S., Sun, J., Lu., L, Vermund, S.H., 2007. Expansion of HIV/AIDS in China: Lessons from Yunnan province. *Soc. Sci. Med.* 64, 665-675.
- Yang, H., Li, X., Stanton, B., Liu, H., Liu, H., Wang, N., Fang, X., Lin, D., Chen, X., 2005a. Heterosexual transmission of HIV in China: A systematic review of behavioural studies in the past two decades. *Sex. Transm. Dis.* 32, 270-280.
- Yang, X., 2005b. Does where we live matter? Community characteristics and HIV and sexually transmitted disease prevalence in southwestern China. *Int. J. STD AIDS* 16, 31-37.
- Yu, X. F., Chen, J., Shao, Y., Beyrer, C., Liu, B., Wang, Z., Liu, W., Yang, J., Liang, S., Viscidi, R.P., Gu, J., Gurri-Glass, G., Lai, S., 1999. Emerging HIV infections with distinct subtypes of HIV-1 infection among injection drug users from geographically separate locations in Guangxi province, China. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 22, 180-188.
- Zhang, C., Yang, R., Xia, X., Qin, S., Dai, J., Zhang, Z., Peng, Z., Wei, T., Liu, H., Pu, D., Luo, J., Takebe, Y., Ben, K., 2002. High prevalence of HIV-1 and hepatitis C virus coinfection among injection drug users in southeastern region of Yunnan, China. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 29, 191-196.

Table 2.1. Drug-related risk behaviours of mobile populations

Author/Year	Country	Context	Risk Behavior	Mobility	
				Yes	No
Brindis, 1995	USA	California High School Students	Engaged in any risk behavior (i.e. drug and alcohol use)	Hispanic immigrants: 71%	US-born Hispanic: 69% US-born non-Hispanic white: 52%
Cooper, 2005	USA	Middle school (MS) and High School (HS) students in rural Texas	Ever injected drugs	MS migrants: 22%	MS other: 6.9%
			Ever used marijuana	MS migrants: 32.5% HS migrants: 49.3%	MS other: 19.5% HS other: 40.4%
			Ever used cocaine	MS migrants: 26.4% HS migrants: 32.1%	MS other: 9.3% HS other: 13.6%
			Ever used inhalants	MS migrants: 26.0% HS migrants: 34.4%	MS other: 14.5% HS other: 14.6%

Denner, 2005	USA	Rural towns/small cities in Central California	Carrying condoms	T-tests detected significant differences in the likelihood of carrying condoms between migrant IDU vs. migrant non-IDU with IDU being less likely to carry condoms: $t(1, 361) = 2.48$ ($p < 0.05$)
			Sexual risk behavior	Hierarchical multiple regression noted that injection drug use was a significant predictor of sexual risk taking among migrants: $\beta = 0.28$ ($p < 0.01$)
Deren, 2003	USA/Puerto Rico	East Harlem, New York and Bayamon, Puerto Rico (PR)	Shooting gallery use	PR migrant IDU in NY: 32%
			Shared injection equipment	PR migrant IDU in NY: 41%
Freeman, 1999	USA	10 cities in the USA	Shared needles	Based on logistic regression estimates (LRE) Mexican migrant IDU were more likely than US-born IDU to share needles ($p < 0.001$)
			Shared injection equipment	Based on LRE, Mexican-born IDU ($p < 0.001$) and Cuban-born IDU ($p < 0.002$) were more likely to share injection equipment compared to US-born IDU

			Public injecting (i.e. shooting gallery)	Based on LRE, Mexican IDU ($p < 0.001$) and Puerto Rican IDU ($p < 0.001$) were more likely to inject in public places when compared to US-born IDU
			Trade sex for drugs	Mexican IDU: 32.9% US-born IDU: 14.9%
			Trade sex for money	Mexican IDU: 33.9% US-born IDU: 12.5%
Lee, 2002	USA	Houston, Texas	Number of injector partners	Based on repeated-measures ANOVA, IDU have fewer injecting partners when traveling than when at home (0.73 vs. 2.23, $p < 0.01$)
			Number of sexual partners without condom use	Based on repeated-measures ANOVA, IDU have fewer sexual partners without condom use when traveling than when at home (0.94 vs. 2.47, $p < 0.05$)
Magis-Rodriguez, 2004	Mexico	Analysis of the Migrants Survey Behaviors in Morelos and Puebla (2002)	Injected illicit drugs	Migrants to the US: 9.8% Non-migrants: 1.2%
			Ever used cocaine	Migrants to the US: 13.4% Non-migrants: 1.7%

Paschane, 2000	USA	Anchorage, Alaska	Shared injection equipment	When compared to homeless non-migrants, transitional migrants were more likely to share AOR = 5.80, 95% CI: 1.62-20.72
Williams, 1997	USA	Multi-site	Travel to high seroprevalence city and injected drugs there > 2 times	Participants that responded "yes" to this question were almost more likely to be HIV-positive: AOR = 6.58, 95% CI: 3.04-14.30
			Travel to a high seroprevalence city and had sex > 2 times	Participants that responded "yes" to this question were more likely to be HIV-positive: AOR = 7.48, 95% CI: 3.83-14.60
Yang, 2005	China	South provinces	Injection drug use	There was a significant correlation between injection drug use and the % of temporary migrants in a region ($p < 0.001$)

Figure 2.1: Major opium producers and trafficking routes



Size of shaded circles indicates estimated opium production of primary producers in metric tons. General direction of major trafficking routes is indicated by arrows.

Source: Data on opium production was derived from the 2006 World Drug Report of the UNODC (UNODC, 2006). Estimated trafficking routes were compiled from reports cited in text and from the U.S. Central Intelligence Agency, "Major Narco Trafficking Routes and Crop Areas" GPO item 751981AI (R00350) 1-00.

CHAPTER 3²

FACTORS ASSOCIATED WITH MIGRATION IN VIDUS

3.1 INTRODUCTION

For injection drug users (IDU), there exists considerable potential for the transmission and spread of HIV and other blood-borne or sexually transmitted infections (Brettle, 1991; Goldberg et al., 1994; Hamers et al., 1997; Freeman et al., 1999; The Joint United Nations Programme in HIV/AIDS (UNAIDS), 2006). Particular drug use behaviours contribute to HIV infection among IDU, with the biggest risk coming from using contaminated syringes (Hamers et al., 1997; Strathdee et al., 1998; Freeman et al., 1999; Wood et al., 2001), although IDU are also known to transmit HIV to their sexual partners, including those who do not inject drugs (Hamers et al., 1997; Gyarmathy and Neaigus, 2005).

Recent conceptual models describing risk among IDU have moved beyond examining individual behaviours to focusing on the broader "risk environment" and the role that social, structural and environmental factors play in HIV transmission (Hoffmann et al., 1997; Atlani et al., 2000; Rhodes, 2002; Soskolne and Shtarkshall, 2002; Organista et al., 2004; Rhodes et al., 2005). For example, social factors such as extended peer networks (Hoffmann et al., 1997; Williams et al., 1997; Haw and Higgins, 1998;

² A version of this chapter is under review in *Health and Place* as: "Rachlis, B., Hogg, R.S., Wood, E., Li, K., Kerr, T., 2007. Factors associated with geographic migration among a cohort of injection drug users".

Atlani et al., 2000; Deren et al., 2003; Gyarmathy and Neaigus, 2005; Williams et al., 2005) and prevailing social and cultural norms (Atlani et al., 2000; Rhodes, 2002; Parrado et al., 2004; Gyarmathy and Neaigus, 2005) are known to facilitate risk for infectious disease. Membership in a large sociometric risk-network has been identified as a significant risk factor for HIV infection and transmission (Friedman et al., 1997; Lovell, 2002), as network-related social and normative influences are generally predictive of high-risk activity including illicit drug use (Lovell, 2002).

In Vancouver's Downtown Eastside (DTES), Canada's poorest neighborhood, extreme poverty, high crime, homelessness, poor housing, and high rates of alcohol and drug abuse prevail (Buxton, 2003). As the area is densely populated, the social networks among IDU, in addition to risky environmental conditions creates social circumstances that shape and influence risky injection practices (e.g., syringe sharing) (Lovell, 2002). Environmental influences such as geographic location (Haw and Higgins, 1998; Freeman et al., 1999; Rhodes, 2002; Rhodes et al., 2005; Williams et al., 2005; Corneil et al., 2006; Maas et al., 2007) and the physical context of specific injecting environments, including public spaces (Celentano et al., 1991; Hoffmann et al., 1997; Deren et al., 2003; Gyarmathy and Neaigus, 2005) are also known to influence risk-taking among IDU. In Vancouver, for example, living in unstable housing is often a predictor for syringe sharing (Corneil et al., 2006).

However, injection drug use is not solely an urban phenomenon. Many IDU live in and/or travel to smaller communities that are often rural or semi-rural settings (Haw and Higgins, 1998; Day et al., 2006), although few studies focus primarily on drug use in these more remote environments. Findings from the CEDAR project, a prospective study of Aboriginal youth in Vancouver and the more rural community of Prince George demonstrated that injection cocaine, difficulty accessing syringes, needle borrowing, and prevalence of hepatitis C (HCV) are all higher in Prince George relative to Vancouver suggesting a pending AIDS epidemic in this setting (Craib et al., 2005). In the U.S., studies of geographical variation of HIV infection have concluded that viral spread into rural areas has resulted from the high-risk behaviour of rural residents who frequently travel to urban areas. Indeed, population movement is thought to be one social factor contributing to the spread of HIV; mobile individuals can act as "bridging" populations linking infectious diseases from high-risk to low-risk individuals, as well as from areas of high seroprevalence into regions with low seroprevalence (White, 2003; Williams et al., 2005). While traveling to a high prevalence area, IDU can become infected with HIV and upon returning home, these individuals can introduce the virus into local social networks (Williams et al., 1997; Brockerhoff and Biddlecom, 1999; White, 2003; Parrado et al., 2004).

Therefore, when injection drug use and mobility overlap, risk for infectious disease transmission to other populations may be substantially elevated. Drucker (1990)

discusses the dynamics of mobility among IDU and suggests that when geographical boundaries are breached, needle sharing networks may become blurred and the morphology of some networks may become more fluid, offering opportunities for visiting or new members to participate in high-risk activities (McCoy et al., 1996). However, a lack of established social contacts may also protect against elevated risk-taking, as was demonstrated in one U.S. study where IDU reported lower numbers of drug injection and sexual partners while traveling than when at home (Lee et al., 2002). Given that IDU appear to be a relatively mobile group, often moving between cities, smaller communities, and across international borders for reasons of work, security, or access to narcotics (Drucker, 1990; Dehne et al., 1999; Uriely and Belhassen, 2005), further study is merited given the potential for IDU who engage in risky behaviour outside their home areas to transmit HIV to other IDU, their sex partners, and others in the population (Williams et al., 2005). Migration may also compromise the delivery of necessary preventative or addiction-related treatment services. Therefore, we sought to determine which drug use practices and other risk factors known to correlate with HIV infection are associated with migrating out of the Greater Vancouver area among IDU in Vancouver, Canada.

3.2 METHODS

The Vancouver Injection Drug Users Study (VIDUS) is an open prospective study that has enrolled and followed 1603 IDU recruited through self-referral or street

outreach from Vancouver's Downtown Eastside since May 1996. The cohort has been described previously in detail (Wood et al., 2001; Tyndall et al., 2003). In brief, individuals were eligible for participation if they were 14 years of age or older, had injected illicit drugs at least once in the month prior to enrollment, resided in the Greater Vancouver area and provided written informed consent. At baseline and semi-annually, participants provide blood samples and complete an interviewer-administered questionnaire, which elicits demographic data including age, sex, and place of residence and information regarding injection and non-injection drug use, injection practices, sexual risk behaviours, and enrollment into addiction treatment. Participants also provide venous blood samples, which are tested for HIV and HCV antibodies. All subjects receive a \$20 stipend at each visit to compensate for their time and cover transportation costs to the facility. This study has been approved by Providence Health Care and the University of British Columbia's Research Ethics Board (See Appendix I).

Consistent with the risk environment framework (Rhodes, 2002), our analysis examined correlates between migration and socio-demographic characteristics, drug use, and risk behaviours known to be associated with HIV infection and transmission. In June 1999, questions specific to migration (e.g., places traveled to or lived in since last visit) were added to the VIDUS follow-up questionnaire in efforts to prospectively examine migration patterns in this cohort. Therefore, all participants who had at least

one follow-up visit between June 1999 and May 2005 were eligible for inclusion in the present analysis. As we were not interested in brief visits outside of Greater Vancouver or movement within the same geographic area, migration in the present study, was defined as residing outside of Greater Vancouver between June 1999 and May 2005, and was the primary endpoint in this analysis. Given that all participants were living in the Greater Vancouver area at the time of enrollment, migration was assessed during follow-up study visits through the use of the following question: "Are you living in the Lower Mainland (i.e., the Greater Vancouver area) now? If not, where are you living?" Explanatory variables of interest included socio-demographic information: age, gender, Aboriginal ethnicity (yes vs. no), unstable housing (yes vs. no), and HIV status (yes vs. no). Unstable housing was self-defined as living in single room occupancy (SRO) hotels, hostels, recovery houses or being homeless. Drug use variables of interest included: years injecting, frequent heroin injection (yes vs. no), frequent cocaine injection (yes vs. no), frequent crack cocaine smoking (yes vs. no), syringe borrowing (yes vs. no), syringe lending (yes vs. no), requiring help injecting (yes vs. no), public injecting (yes vs. no), non-fatal overdose (yes vs. no) and alcohol use (yes vs. no). As in previous analyses (Tyndall et al., 2003), frequent heroin, cocaine and crack use was defined as use equal to or greater than once daily. Other factors of interest included incarceration (yes vs. no) and involvement in the sex trade (yes vs. no). Two treatment status variables were examined: being denied access to drug treatment (yes vs. no) and current methadone

treatment (i.e. as opposed to illicitly obtained methadone) (yes vs. no). Unless otherwise noted, all behavioural variables refer to the six-month period prior to the interview.

We examined each episode of migration and looked at all covariates (i.e., explanatory variables) associated with that episode. However, as the analyses of factors potentially correlated with migration during the study period included numerous observations per participant, generalized estimating equations (GEE) were used for binary outcomes with logit link to determine which factors were independently associated with migration throughout the follow-up period (i.e., June 1999-May 2005). These methods provided standard errors adjusted by multiple observations per person using an exchangeable correlation structure. Therefore, data from every participant follow-up visit were considered in this analysis. For instance, an individual participant may have migrated more than once during follow-up and this approach serves to examine behaviours and characteristics that correlated with and without migration within individuals and between individuals. This approach, therefore, also accommodates changes in predictor variables over time. This analytic approach has been used successfully in previous studies examining correlates of various outcomes in prospective cohort studies of IDU (Shah et al., 2000, Kerr et al., 2005). As a first step, variables potentially associated with migration were examined in bivariate GEE analyses. To determine independent predictors of migration, we fit a multivariate logistic GEE model using an *a priori* defined model building protocol that involved

adjusting for all explanatory variables that were found to be statistically significant at $p < 0.05$ in bivariate analyses. All statistical analyses were performed using SAS software version 8.0 (SAS, Cary, NC).

3.3 RESULTS

In total, 1603 participants were eligible for participation in this analysis. However, 358 individuals, including 96 (26.8%) women and 68 (18.9%) Aboriginal participants only had one follow-up between June 1999 and May 2005 and were excluded from the analysis. Therefore, there were a total of 1245 participants included in this analysis, including 488 (39.2%) women and 367 (29.4%) self-identified Aboriginal participants. Compared to the 358 individuals not included in this analysis, those included were more likely to be Aboriginal (Odds Ratio [OR] = 1.79, 95% Confidence Interval [CI]: 1.34-2.39, $p < 0.001$) and female (OR = 1.76, 95% CI: 1.36-2.29, $p < 0.001$). There were no significant differences in age between groups ($p < 0.643$). The median age among included and excluded participants were 33.4 (Interquartile Range [IQR]: 18.7 - 48.0) and 33.2 (IQR: 25.9 - 39.5) respectively. The median number of follow-up visits between June 1999- May 2005 was 9 (IQR: 4, 12), and the rate of migration for each study period ranged between 2.5% and 11.8% (Figure 1).

A total of 149 locations to where participants migrated to were cited, with the majority (53.7%) being within the province of British Columbia (Figure 2). The majority of places cited were rural or semi-rural settings and included 2 Native reserves (See Appendix II for all locations). With regards to migration outside the province of British Columbia, approximately 11% of locations reported were within in the province of Ontario and in the United States.

In bivariate analysis (Table 1), the only factor positively associated with leaving the Greater Vancouver area was alcohol use (OR = 1.22, 95%CI: 1.04-1.41, $p = 0.014$). All other factors considered were negatively associated including: frequent crack cocaine smoking (OR=0.37, 95%CI: 0.31-0.44, $p < 0.001$), frequent heroin injection (OR=0.44, 95%CI: 0.37-0.53, $p < 0.001$), requiring help injecting (OR =0.47, 95%CI: 0.38-0.58, $p < 0.001$), sex trade involvement (OR= 0.57, 95%CI: 0.46–0.71, $p < 0.001$), current methadone treatment (OR= 0.59, 95%CI: 0.50-0.88, $p < 0.001$), public injecting (OR= 0.59, 95%CI: 0.48-0.72, $p < 0.001$), unstable housing (OR= 0.61, 95%CI: 0.52-0.71, $p < 0.001$), syringe lending (OR= 0.68, 95%CI: 0.52-0.88, $p = 0.005$), non-fatal overdose (OR= 0.66, 95%CI: 0.48-0.90, $p = 0.009$), frequent cocaine injection (OR=0.68, 95%CI:0.57-0.81, $p < 0.001$), incarceration (OR= 0.79, 95%CI:0.68-0.90, $p < 0.001$), older age (OR=0.96, 95%CI: 0.94-0.98, $p < 0.001$), and number of years injecting (OR= 0.98, 95% CI: 0.96-0.99, $p < 0.001$).

Factors negatively associated with migrating out of the Greater Vancouver area in multivariate GEE analyses (Table 1) included: frequent crack cocaine smoking (Adjusted Odds Ratio [AOR] = 0.44, 95%CI: 0.37-0.52, $p < 0.001$), current methadone use (AOR = 0.50, 95%CI: 0.40-0.63, $p < 0.001$), frequent heroin injection (AOR = 0.51, 95%CI: 0.41-0.64, $p < 0.001$), requiring help injecting (AOR = 0.60, 95%CI: 0.47 – 0.77, $p < 0.001$), sex trade involvement (AOR = 0.64, 95%CI: 0.51-0.82, $p < 0.001$), unstable housing (AOR = 0.69, 95%CI: 0.58-0.83, $p < 0.001$), public injecting (AOR = 0.75, 95%CI: 0.60 – 0.94, $p = 0.014$), incarceration (AOR = 0.77, 95%CI: 0.61-0.96, $p = 0.019$), and older age (AOR = 0.94, 95%CI: 0.92-0.96, $p < 0.001$). Alcohol use remained positively associated with migration out of the Greater Vancouver area (AOR = 1.25, 95%CI: 1.05 – 1.48, $p = 0.011$).

3.4 DISCUSSION

In the present analysis, we found evidence of significant mobility among VIDUS participants. Consistent with the risk environment theory, migrating out of the urban center and surrounding Greater Vancouver area was negatively associated with several risk behaviours including frequent crack cocaine smoking and frequent heroin injection. However, migrating was positively associated with alcohol use and being less likely to be currently in a methadone treatment program.

The migration patterns of Vancouver's IDU appeared to vary over time and in this analysis, the proportion of participants reporting residence outside of Greater

Vancouver ranged between 2.5% and 11.8%, depending on the study visit. The observed decline demonstrated in Figure 1 may reflect losses to follow-up (i.e. if participants that move away are no longer followed, then the rate of migrating out goes down). However, the variation in migration rates may also be explained by yearly seasonal and weather fluctuations, which can influence where people choose to live at any given time.

Migrating, in this analysis, was associated with lower levels of reported risk behaviours including frequent crack cocaine and heroin use, requiring help injecting, sex trade involvement, incarceration, and public injecting. Among Vancouver IDU, having been recently incarcerated (Wood et al., 2005) and living in unstable housing (Corneil et al., 2006) are both associated with syringe sharing (Hamers et al., 1997; Strathdee et al., 1998; Freeman et al., 1999; Wood et al., 2001). In addition, requiring help injecting (O'Connell et al., 2005) and involvement in the sex trade (Kuyper et al., 2004) are demonstrated risk factors for HIV incidence among IDU in the city. In light of the aforementioned associations and findings of the present study, it appears that migrating in this context may result in more stability and lower risk for both infection and transmission of HIV and other blood-borne infections among IDU living outside of Greater Vancouver. While, additional research is needed to determine whether the lower levels of reported behaviours are a real consequence of the migration process, risky behaviours do seem to be concentrated in the DTES and surrounding urban core.

This current observation is consistent with previous findings which demonstrated that DTES residence is, in itself, a risk factor for HIV infection among local IDU (Maas et al., 2007).

Conversely, it should be noted that while there was a trend towards lower levels of risk-taking among those who migrate, alcohol use remained positively associated with migration in the present study. This may be partly explained by the fact that while the availability of particular drugs outside of the metropolitan areas is limited, alcohol is widely available in most communities. Interestingly, previous findings have suggested that rates of alcohol consumption are higher in the Interior, Upper Island, Northeast and Northwest regions of British Columbia, compared to Vancouver proper, particularly among youth (Buxton, 2005), and in this analysis younger age was positively associated with migration. Further research should be directed towards determining whether the higher levels of alcohol consumption observed among those who migrated, correlate with the lower levels of intense drug use behaviours reported. For some IDU, migrating may be a way to escape the heavy drug use common among users living in the DTES and surrounding Vancouver area. However, as has been observed in other mobile populations (Kim-Goodwin and Bechtel, 2004), intense alcohol use may also be one way to cope with the stresses of migrating.

The locations participants migrated to varied substantially and ranged from smaller communities including reserves to large metropolitan areas, both within and outside of Canada, indicating that local IDU are bridging both provincial and national boundaries. However, consistent with an American study examining mobility patterns among IDU which demonstrated that most traveled within a region (McCoy et al., 1996), the majority of moves reported in this study were within the province of British Columbia. While urban destinations such as Toronto have HIV programs and health services in place targeted for drug-using populations, rural IDU may be at greater risk due to limited services availability (Graham et al., 1995; White, 2003; Day et al., 2006). In addition, studies from North America have repeatedly demonstrated that many IDU have poor access to prevention programs, addiction treatment, and general medical care (Strathdee et al., 1997; Freeman et al., 1999; Wood et al., 2004; Corneil et al., 2006). Among VIDUS participants, almost 25% have reported having difficulty accessing syringes and cited being away from where needle exchange programmes (NEP) are run, as a major barrier to access (Wood et al., 2004). Therefore, reduced availability and accessibility of health services is another important health risk faced by mobile populations including IDU (UNAIDS, 2004). While "being denied addiction treatment" was not associated with migration in this analysis, this association should not be interpreted to reflect reduced access to addiction treatment since individuals cannot be denied services that do not exist. In this analysis, participants who migrated demonstrated lower levels of current MMT use. Although this finding may indeed

reflect reduced access to addiction treatment, it is notable that migration was also associated with lower rates of frequent heroin use. Therefore, it may be that IDU who migrate to rural settings are actively seeking to get away from all drug use including methadone. That said, recent studies have indicated that illicit use of prescription opiates is more popular than heroin use in settings outside of Vancouver and therefore future studies should assess whether heroin use is replaced with other forms of opiate use following migration out of Greater Vancouver (Fisher et al., 2006). However, it should also be noted that for IDU currently using methadone, there may be greater incentive to stay in and around the urban centers where most physicians able to prescribe methadone, are based. Health authorities have indicated that the number of physicians able to prescribe methadone is especially low in smaller communities and rural areas within the province (Public Health Agency of Canada (PHAC), 2001).

There were limitations in our analysis. The VIDUS cohort is not a random sample, although previous studies have indicated that the group is highly representative of Vancouver IDU (Wood et al., 2000). As well, given our definition of migration (e.g., living outside the Greater Vancouver area during follow-up), and the length of the recall period specified for most variables (e.g., in the past 6 months), we are limited in our ability to determine if the reported behaviours correspond to living in the Greater Vancouver area (i.e., before a move) or outside the Greater Vancouver area (i.e., after a move). Additionally, as we did not compare risk behaviours before and

after migration, we are unable to conclude if the lower levels of risk-taking associated with migration in this analysis, are a direct result of migrating or are due to other factors not directly measured in the present study, including reasons for moving, whether moving was voluntary or non-voluntary, and the extent to which social networks and support systems are disrupted as a result of migrating. Also, since we relied on self-report data regarding drug use and sexual practices, our analysis could be subject to social desirability responding. While VIDUS has maintained an exceptionally high follow-up rate (~90%), participants lost to follow-up may be more likely to have migrated away from the region and so our calculation of the rate of migration during the follow-up period may have been underestimated. This, in turn, may have muted the association between migration and risk-taking. However it is worth noting that participants are able to complete the interviewer-administered questionnaire via telephone or in other locations outside of the study site situated in the DTES and staff engage in extensive outreach efforts.

In summary, we found migration rates to vary widely over time among VIDUS participants. While the majority of moves reported were within the province of British Columbia, many of the locations participants migrated to were outside the province and/or Canada indicating that local IDU are bridging both provincial and national boundaries. Consistent with the risk environment framework, the findings of this present study demonstrate that migrating out of Greater Vancouver is associated with

lower levels of risk-taking among IDU. However, migration was also associated with higher levels of alcohol use which may reflect one way IDU cope with the stresses of migrating or the reduced availability of harder drugs outside of Greater Vancouver. In addition, those IDU who migrated were less likely to be currently in a methadone program which could be a sign of access barriers outside of Greater Vancouver, or an active attempt to reduce all levels of drug use including reliance on methadone. While it appears that IDU who migrate are less at risk for HIV infection given lower levels of reported risk-taking, uncovering the motivations and reasons for mobility in this context, may clarify whether the lower levels of risk observed in this setting occur as a consequence of the migration process, are simply a result of intrinsic differences between those who move and those who did not, or are due to other unmeasured factors. Future research should also focus on health services utilization, particularly patterns of addiction treatment and MMT use among IDU living outside of Greater Vancouver, to determine if out-migration from the urban center does, in itself, present access-related barriers for IDU seeking care.

3.5 REFERENCES

- Atlani, L., Carael, M., Brunet, J.B., Frasca, T., Chaika, N., 2000. Social change and HIV in the former USSR: the making of a new epidemic. *Soc. Sci. Med.* 50, 1547-1556.
- Brette, R. 1991. HIV and harm reduction for injection drug users. *AIDS* 5, 125-136.
- Brockhoff, M., Biddlecom, A.E., 1999. Migration, sexual behaviour and the risk of HIV in Kenya. *Int. Migr. Rev.* 33, 833-856.
- Buxton, J., 2003. Vancouver Drug Use Epidemiology. Canadian Community Epidemiology Network on Drug Use, Vancouver
- Buxton, J., 2005. Vancouver Drug Use Epidemiology. Canadian Community Epidemiology Network on Drug Use, Vancouver.
- Celentano, D.D., Vlahov, D., Cohn, S., Anthony, J.C., Solomon, L., Nelson, K.E., 1991. Risk factors for shooting gallery use among intravenous drug users. *Am. J. Public Health* 81, 1291- 1295.
- Corneil, T., Kuyper, L.M., Shoveller, J., Hogg, R.S., Li, K., Spittal, P.M., Schechter, M.T., Wood, E., 2006. Unstable housing, associated risk behaviour, and increased risk for HIV infection among injection drug users. *Health Place* 12, 79-85.
- Craib, K.J., Schechter, M.T., Medd, L, Barney, L, Baylis, C., Spittal, P.M., 2005. HIV and HCV prevalence and risk factors among young aboriginal drug users in Vancouver and Prince George, British Columbia. *Can. J. Infect. Dis.* 16 (Suppl A).

- Day, C., Conroy, E., Lowe, J., Page, J., Dolan, K., 2006. Patterns of drug use and associated harms among rural injecting drug users: Comparisons with metropolitan injecting drug users. *Aust. J. Rural Health* 14, 120-125.
- Dehne, K.L., Khodakevich, L., Hamers, F.F., Schwartlander, B., 1999. The HIV/AIDS epidemic in Eastern Europe: recent patterns and trends and their implications for policy-making. *AIDS* 13, 741-749.
- Deren, S., Kang, S.Y., Colon, H.M., Andia, J.F., Robles, R.R., Oliver-Velez, D., Finlinson, A., 2003. Migration and HIV risk behaviours: Puerto Rican drug injectors in New York City and Puerto Rico. *Am. J. Public Health* 93, 812-816.
- Fisher, B., Rehm, J., Patra, J., Firestone Cruz, M., 2006. Changes in illicit opioid use across Canada. *CMAJ*, 175: 1385-1387.
- Freeman, R., Williams, M.L., Sanders, L.A., 1999. Drug use, AIDS knowledge and HIV risk behaviours of Cuban-, Mexican-, and Puerto Rican-born drug injectors who are recent entrants into the United States. *Subst. Use Misuse* 34, 1765-1793.
- Friedman, S.R., Neaigus, A., Jose, B., Curtis, R., Goldstein, M., Ildefonso, G., Rothernberg, R.B., Des Jarlais, D.C., 1997. Sociometric risk networks and HIV risk. *Am. J. Public Health* 87, 1289-1296.
- Goldberg, D., Frischer, M., Taylor, A., Green, S.T., McKeganey, N., Bloor, M., Reid, D., Cossar, J., 1994. Mobility of Scottish injecting drug users and risk of HIV infection. *Eur. J. Epidemiol.* 10, 387-392.

- Graham, R., Forrester, M.L., Wysong, J.A., Rosenthal, T.C., James, P.A., 1995. HIV/AIDS in the rural United States: Epidemiology and health services delivery. *Med. Care Res. Rev.* 52, 435-452.
- Gyarmathy, V., Neaigus, A. 2005. Marginalized and socially integrated groups of IDUs in Hungary: potential bridges of HIV infection. *J. Urban Health* 82, iv101-112.
- Hamers, F., Batter, V., Downs, A.M., Alix, J., Cazein, F., Brunet, J.B., 1997. The HIV epidemic associated with injecting drug use in Europe: geographic and time trends. *AIDS* 11, 1365-1374.
- Haw, S., Higgins, K., 1998. A comparison of the prevalence of HIV infection and injecting risk behaviour in urban and rural samples in Scotland. *Addiction* 93, 855-863.
- Hoffmann, J., Su, S.S., Pach, A., 1997. Changes in network characteristics and HIV risk behaviour among injection drug users. *Drug Alcohol Depend.* 46, 41-51.
- Joint United Nations Programme on HIV/AIDS, 2004. Report on the Global epidemic. 4th report. Available at http://www.unaids.org/bangkok2004/GAR2004_html/GAR2004_00_en.htm. Accessed on September 15, 2006.
- Joint United Nations Programme on HIV/AIDS, 2006. Report on the global AIDS epidemic. Available at http://www.unaids.org/en/HIV_data/2006GlobalReport/default.asp. Accessed on August 30, 2006.

- Kerr, T., Marsh, D., Li, K., Montaner, J., Wood, E., 2005. Factors associated with methadone maintenance therapy use among a cohort of polysubstance using injection drug users in Vancouver. *Drug Alcohol Depend.* 80, 329-335.
- Kim-Goodwin, V.S., Bechtel, G.A., 2004. Stress among migrant and seasonal farmworkers in rural southeast North Carolina. *J. Rural Health* 20, 271-278.
- Kuyper, L. M., Lampinen, T.M., Li, K., Spittal, P.M., Hogg, R.S., Schechter, M.T., Wood, E., 2004. Factors associated with sex trade involvement among male participants in a prospective study of injection drug users. *Sex. Transm. Dis.* 80, 531-535.
- Lee, D., Bell, C., Hinojosa, M., 2002. Drug use, travel and HIV risk. *AIDS Care* 14, 443-453.
- Lovell, A.M., 2002. Risking risk: the influence of types of capital and social networks on the injection practices of drug users. *Soc. Sci. Med.* 55, 803-821.
- Maas, B., Fairbairn, N., Kerr, T., Li, K., Montaner, J.S., Wood, E., 2007. Neighborhood and HIV Infection among IDU: Place of residence independently predicts HIV infection among a cohort of injection drug users. *Health Place* 13, 432-439.
- McCoy, V., Correa, R., Fritz, E. 1996. HIV diffusion patterns and mobility: gender differences among drug users. *Pop. Res. Policy Review* 15, 249-264.
- O'Connell, J.M., Kerr, T., Li, K., Tyndall, M.W., Hogg, R.S., Montaner, J.S., Wood, E., 2005. Requiring help injecting independently predicts incident HIV infection among injection drug users. *J. Acquir. Immune Defic. Syndr.* 40, 83-88.

- Organista, K.C, Carrillo, H., Ayala, G., 2004. HIV prevention with Mexican migrants: review, critique and recommendations. *J. Acquir. Immune. Defic. Syndr.* 37, s227-s239.
- Parrado, E.A., Flippen, C.A., McQuiston, C., 2004. Use of commercial sex workers among hispanic migrants in North Carolina: Implications for the Spread of HIV. *Perspect. Sex. Reprod. Health* 36, 150-156.
- Public Health Agency of Canada, 2001. Harm reduction and injection drug use: an international comparative study of contextual factors influencing the development and implementation of relevant policies and programs.
- Rhodes, T., 2002. The 'risk' environment: A framework for understanding and reducing drug related harm. *Int. J. Drug Policy* 13, 85-94.
- Rhodes, T., Singer, M., Bourgois, P., Friedman, S.R., Strathdee, S.A., 2005. The social structural production of HIV risk among injecting drug users. *Soc. Sci. Med.* 61, 1026-1044.
- Shah, N.G., Celentano, D.D., Vlahov, D., Stambolis, V., Johnson, L., Nelson, K.E., Strathdee, S.A., 2000. Correlates of enrollment in methadone maintenance treatment programs differ by HIV-serostatus. *AIDS* 14, 2035-2043.
- Soskolne, V., Shtarkshall, R.A. 2002. Migration and HIV prevention programmes: linking structural factors, culture, and individual behaviour-an Israeli experience. *Soc. Sci. Med.* 55, 1297-1307.

- Strathdee, S., Patrick, D.M., Currie, S.L., Cornelisse, P.G., Rekart, M.L., Montaner, J.S., Schechter, M.T., O'Shaughnessy, M.V., 1997. Needle exchange is not enough: lessons from the Vancouver injecting drug use study. *AIDS* 11, F59-65.
- Strathdee, S., van Ameijden, E.J., Mesquita, F., Wodak, A., Rana, S., Vlahov, D., 1998. Can HIV epidemics among injection drug users be prevented? *AIDS* 12, S71-79.
- Tyndall, M.W., Currie, P., Spittal, P., Li, K., Wood, E., O'Shaughnessy, M.V., Schechter, M.T., 2003. Intensive injection cocaine use as the primary risk factor in the Vancouver HIV-1 epidemic. *AIDS* 17, 887-893.
- White, R., 2003. Commentary: What can we make of an association between human immunodeficiency virus prevalence and population mobility? *Int. J. Epidemiol.* 32, 753-754.
- Williams, M., Atkinson, J., Klovdahl, A., Ross, M.W., Timpson, S., 2005. Spatial bridging in a network of drug-using male sex workers. *J. Urban Health* 82, i35-i42.
- Williams, M., Zhao, Z., Bowen, A.M., Freeman, R.C., Elwood, W.N., Rusek, R., 1997. Introduction of HIV into drug injector networks outside AIDS epicenters. *Int. J. STD AIDS* 8, 629-635.
- Wood, E., Li, K., Small, W., Montaner, J.S., Schechter, M.T., Kerr, T., 2005. Recent incarceration is independently associated with syringe sharing among injection drug users. *Public Health Rep.* 120, 150-156.

Wood, E., Spittal, P.M., Li, K., Kerr, T., Miller, C.L., Hogg, R.S., Montaner, J.S.,

Schechter, M.T., 2004. Inability to access addiction treatment and risk of HIV-infection among injection drug users. *J. Acquir. Immune Defic. Syndr.* 36, 750-754.

Wood, E., Tyndall, M.W., Spittal, P.M., Li, K., Kerr, T., Hogg, R.S., Montaner, J.S.,

O'Shaughnessy, M.V., Schechter, M.T., 2001. Unsafe injection practices in a cohort of injection drug users in Vancouver: could safer injecting rooms help? *CMAJ.* 165, 405-410.

Wood, E., Schechter, M.T., Tyndall, M.W., Montaner, J.S., O'Shaughnessy, M.V., Hogg,

R.S., 2000. Antiretroviral use among injection drug users: two potential futures. *AIDS* 14, 1229-1235.

Table 3.1. Univariate and multivariate GEE of factors associated with migration between 1999 – 2005 (n = 1245)

Characteristic	Unadjusted odds ratio (95% CI*)	<i>p-value</i>	Adjusted odds ratio (95% CI*)	<i>p-value</i>
Age	0.96 (0.94-0.98)	<0.001	0.94 (0.92-0.96)	<0.001
Gender	1.10 (0.82-1.47)	0.532	-	-
Aboriginal ethnicity	1.06 (0.79-1.45)	0.671	-	-
Unstable housing	0.61 (0.52-0.71)	<0.001	0.64 (0.58-0.83)	<0.001
HIV status	1.11 (0.88-1.41)	0.369		
Incarceration	0.79 (0.68-0.90)	<0.001	0.77 (0.61-0.96)	0.019
Years injecting	0.98 (0.96-0.99)	<0.001	1.01 (0.99-1.03)	0.351
Frequent heroin	0.44 (0.37-0.53)	<0.001	0.51 (0.41-0.64)	<0.001
Frequent cocaine	0.68 (0.57-0.81)	<0.001	1.15 (0.94-1.41)	0.186
Frequent crack	0.37 (0.31-0.44)	<0.001	0.44 (0.37-0.52)	<0.001
Syringe borrowing	0.84 (0.65-1.09)	0.176	-	-
Syringe lending	0.68 (0.52-0.88)	0.005	0.87 (0.62-1.22)	0.425
Require help injecting	0.47 (0.38-0.58)	<0.001	0.60 (0.47-0.77)	<0.001
Non-fatal OD	0.66(0.48-0.90)	0.001	0.80 (0.56-1.15)	0.230
Current methadone	0.59 (0.50-0.88)	<0.001	0.50 (0.40-0.63)	<0.001
Denied treatment	0.81 (0.63-1.04)	0.107	-	-
Public injecting	0.59 (0.48-0.72)	<0.001	0.75 (0.60-0.94)	0.014
Sex trade involved	0.57 (0.46-0.71)	<0.001	0.64 (0.51-0.82)	<0.001
Alcohol use	1.22 (1.04-1.41)	0.014	1.25 (1.05-1.48)	0.011

+Generalized Estimating Equation * Confidence Interval

Figure 3.1. Rates of migration for each follow-up period (Visit 6-17) between 1999-2005 (n= 1245)

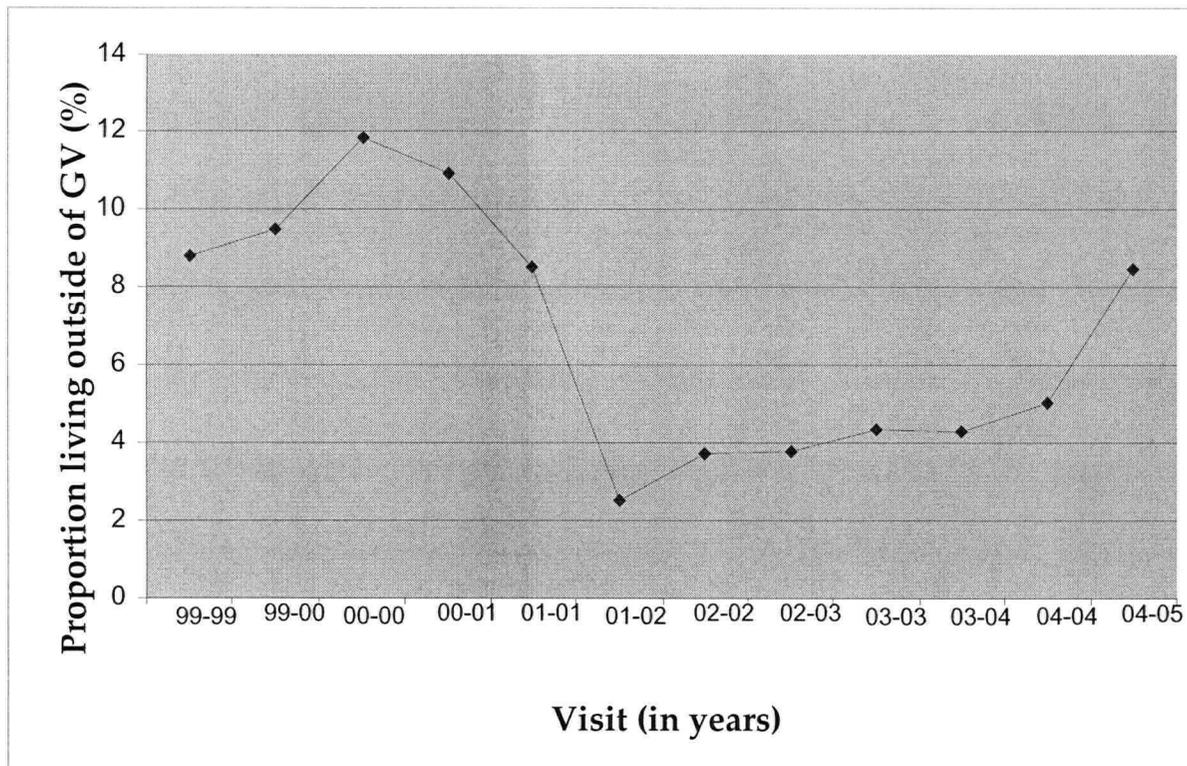
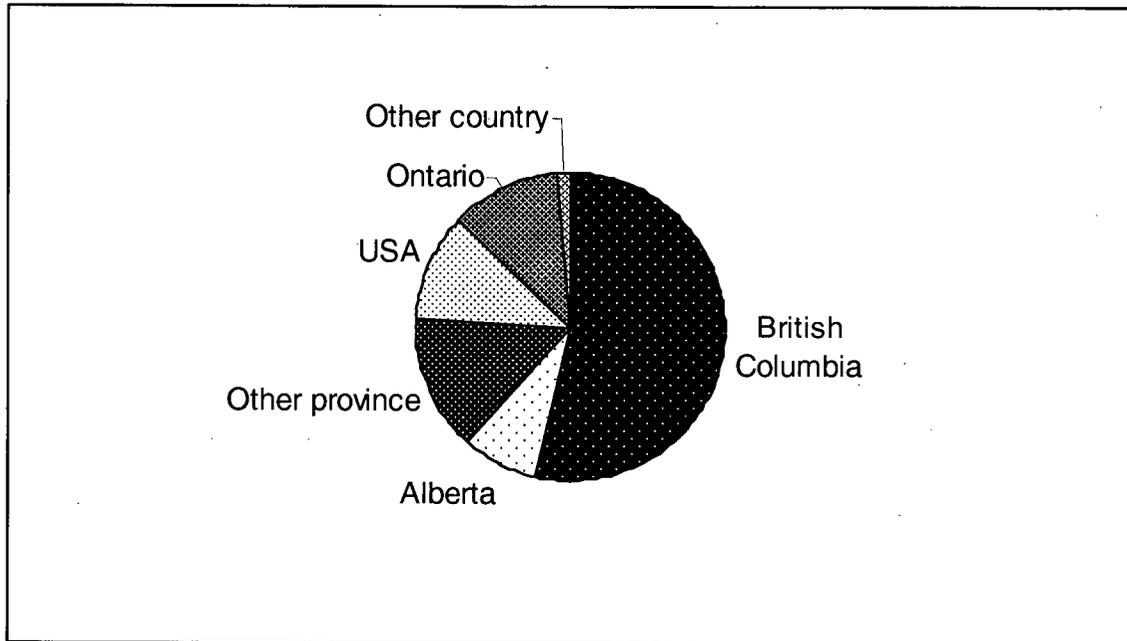


Figure 3.2. Locations participants migrated to between 1999-2005 (n=1245)



CHAPTER 4³

THE IMPACT OF MIGRATION ON RISK BEHAVIOURS IN VIDUS

4.1 INTRODUCTION

Injection drug users (IDU) are a high-risk group for both the acquisition and transmission of HIV and other blood-borne or sexually transmitted infections (STI). Transmission of infectious disease occurs largely through syringe sharing and through the use of other contaminated injection equipment (Hamers et al., 1997; Strathdee et al., 1998; Freeman et al., 1999; Wood et al., 2001), although IDU are also known to transmit HIV to their sexual partners, including those who do not inject drugs (Hamers et al., 1997; Gyarmathy and Neaigus, 2005). While most research focuses on drug use in large settings, particularly large cities, injection drug use is not solely an urban phenomenon and there is evidence that suggests many IDU live in and/or travel to smaller communities, often rural or semi-rural settings, located outside the metropolitan areas (Haw and Higgins, 1998; Day et al., 2006).

Indeed, population movement is thought to be one social factor contributing to the geographic spread of HIV, as mobile individuals act as “bridging” populations linking infectious diseases from high-risk to low-risk individuals as well as from areas of high seroprevalence into regions with low seroprevalence (White 2003; Williams et

³ A version of this chapter is under review at AIDS as: “Rachlis, B., Wood, E., Hogg, R.S., Li, K., Kerr, T., 2007. “Drug and HIV-related risk behaviours after geographic migration among a cohort of injection drug users.”

al., 2005). While the majority of literature suggests that mobile populations, including migrant workers, generally exhibit greater risk-taking compared to less mobile individuals (Brindis et al., 1995; Freeman et al., 1999; Paschane and Fisher, 2000; Deren et al., 2003; Magis-Rodriguez et al., 2004; Cooper et al., 2005; Denner et al., 2005; Williams et al., 2005), some have proposed that the situations surrounding migration (e.g., reason for mobility) as well the individual characteristics of those involved, actually determines whether risk-taking is exacerbated or improved (Soskolne and Shtarkshall, 2002).

While research on the migratory patterns of drug users in Canada has not been well studied, there is evidence to suggest that Canadian IDU are a mobile population. Data from the I-Track study monitoring risk behaviour among Canadian IDU, for example, noted that while the majority of participants cited the places where surveyed as their current residence, approximately 26% had lived elsewhere during the six-month period prior to being interviewed (Health Canada, 2004). Furthermore, while it has been demonstrated repeatedly in North America that IDU generally have poor access to prevention programs, addiction treatment and medical care, migration away from key services often based in the urban centres may create additional barriers for those seeking care, likely contributing to poor health outcomes including HIV infection and transmission (Wood et al. 2002a; Wood et al., 2004). For example, in Vancouver,

difficulty accessing syringes has been previously identified as a predictor of syringe sharing (Wood et al. 2002a; Wood et al. 2002b).

In a recent study, Maas et al. (2007) demonstrated that living in Vancouver's Downtown Eastside (DTES), Canada's poorest postal code, was an independent risk factor for HIV seroconversion among local IDU. As in other disadvantaged urban neighborhoods, homelessness, extreme poverty, high crime rates, and high levels of alcohol and drug abuse characterize the DTES (Buxton, 2005). Consequently, we sought to explore the impact of migrating out of the DTES and surrounding Greater Vancouver area (GV) on HIV-related risk behaviour among participants enrolled in the Vancouver Injection Drug Users Study (VIDUS). We hypothesized, given the concentrated drug scene situated in the DTES and surrounding Vancouver area that in this analysis, migration would result in identifiable changes in drug use and HIV-related risk behaviours.

4.2 METHODS

VIDUS is an open prospective cohort that enrolled and followed 1603 IDU recruited through self-referral or street outreach from Vancouver's DTES between May 1996 and November 2005. The cohort has been described elsewhere (Wood et al., 2001; Tyndall et al. 2003). In brief, individuals were eligible for participation if they were 14 years of age or older, had injected illicit drugs at least once in the month prior to enrollment, resided in GV, and provided written informed consent. At baseline and

semi-annually, participants provide blood samples and complete and interviewer-administered questionnaire, which elicits demographic data including age, sex, place of residence, and information regarding injection and non-injection drug use, injection and sexual risk behaviours and enrollment into addiction treatment. Participants also provide venous blood samples, which are tested for HIV and hepatitis C virus (HCV) antibodies. All subjects receive a \$20 stipend at each visit to compensate for their time and cover transportation costs to the study office. This study has been approved by Providence Health Care and the University of British Columbia's Research Ethics Board.

Our analysis sought to determine whether migrating out of GV impacted drug use and risk behaviours of study participants. Migration was defined as residing outside of GV during the follow-up period (i.e., May 1996 – November 2005). All participants who had reported migrating out of GV during follow-up were initially identified. Among those, only participants who had at least one visit prior to moving and at least one visit after a move had been reported while still living outside GV were eligible for inclusion as 'movers' in this analysis.

By proportionally matching movers' visits, a control group consisting of non-movers was selected. As a first step, VIDUS participants who had never reported moving out of GV during follow-up were considered non-movers and potential

controls. For each follow-up where a move had been reported, non-movers with complete follow-up data around that visit were randomly selected to match the same frequency of movers at that visit (e.g., if 10% of all movers report moving at that visit, then 10% of total non-movers were selected for that visit).

In the following, the “before” period refers to the visit prior to the follow-up when a move was reported while “after” refers to the participants’ immediate subsequent visit after the move. Differences in risk factors were first assessed using McNemar’s test. Changes in behaviours in the before and after period were also examined in the selected control group. Variables of interest in this analysis included: unstable housing (yes vs. no), public injecting (yes vs. no), frequent heroin injection (yes vs. no), frequent cocaine injection (yes vs. no), frequent crack cocaine smoking (yes vs. no), syringe borrowing (yes vs. no), syringe lending (yes vs. no), requiring help injecting (yes vs. no), non-fatal overdose (OD) (yes vs. no) recent incarceration (yes vs. no), sex trade involvement (yes vs. no), alcohol use (yes vs. no), current methadone treatment (yes vs. no), and any addiction treatment (yes vs. no). Unstable housing was defined as living in single room occupancy (SRO) hotels, hostels, recovery houses or being homeless. Frequent heroin, cocaine, and crack use was defined as use equal to or greater than once daily. All behaviours refer to the six-month period prior to the interview. All variable definitions have been used extensively and were identical to earlier reports (Tyndall et al. 2003).

To formally test for differences over time and between movers and non-movers, we performed linear growth curve analyses. This method has been successfully used in studies involving IDU in the past, and models changes over time incorporating interaction terms to determine if changes over time differ significantly between groups (Hoffmann et al., 1997; Vlahov et al., 2001). By using generalized linear models with repeated measurements, models were constructed for each selected behaviour with group (mover vs. non-mover) and period (before vs. after) as the explanatory variables. Then, each model was adjusted for age, gender and Aboriginal ethnicity (yes vs. no) and potential interactions were explored (i.e., for each risk behaviour, mover vs. non-mover by time period). Models were only constructed for variables in which different trends emerged over time between groups in univariate analyses. The combined use of McNemar's test and the linear growth curve methods allowed us to first determine if differences within individuals were statistically significant (McNemar's) and then if this difference was statically different than a control group (growth curve method). All *p*-values are two sided. All statistical analyses were performed using SAS software version 8.0 (SAS, Cary, NC).

4.3 RESULTS

In total there were 1122 participants included in this analysis, including 430 (38.3%) women and 331 (29.5%) self-identified Aboriginal participants. Of the 1122 participants, 192 (17.1%) individuals reported migrating out of GV (movers) while 930

(82.9%) participants never reported such a move (non-movers). Table 1 highlights that while there were no significant differences between groups with respect to gender and ethnicity, participants reporting a move were significantly younger than those who ever moved ($p < 0.001$); the median ages in the mover and non-mover group were 32.0 (Interquartile Range [IQR]: 24.3 – 39.2) and 34.6 (IQR: 26.9 – 40.8) years respectively.

Table 2 indicates the proportion of movers and non-movers reporting drug use and selected risk behaviours in the before versus after period. Both groups demonstrated significant decreases in the proportion reporting syringe borrowing, syringe lending, requiring help injecting, having had a non-fatal overdose, having been recently incarcerated and having been sex trade involved. The proportion reporting alcohol use, current methadone use or any addiction treatment increased significantly in both groups in the before versus after period. Consequently none of the aforementioned variables were explored in further analyses. The proportion of participants who reported living in unstable housing, public injecting, frequent heroin or cocaine use and frequent crack smoking did differ between groups in the before versus after period and these variables were explored further in logistic growth curve analyses.

Figure 1 shows frequency tables representing the proportion of drug use practices and HIV-related risk behaviours at two consecutive times for non-movers (the

first two bars for each behaviour) and the visit before and after a move had been reported for those participants who had migrated out of GV (second two bars for each behaviour). Overall, all risk behaviours were initially lower (first two bars) among participants who had reported migrating when compared with those who did not. The proportion reporting public injecting decreased in both groups from 20.8% to 14.6% ($p = 0.077$) among movers and 23.6% to 21.7% ($p = 0.276$) among non-movers, although these differences could be due to chance in both groups. The linear growth curve analysis (Table 2) adjusted for age, gender, and ethnicity demonstrate that the change in the proportion of participants reporting public injecting was not significant ($p = 0.219$). There was a significant decline among movers in the proportion living in unstable housing (49.0% to 31.8%; $p < 0.001$) while no change in housing status was observed among those who did not move (50.1% to 49.9%; $p = 0.919$). Linear growth curve analysis indicated that this difference was significant ($p = 0.002$). Among movers, the proportion reporting frequent heroin injection declined significantly after a move was reported (30.2% to 15.6%; $p < 0.001$), and while there was a slight decrease in frequent heroin use among non-movers (39.6% to 36.9%), the difference was not significant ($p = 0.100$). The result of the linear growth curve analysis indicated that the difference between groups was significant ($p < 0.001$). There was a significant decrease in the proportion of movers reporting frequent cocaine injection from 28.1% to 12.5% ($p < 0.001$). The slight decline in frequent cocaine injection observed among non-movers (30.3% to 27.5%) was not significant ($p = 0.107$). As table 2 shows, the difference in

slopes for frequent cocaine was significant ($p < 0.001$). While the proportion of participants reporting frequent crack use increased among non-movers (21.7% vs. 29.3%, $p < 0.001$), no change was observed among movers (10.4% vs. 10.4%, $p = 1.000$). In the linear growth curve analysis for crack use, the difference in slopes was not significant ($p = 0.197$).

4.4 DISCUSSION

In this analysis, a substantial proportion of IDU reported moving out of the Greater Vancouver area and we observed statistically detectable declines in risk behaviour among IDU who had moved. For example, a significantly smaller proportion reported living in unstable housing and being frequent heroin and cocaine injectors after a move had occurred. While there were similar decreases in risk factors among non-movers, the differences over time were not significant.

Since injection drug use is rather collective in nature and shaped by various environmental and structural factors, the likelihood of engaging in specific behaviours is often influenced by the broader 'risk environment' that surrounds the individual (Hoffmann et al., 1997; Atlani et al., 2000; Rhodes, 2002; Soskolne and Shtarkshall, 2002; Organista et al., 2004; Rhodes et al., 2005). As we have previously described (Rachlis et al., 2007), given that the majority of participants in VIDUS who migrate often move to smaller regions within British Columbia, decreases in risk-taking were

expected as in most cases, the new settings do not have concentrated and open drug scenes conducive to high rates of risky activity comparable to that of the DTES.

After extensive multivariate adjustment, migration out of GV in this analysis was associated with a decrease in the likelihood of living in unstable housing. This finding is important given that unstable housing is a key factor leading to heightened health risks particularly those related to injection drug use (Latkin et al., 1994; Buhrich et al., 2000; Aidala et al., 2005; Rhodes et al., 2006). Among Vancouver IDU, living in unstable housing is a demonstrated risk factor for syringe sharing (Corneil et al., 2006). Therefore, it is concerning that the proportion of VIDUS participants living in unstable housing remained fairly constant among non-movers, and suggests that this issue has yet to be adequately addressed. Interestingly, there was little change in the proportion reporting public injecting among participants who remained within Greater Vancouver, although given the evidence which highlights the interplay between housing status and public injecting (Klein and Levy, 2003; Rhodes et al., 2005; Small et al., 2005; Rhodes et al., 2006), this finding was not surprising.

The proportion of participants reporting frequent heroin and frequent cocaine injection decreased in both movers and non-movers but the differences in the latter group was not significant. The overall decrease may reflect, at least to some degree, changing drug trends over time or the natural history of injection drug use trajectories.

For example, a sustained decline in heroin use has been occurring among Vancouver IDU since 2000 (Wood et al. 2003). However, given that only significant differences in injection frequency occurred among movers, migration is likely a key factor. The reduced availability of particular drugs outside the urban centre may also explain the observed declines in frequent use, or the fact that participants who migrate may be actively attempting, through their move, to get away from heavy drug use. Regardless, the implications of this finding are clear given, that at the population level, the use of any injection drugs is a significant factor increasing risk for both HIV and HCV infection and transmission (Alter & Moyer, 1998; Des Jarlais & Friedman, 1998). The relationship between frequency of injection and HIV infection was established early with a U.S. study demonstrating a positive correlation between HIV prevalence and frequency of injection (Marmor et al., 1987). In VIDUS, the binge use of injection drugs (Miller et al., 2006) is independently associated with HIV seroconversion while frequent cocaine injection remains the strongest predictor influencing risk for HIV infection among participants (Tyndall et al., 2003). Cocaine use is characterized by a higher frequency of injections and high intensity use that profoundly influence risk (Magura et al., 1998). Furthermore, given that injection use of cocaine is associated with increased sexual activity (Rawson et al., 2002), the significant decline observed among movers implies reduced vulnerability to both blood-borne and sexually transmitted infections as a result of migrating.

The findings of this analysis, however, also indicate that there is still a proportion, albeit a smaller proportion, of individuals living in rural or semi-rural settings outside of Greater Vancouver (Rachlis et al., 2007) who continue to be frequent injectors. This observation is concerning and suggests that appropriate HIV prevention and drug treatment services are still needed in these settings. However, given that movers in this analysis demonstrated greater stability than their less mobile counterparts, communities in which IDU migrate to may benefit by having an adequate number of medium and high threshold level services available as these specifically target more stable IDU seeking treatment (Canadian Centre for Substance Abuse (CCSA), 1996; Marlatt, 1996). Interestingly, there was no association between migration and crack use in this analysis. In Canada, crack use has become increasingly prevalent among street drug users (Fischer et al., 2006); in VIDUS the proportion reporting crack use rose from 35% to 55% between 1998 and 2000 (Buxton, 2003). While we did expect that non-movers would show an increase in crack use given its increasing popularity (Fischer et al., 2006), we were surprised that movers showed no change in use and further, that the difference in trends between groups was not significant. It is also notable that some level of syringe sharing persisted in both movers and non-movers, and these findings indicated the need for the expansion of interventions that target this form of HIV risk behaviour, such as needle exchange programs, within and outside of urban settings.

There were limitations in our study. VIDUS is not a random sample and therefore, findings from this analysis may not generalize to the wider population of IDU in our setting. Secondly, while VIDUS has maintained an exceptionally high follow-up rate (~90%), participants lost to follow-up are more likely to have migrated away from the region and so our calculation of the rate of migration may be underestimated and in fact, migrating has a stronger impact on risk-taking than measured. It is worth noting, however, that participants are able to complete their follow-up questionnaires via telephone or in various locations throughout the Greater Vancouver area; study staff also engage in extensive outreach efforts. Additionally, since we relied on self-report data regarding drug practices, our analysis could be subject to social desirability responding. Furthermore, given that movers are more likely to complete their follow-up interviews by phone, they may be less likely to over-report socially desirable responses (e.g., less syringe sharing) compared to participants who complete their interviews in-person (i.e., non-movers). Therefore, the true difference in risk-taking between groups may in fact be larger than observed, and the impact of migration in this analysis as a result may be underestimated. However, the exclusion of participants who moved out of GV but who did not have complete follow-up around the move, may bias our study population towards being more stable and thus the positive impact of migration may be overestimated. Additionally, the 'after' period for considering risk behaviours was limited to the first semi-annual visit following the visit where a move was reported and although we expected the effect of

migration to be visible soon after a move had occurred, additional follow-up may be needed to provide a more comprehensive understanding of the effects of migration on levels of risk-taking. Finally, unmeasured factors including reasons for moving and social network characteristics, may also contribute to the observed findings.

In summary, we found that migration outside of GV among IDU was associated with declines in risk-taking. We demonstrated that while most behaviours decreased in both movers and non-movers, movers were less likely to live in unstable housing and inject heroin and cocaine frequently. The findings of this analysis demonstrate, therefore, that migrating out of the Greater Vancouver area is associated with greater stability among IDU and reduces vulnerability to HIV infection and transmission. The implications of these findings suggest that interventions for IDU offered in settings away from the urban areas should include an adequate number of medium and higher threshold services while maintaining an appropriate number of lower threshold services accessible to higher risk IDU. Further study investigating why IDU migrate out of the Greater Vancouver area may provide much needed insight into the mechanisms by which migration, as a process, influences risk behaviour among IDU.

4.5 REFERENCES

- Aidala, A., Cross, J.E., Harre, D., Sumartojo, E., 2005. Housing status and HIV risk behaviours: implications for prevention and policy. *AIDS Behav.* 9, 251-265.
- Alter MJ, Moyer LA. The importance of preventing hepatitis C virus infection among injection drug users in the United States. *J. Acquir. Immune. Defic. Syndr. Hum. Retrovirol.* 1998;18(Suppl 1):S6-10
- Atlani, L., Carael, M., Brunet, J.B., Frasca, T., Chaika, N., 2000. Social change and HIV in the former USSR: the making of a new epidemic. *Soc. Sci. Med.* 2000, 1547-1556.
- Brindis, C., Wolfe, A.L., McCarter, V., Ball, S., Starbuck-Morales, S., 1995. The associations between immigrant status and risk-behaviour patterns in Latino adolescents. *J. Adolesc. Health* 17, 99-105.
- Buhrich, N., Hodder, T., Teeson, M., 2000. Lifetime prevalence of trauma among homeless people in Sydney. *Aust. NZ J. Psychiatry* 34, 863-866.
- Buxton, J. 2003. Vancouver Drug Use Epidemiology. Site Report for the Canadian Community Epidemiology Network on Drug Use. Available at www.vancouver.ca/fourpillars/pdf/report_vancouver_2003.pdf. Accessed on November 10, 2005.
- Buxton, J. 2005. Vancouver Drug Use Epidemiology. Site Report for the Canadian Community Epidemiology Network on Drug Use. Available at www.vancouver.ca/foupillars/pdf/report_vancouver_2005.pdf. Accessed on January 3, 2007.

- Canadian Centre on Substance Abuse (CCSA). 1996. Harm Reduction: Concepts and Practice: A Policy Discussion Paper. Canadian Centre on Substance Abuse (CCSA) National Working Group on Policy.
- Cooper, S.P., Weller, N.F., Fox, E.E., Cooper, S.R., 2005. Comparative description of migrant farmworkers versus other students attending rural south Texas schools: substance use, work and injuries. *J. Rural Health* 21, 361-366.
- Corneil, T., Kuyper, L.M., Shoveller, J., Hogg, R.S., Li, K., Spittal, P.M, Schechter, M.T., Wood, E., 2006. Unstable housing, associated risk behaviour, and increased risk for HIV infection among injection drug users. *Health Place* 12, 79-85.
- Denner, J., Organista, K.C., Dupree, J.D., Thrush, G., 2005., Predictors of HIV transmission among migrant and marginally housed Latinos. *AIDS Behav.* 9, 201-210.
- Deren, S., Kang, S.Y., Colon, H.M., Andia, J.F., Robles, R.R., Oliver-Velez, D., Fininlinson, A., 2003. Migration and HIV risk behaviours: Puerto Rican drug injectors in New York City and Puerto Rico. *Am. J. Public Health* 93, 812-816.
- Des Jarlais, D.C., Friedman, S.R., 1998. Fifteen years of research on preventing HIV infection among injection drug users: what we have learned, what we have not learned, what we have done, what we have not done. *Public Health Rep.* 113 (Suppl 1), 182-188.

- Fairbairn, N., Wood, E., Small, W., Stolz, J.A., Li, K., Kerr, T., 2006. Risk profile of individuals who provide assistance with illicit drug injections. *Drug Alcohol Depend.* 82, 41-46.
- Fischer, B., Rehm, J., Patra, J., Kalousek, K., Haydon, E., Tyndall, M., El-Guebaly, N., 2006. Crack across Canada: comparing crack users and crack non-users in a Canadian multi-city cohort of illicit opioid users. *Addiction* 101, 1760-1770.
- Freeman, R., Williams, M.L., Sanders, L.A., 1999. Drug use, AIDS knowledge and HIV risk behaviours of Cuban-, Mexican-, and Puerto Rican-born drug injectors who are recent entrants into the United States. *Subst. Use Misuse.* 34, 1765-1793.
- Fuller, C.M, Borrell, L.N, Latkin, C.A., Galea, S., Ompad, D.C., Strathdee, S.A., Vlahov, D., 2005. Effects of race, neighborhood and social network on age at initiation of injection drug use. *Am. J. Public Health* 95, 689-695.
- Hoffmann, J., Su, S.S., Pach, A., 1997. Changes in network characteristics and HIV risk behaviour among injection drug users. *Drug Alcohol Depend.* 46, 41-51.
- Johnson, T.P., VanGeest, J.B., Cho, Y.I., 2002. Migration and substance abuse: evidence from the US national health interview survey. *Subst. Use Misuse.* 37, 941-972.
- Klein, H., Levy, J., 2003. Shooting gallery users and HIV risk. *J. Drug Issues* 33, 751-768.
- Latkin, C.A., Mandell, W., Vlahov, D., Oziemkowska, M., Knowlton, A., Celentano, D., 1994. My place, your place and no place: behaviour settings as a risk factor for HIV-related injection practices of drug users in Baltimore, Maryland. *Am. J. Commun. Psychol.* 22, 415-430.

- Maas, B., Fairbairn, N., Kerr, T., Li, K., Montaner, J.S.G., Wood, E., 2007. Neighborhood and HIV Infection among IDU: Place of residence independently predicts HIV infection among a cohort of injection drug users. *Health Place* 13, 432-439.
- Magis-Rodriguez, C., Gayet, C., Negroni, M., Leyva, R., Bravo-Garcia, E., Uribe, P., Bronfman, M., 2004. Migration and AIDS in Mexico: an overview based on recent evidence. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 37, S215-226.
- Magura, S., Kang, S.Y., Nwacheze, P.C, Demsky, S., 1998. Temporal patterns of heroin and cocaine use among methadone patients. *Subst. Use Misuse* 33:2441-2467
- Marlatt, G.A., 1996. Harm reduction: come as you are. *Addict. Behav.* 21, 779-788.
- Marmor, M., Des Jarlais, D.C., Cohen, H., Friedman, S.R., Beatrice, S.T., Dubin, N., el-Sadr, W., Mildvan, D., Yancovitz, S., Mathur, S., et al., 1987. Risk factors for infections with human immunodeficiency virus among intravenous drug users in New York City. *AIDS* 1, 39-44.
- Miller, C.L., Kerr, T., Frankish, J.C., Spittal, P.M., Li, K., Shechter, M.T., Wood, E., 2006. Binge drug use independently predicts HIV seroconversion among injection drug users: implications for public health strategies. *Subst. Use Misuse* 41, 199-210.
- Organista, K., Carrillo, H., Ayala, G., 2004. HIV prevention with Mexican migrants: review, critique and recommendations. *J Acquir Immune Defic Syndr.* 37, S227-239.

- Paschane, D., Fisher, D.G., 2000. Etiology of limited transmission diseases among drug users: does recent migration magnify the risk of sharing injection equipment. *Soc. Sci. Med.* 50, 1091-1097.
- Rachlis, B., Hogg, R.S., Wood, E., Li, K., Kerr, T. 2007. Factors associated with Geographic Migration among a cohort of injection drug users. Under Review at *Health Place*.
- Rawson, R.A., Washton, A., Domier, C.P., Reiber, C., 2002. Drugs and sexual effects: role of drug type and gender. *J. Subst. Abuse Treat.* 22, 103-108.
- Rhodes, T., 2002. The 'risk' environment: A framework for understanding and reducing drug related harm. *Int. J. Drug Policy* 13, 85-94.
- Rhodes, T., Kimber, J., Small, W., Fitzgerald, J., Kerr, T., Hickman, M., Holloway, G., 2006. Public injecting and the need for 'safer environment interventions' in the reduction of drug-related harm. *Addiction* 101, 1384-1393.
- Rhodes, T., Singer, M., Bourgois, P., Friedman, S.R., Strathdee, S.A., 2005. The social structural production of HIV risk among injecting drug users. *Soc. Sci. Med.* 61, 1026-1044.
- Small, W., Kerr, T., Charette, J., Wood, E., Spittal, P.M., 2005. HIV risks related to public injecting in Vancouver's Downtown Eastside. *Can. J. Infect. Dis.* 16, 36A.
- Soskolne, V., Shtarkshall, R.A., 2002. Migration and HIV prevention programmes: linking structural factors, culture, and individual behaviour-an Israeli experience. *Soc. Sci. Med.* 55, 1297-1307.

- Tyndall, M.W., Currie, S., Spittal, P.M., Li, K., Wood, E., O'Shaughnessy, M.V., Schechter, M.T. 2003. Intensive injection cocaine use as the primary risk factor in the Vancouver HIV-1 epidemic. *AIDS* 17, 887-893.
- Vlahov, D., Safaien, M., Lai, S., Strathdee, S.A., Johnson, L., Sterling, T., Celentano, D.D., 2001. Sexual and drug risk-related behaviours after initiating highly active antiretroviral therapy among injection drug users. *AIDS* 15, 2311-2316.
- Warner, L.A., Valdez, A., Vega, W.A., de la Rosa, M., Jay Turner, R., Canino, G., 2006. Hispanic drug abuse in an evolving cultural context: an agenda for research. *Drug Alcohol Depend.* 84S, S8-S16.
- White, R., 2003. Commentary: What can we make of an association between human immunodeficiency virus prevalence and population mobility? *Int. J. Epidemiology* 32, 753-754.
- Williams, M., Atkinson, J., Klovdahl, A., Ross, M.W., Timpson, S., 2005. Spatial bridging in a network of drug-using male sex workers. *J. Urban Health* 82, i35-i42.
- Wood, E., Tyndall, M.W., Spittal, P.M, Li, K., Anis, A.H., Hogg, R.S., Montaner, O'Shaughnessy, M.V., Schechter, M.T., 2003. Supply-side policies for control of illicit drugs in the face of the AIDS and overdose epidemics: investigation of a massive heroin seizure. *CMAJ.* 168, 165-169.

Wood, E., Tyndall, M.W., Spittal, P.M., Li, K., Kerr, T., Hogg, R.S., Montaner, J.S.,

O'Shaughnessy, M.V., Schechter, M.T., 2001: Unsafe injection practices in a cohort of injection drug users in Vancouver: could safer injecting rooms help? CMAJ.

165, 405-410.

Table 4.1. Socio-demographic characteristics associated with those who had migrated out of Greater Vancouver versus those who had never moved between 1999 - 2005

Characteristics	Movers (n = 192)	Non-Movers (n = 930)	<i>p</i>-value
Gender (%)			
Male	117 (60.9)	575 (61.8)	
Female	75 (39.1)	355 (38.2)	0.871
Age			
Median (IQR)	32.0 (24.3 – 39.2)	34.6 (26.9 – 40.8)	<0.001
Ethnicity (%)			
Other	130 (67.7)	661 (71.1)	
Aboriginal	62 (23.3)	269 (28.9)	0.385

Table 4.2. Proportion of movers (n = 192) and non-movers (n = 930) reporting risk behaviours between 1996 – 2005

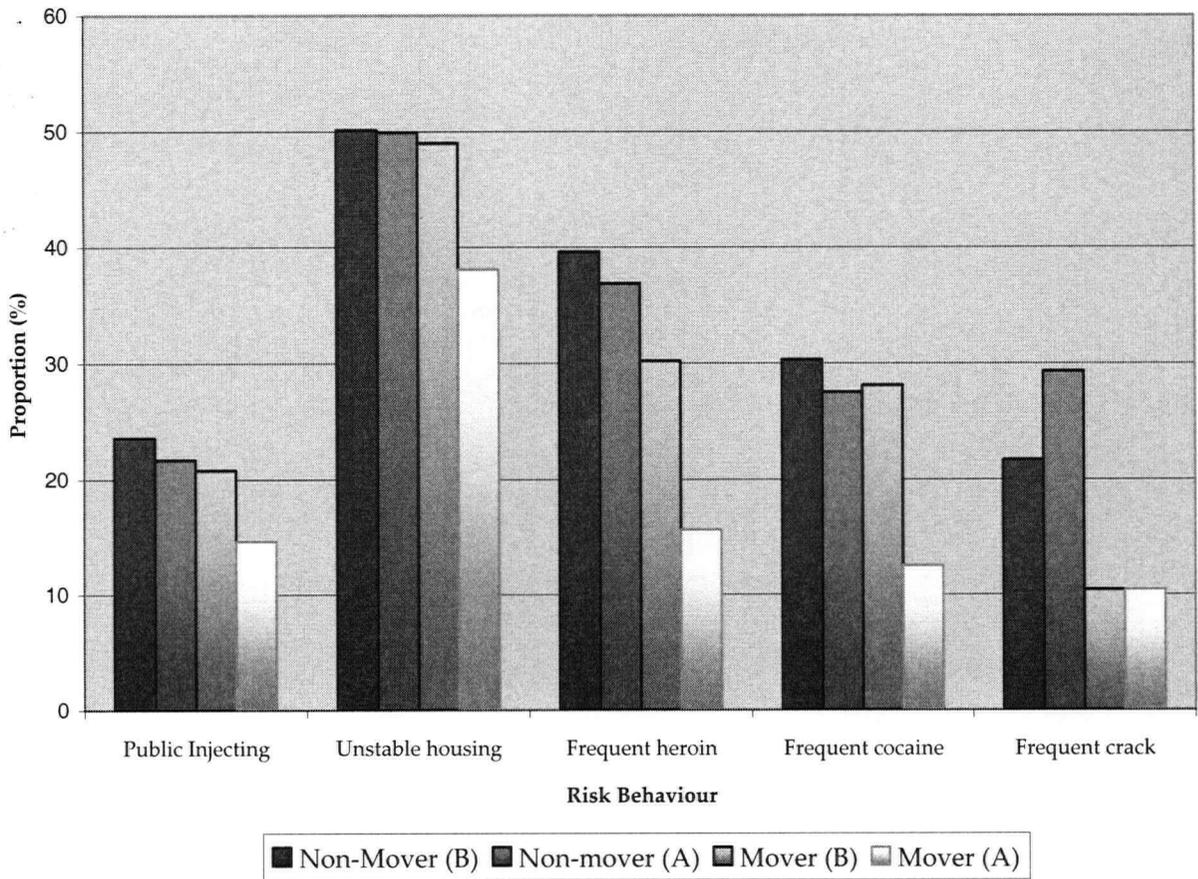
Behaviour	Before n (%)	After n (%)	p-value
Public injecting			
Mover	39 (20.8)	28 (14.6)	0.077
Non-mover	219 (23.6)	281(21.7)	0.276
Unstable housing			
Mover	94 (49.0)	61 (31.8)	<0.001
Non-mover	465 (50.1)	464 (49.9)	0.919
Frequent heroin			
Mover	57 (30.2)	29 (15.6)	<0.001
Non-mover	368 (39.6)	343 (36.9)	0.100
Frequent cocaine			
Mover	53 (28.1)	24 (12.5)	<0.001
Non-mover	281(30.3)	255 (27.5)	0.107
Frequent crack			
Mover	20 (10.4)	20 (10.4)	1.000
Non-mover	201(21.7)	272 (29.3)	<0.001
Syringe borrowing			
Mover	46 (24.0)	27 (14.1)	0.007
Non-mover	186 (20.0)	135 (14.5)	<0.001
Syringe lending			
Mover	45 (23.4)	21 (10.9)	<0.001
Non-mover	176 (18.9)	123 (13.2)	<0.001
Require help injecting			
Mover	47 (24.5)	24 (12.5)	<0.001
Non-mover	246 (26.5)	205 (22.0)	0.003
Non-fatal OD			
Mover	38 (19.8)	10 (5.2)	<0.001
Non-mover	175 (18.8)	95 (10.2)	<0.001
Incarceration			
Mover	58 (30.2)	36 (18.8)	0.005
Non-mover	291 (31.3)	226 (24.3)	<0.001
Sex trade involved			
Mover	31 (16.2)	16 (8.3)	0.004
Non-mover	210 (22.6)	173 (18.6)	<0.001
Alcohol use			
Mover	79 (41.1)	100 (52.1)	0.018
Non-mover	357 (38.4)	402 (43.3)	0.006
Current methadone			
Mover	29 (15.1)	40 (20.8)	0.041
Non-mover	196 (21.1)	251 (27.0)	<0.001
Any addiction treatment			
Mover	63 (32.8)	87 (45.3)	0.003
Non-mover	300 (32.3)	373 (40.1)	<0.001

Table 4.3. Results of individual logistic growth curve analyses for each risk behaviour modeled as the outcome and adjusted for age, gender, and ethnicity

Behaviour	Slope	<i>p</i>-value
Public Injection		
Mover	-0.4037	
Non-Mover	-0.0636	0.2190
Unstable Housing		
Mover	-0.7491	
Non-Mover	-0.0056	0.0017
Frequent Heroin		
Mover	-0.8231	
Non-Mover	0.0900	0.0005
Frequent Cocaine		
Mover	-0.9707	
Non-Mover	-0.1357	0.0007
Frequent Crack		
Mover	0.0555	
Non-Mover	0.4467	0.1969
Alcohol Use		
Mover	0.4334	
Non-Mover	0.2138	0.2881

Note: slope represents differences in outcome by group (mover vs. non-mover) over time (before vs. after). P-values represent the interaction term.

Figure 4.1. Proportion reporting risk behaviours before and after a move was reported in movers vs. non-movers in VIDUS (1996 – 2005)



CHAPTER 5

SUMMARY, CONTRIBUTIONS, RECOMMENDATIONS, FUTURE RESEARCH, AND CONCLUSIONS

5.1 SUMMARY OF STUDY FINDINGS

The first phase of this research project involved an extensive literature search of materials that examined the relationship between migration and the risk for transmission of blood-borne infections among injection drug-using populations. The results of the review indicate that, while there is a fair amount of research conducted globally on HIV/AIDS risk among migrant individuals (e.g., farmworkers), little research has been conducted in this area that is specific to injection drug users. Migration appears to play a role in the transmission dynamics of HIV/AIDS, exacerbating risk of infection particularly in individuals separated from their families/spouses and finding themselves in a new environment in which they face poverty, exploitation and cultural barriers. For these individuals, increased drug use may be a coping mechanism. Additionally, particular policies in place and general attitudes towards 'migrant' populations often play a powerful role in further intensifying risk-taking. However, the review also revealed that in some contexts, migrating might have a protective effect on risk-taking, particularly for those who find themselves in an area less conducive to high levels of risk activity. Further, the findings from the review suggest that migration as a risk factor for HIV transmission is a complex topic that requires consideration of the context and patterns of those

migrating. What is clear is that aside from the largely conclusive evidence that injection drug use and subsequently HIV spreads along drug trafficking routes, there is a gap in the literature that specifically addresses migration among IDU, as well as a solid understanding of how being mobile may impact on drug-using patterns and HIV-related risks.

In Chapter 3, I demonstrated that the rate of migration, defined as the proportion of VIDUS participants living outside of Greater Vancouver between 1999-2005, ranged from 2.5% to 11.8%. The reason(s) for the large variability in the rates of migration are still largely unknown but may reflect losses to follow-up or seasonal patterns. Additionally, the majority of moves took place within the province of British Columbia (BC) and were to locations that were mostly rural or semi-rural. Furthermore, moves were also reported to other provinces (particularly Ontario) and outside of the country to the U.S. and abroad, indicating that local IDU are bridging national boundaries.

Further, the findings presented in Chapter 3, reveal that those who migrated out of the Greater Vancouver area were often younger and reported lower levels of frequent drug use. Additionally, migration was negatively associated with living in unstable housing, having been incarcerated or sex trade involved, requiring help injecting, having had a non-fatal overdose or reporting public injecting. Based on these findings, it appears that in this population, migrating out of Greater Vancouver results

in greater stability and lower susceptibility to HIV infection. However, migration in VIDUS was also associated with high levels of alcohol use which may reflect the greater universal availability of alcohol in various settings as opposed to particular drugs (e.g., heroin), or as has been observed in other mobile populations (Kim-Goodwin and Bechtel, 2004), one way to cope with the anxieties of migrating.

I also demonstrated that migration out of Greater Vancouver and the surrounding urban core was negatively associated with current methadone use. Although this finding may reflect reduced access to addiction treatment, migrating was also associated with lower levels of frequent heroin injection. Therefore, it may be that IDU who migrate to more rural or semi-rural settings, are attempting to get away from all drug use, including reliance on methadone. However, for IDU already in a MMT program, there may be greater incentive to stay in Greater Vancouver area where the majority of the services and MMT centers are placed. While MMT availability has expanded throughout the province in recent years (Anderson and Warren, 2004), there remains a lack of physicians living in more rural settings with the ability to prescribe MMT. This is consistent with another Canadian study, which demonstrated that IDU living in Ontario's more remote Northern settings were less likely to have ever been in addiction treatment when compared to IDU living in the urban centers (Millson et al., 2003).

The before and after analysis performed and described in Chapter 4 highlights various changes in risk-taking over time between those who move and those who do not. Similar to the GEE analysis discussed in Chapter 3, and as demonstrated graphically in Figure 4.1 (pg. 134), a smaller proportion of movers were living in unstable housing, frequently injecting and smoking crack following a move compared to individuals who never moved over the same time period. While crack use increased only among non-movers, the proportion of individuals living in unstable housing decreased only among movers. While other behavioural patterns changed over time, including the proportion reporting sex trade involvement and accessing any addiction treatment, there were no real differences between groups in univariate analyses and as a result, these factors were not examined further.

The findings of the logistic growth curve analysis indicated that only significant differences between groups were found for unstable housing, frequent heroin and frequent cocaine injection, with movers being less likely to report the aforementioned behaviours following a move. Decreases in particular risky practices including frequent injection may reflect a conscious effort to escape the drug scene, a decreased availability of heroin and cocaine out of the urban areas, or the fact that the 'risk environment' in the new setting is not as conducive to intense drug use as, say, their place of origin. Regardless of the reason, decreases in frequent injecting is an important outcome given, that at the population level, the use of any injection drugs is a significant risk factor for

both HIV and HCV infection and transmission (Alter & Moyer, 1998; Des Jarlais & Friedman, 1998). As discussed in more detail below, the implications of the overall findings indicate that harm reduction services are still very much needed in communities outside Greater Vancouver to ensure that IDU living in these areas have accessible services able to support them through their addiction while minimizing harm.

5.2 UNIQUE CONTRIBUTIONS, IMPACT, AND IMPLICATIONS

First, as a part of my Master's thesis, I performed a broad literature review on the topic of migration, injection drug use and the transmission of HIV and other blood-borne or sexually transmitted infections. To my knowledge, this review is the most comprehensive and up-to-date paper on this topic. Furthermore, while the remainder of my thesis retains a local focus, the review paper examines the issues and evidence on a more global scale and has been published in a top international journal in addictions research.

Further, this project was the first to systematically examine the trends of migration in a longitudinal cohort of IDU. Policy-makers, health professionals and researchers alike can greatly benefit from the findings in this study. We now know that local IDU do, in fact, migrate out of the city and reside in areas, often rural or semi-rural settings. As part of the first phase of my research study, I developed a simple

categorization system to code all locations that VIDUS participants have ever reported moving to over the 10-year follow-up period. I was able to translate 149 locations reported over time into 12 distinct categories. This coding mechanism may be broken down further or be used in a similar way to answer various questions relating to the migration of drug users or other populations (e.g., Aboriginal IDU, people living with HIV/AIDS etc).

Also unique in this project was the use of the previously underutilized growth curve analysis discussed in Chapter 4. The findings of these analyses point to clear and significant differences between participants who moved out of Greater Vancouver versus those who did not in terms of risk-taking, with the former group being less likely to engage in high-risk activity following a move. While some behavioural changes were observed among non-movers (e.g., decline in frequent heroin injection), when compared to movers, these changes were not significant. The success of logistic growth curve analysis as a statistical tool in identifying the effects of migration in these analyses will likely support its use again in separate studies where researchers at the BC Centre for Excellence in HIV/AIDS are interested in studying changes in behaviours over time, or as a result of a new intervention (e.g., prior to vs. after the opening of the Supervised Injection Facility; prior to vs. after initiating HAART).

Finally, this project was unique in that it addresses the issue of addiction service provision in areas outside of the urban setting and as highlighted in Chapter 1, IDU already face many barriers that hinder their ability to access treatment and medical care, pointing to the ever present need to tackle this problem. Further, this topic is important as it supports the concern for the potential need of other important services including the expansion of HAART in the province of BC.

5.3 RECOMMENDATIONS

In addition to the literature review provided in Chapter 2, Chapters 3 to 5 present much insight into the mobility patterns of IDU, and the impacts associated with migrating with respect to drug use and other HIV-related risk behaviours. Upon further inspection into the experiences of local IDU recruited from Vancouver but who have migrated to other communities, the issue of the type and number of services available in these new settings stands out as one area where improvements may be necessary.

Harm reduction emphasizes that the first step towards improved health and social outcomes among IDU should begin with 'where a person is' in terms of their drug use (Lenton and Single, 1998). As an individual moves through each step, essentially climbing up the treatment ladder, continued support is needed. As there is no "magic bullet" for treating substance abuse, harm reduction points to the need for intervention options to be maximized (Lenton and Single, 1998). When discussing this

concept of maximization, the types of and variety of services offered is largely the focus. However, another component central to this principle, although often overlooked, is location (i.e., where such services operate).

At the practical level, low threshold services targeting IDU deeply entrenched in communities where drug misuse is high should be easily accessible (Wood and Spittal, 2003). The term 'threshold' in this context refers to the eligibility criteria for participation in such programs as well as the state of 'readiness' individuals' need to be at prior to entry (Canadian Centre on Substance Abuse (CCSA), 1996). Low threshold services, therefore, have minimal requirements for involvement and work to put IDU in contact with a 'continuum of care' as early as possible (Marlatt, 1996). These services work to stabilize drug users directing them to more intensive treatment services when they are ready. Low threshold services include such activities as NEPs, outreach and education programs, and supervised consumption facilities (CCSA, 1996). The placement of such services in communities where drug use is prevalent is important, therefore, to ensure that those needing such services have adequate access. As drug use behaviours become more stabilized, IDU may benefit from medium threshold services such as medical and social care, including counselling and other types of support that require adherence to program requirements to stay in the program. Finally, as IDU become even more stable as a result of their previous treatment, accessing high threshold services including abstinence-oriented therapies, residential treatment

regimes, and recovery houses, is an appropriate next step (British Columbia Ministry of Health, 2005). So, the importance of the location of both medium and high threshold services, in addition to low threshold services, becomes evident given that we now have a clearer idea of where IDU in the province are, in fact, living.

As of now, low threshold services are mainly but rightfully concentrated in areas where drug use is most rampant, such as the urban centers, including Vancouver's Downtown Eastside. However, based on this thesis project, we now know that IDU do migrate out of the city and live in smaller communities, although the coverage and types of services available and their effectiveness in these regions is unclear. The findings of this analysis demonstrate that IDU migrating out of Greater Vancouver generally reach some level of stability. The implication of this observation points to the need for medium and high level threshold services in communities outside the Greater Vancouver area which work to support drug users through recovery. As one moves away from areas of high rates of substance use (e.g., Downtown Eastside), the threshold level of the majority services provided should, in theory, increase (See Figure 1). However, it is important to note that various risky practices such as frequent heroin injection and public injecting were observed even after migration had occurred. Therefore, fittingly to the principle in harm reduction that emphasizes interventions should be maximized, low threshold services are still needed outside of the Greater Vancouver area. An informal focus group held by the Kelowna Area Network of Drug

Users (KANDU) in 2003, for example, highlighted that local users were concerned with long wait lists for entry into detoxification units as well as the lack of supportive services available for homeless users in transition (i.e. those trying to get off drugs) (Central Okanagan Four Pillars Coalition, 2004).

However, the integration of harm reduction with current services presents challenges in settings with few dedicated resources. Leadership is needed from all levels of government, specifically from those in the community. The issue of addiction as a medical issue must first be recognized before proper planning and management of services can take place. The findings of this thesis project offer insight into where IDU from Vancouver are moving to, but more information could be gathered on the prevalence of substance use in these communities. A needs assessment and inventory of local services in these regions could also be performed to determine if and where the scale-up of services could be advanced. Finally, communities neighbouring each other should identify opportunities for collaboration and coordination of service provision as a means of ensuring that the needs of local drug users as well as the larger populations are being addressed.

5.4 FUTURE RESEARCH

The issue of migration is a complex topic and, as my literature review demonstrated, the situational factors surrounding migration (e.g., reason for mobility)

as well as the individual characteristics of those involved, matter. One area from which future research will likely benefit is a greater understanding of why people, particularly IDU, move. Perhaps participants are migrating home or perhaps they are migrating for work or for a variety of other reasons. Uncovering the motivations for migrating may help to explain the change in behaviours observed in this study. Furthermore, a deeper look into the impact of location and the distance traveled may be merited; the experience of an individual migrating across the country is likely to be very different from that of an individual who migrates to the Interior or to Vancouver Island.

Further, the issue of migration among injection drug users could be examined in other areas across Canada to determine if similar findings are observed. The local concentration and high visibility of the drug scene in the DTES is relatively unique in Canada. Migration away from other cities or regions with less intense drug scenes, may be different as a result.

Finally, while Aboriginal ethnicity did not stand out in this project as being associated with migrating, previous research suggests that, in fact, a great deal of mobility does occur between the reserve and urban setting (Canadian Aboriginal AIDS Network, 1998; Paschane and Fisher, 2000). Further, as we know that Aboriginal populations are disproportionately affected by the HIV/AIDS epidemic (Craib et al., 2003; Hogg et al., 2005), future research should be directed towards specifically

addressing migration and its role in the transmission of HIV and other blood-borne infections in this community, both on and off the reserve.

5.5 CONCLUSIONS

One can take away much from this research project. First, it is clear that IDU from Vancouver do migrate outside of the urban centre. As well, VIDUS participants who do migrate have a somewhat reduced vulnerability with respect to their risk for infectious disease transmission following migration when compared to individuals who do not migrate. Finally, although there is still some risk-taking after migrating, the majority of such behaviours are significantly reduced.

These findings have implications for the types of services that are available for IDU in communities outside of the urban areas. While one principle of harm reduction states that interventions should be maximized, communities outside the Greater Vancouver area may benefit by having a greater number of medium and high threshold services available given that IDU migrating from Vancouver are generally more stable. That is not to say that lower threshold service provision should be neglected given that there are high-risk IDU living in these communities as uncovered in this analysis.

The results discussed throughout this thesis highlight the role that migration plays among IDU. Further, these findings point to the need for improved service

provision among IDU in all locations and to the fact that many issues which exacerbate risk-taking among IDU (e.g., lack of adequate housing) continue to be insufficiently addressed by the appropriate systems and stakeholders.

5.6 REFERENCES

- Anderson, J. F., Warren. L.D., 2004. Client retention in the British Columbia Methadone program, 1996-1999. *Can J Public Health*. 95, 104-109.
- British Columbia Ministry of Health (BC MOH), 2005. Harm Reduction: A British Columbia Community Guide.
- Buxton, J. 2003. Vancouver Drug Use Epidemiology. Site Report for the Canadian Community Epidemiology Network on Drug Use. Available at www.vancouver.ca/fourpillars/pdf/report_vancouver_2003.pdf. Accessed on November 10, 2005.
- Buxton, J. 2005. Vancouver Drug Use Epidemiology. Site Report for the Canadian Community Epidemiology Network on Drug Use. Available at www.vancouver.ca/foupillars/pdf/report_vancouver_2005.pdf. Accessed on January 3, 2007.
- Canadian Aboriginal AIDS Network (CAAN), 1998. Joining the Circle: An Aboriginal Harm Reduction Model. Available at www.niichro.com/hiv/hiv_7.html. Accessed on September 23, 2004.
- Canadian Centre on Substance Abuse (CCSA), 1996. Harm Reduction: Concepts and Practice: A Policy Discussion Paper. Canadian Centre on Substance Abuse (CCSA) National Working Group on Policy.

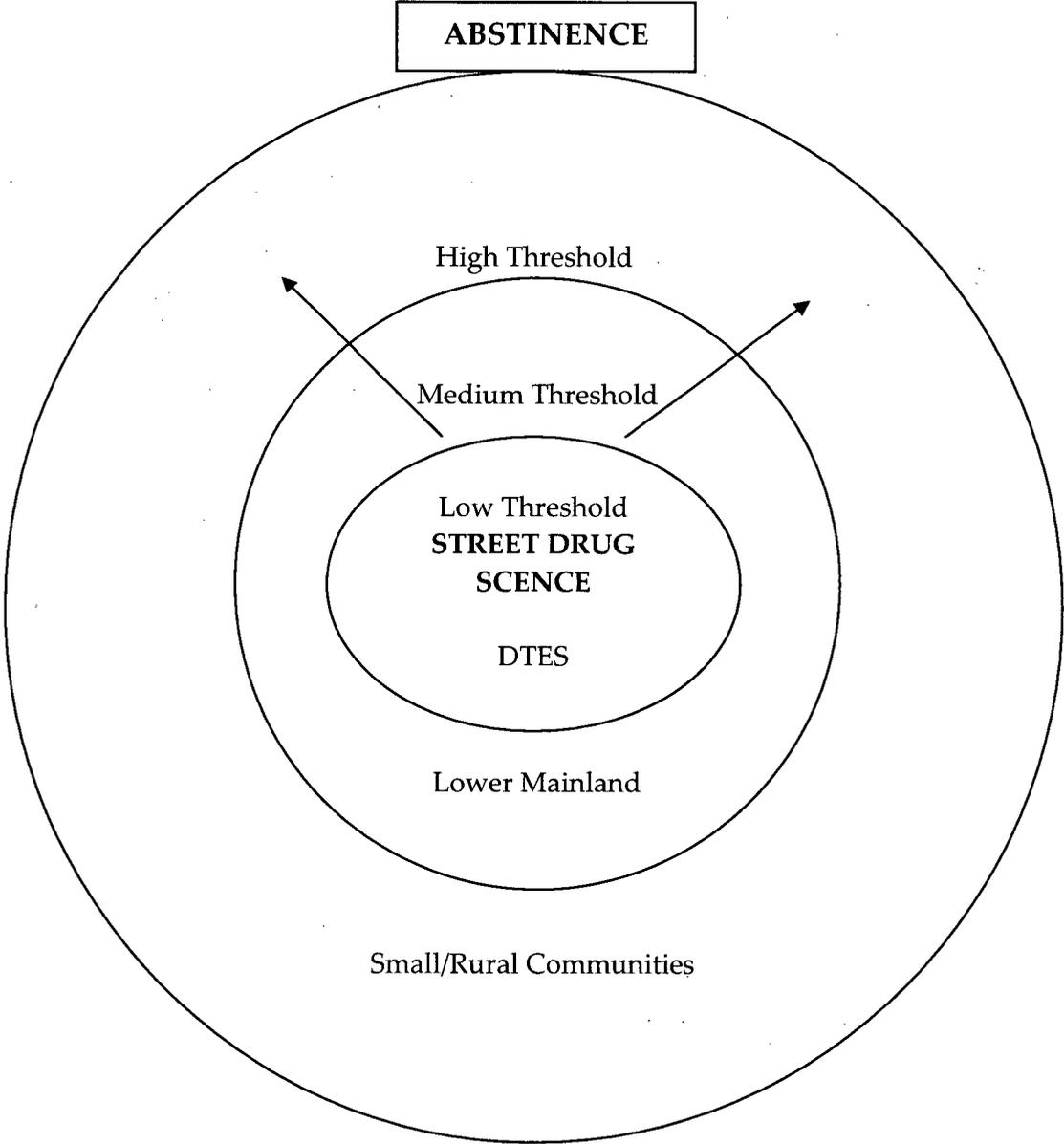
- Central Okanagan Four Pillars Coalition (COFPC), 2004. Kelowna Area Network of Drug Users Survey. Accessed on March 27, 2007. Available at <http://4pillars.livingpositive.ca/kandu.php>.
- Craib, K., Spittal, P.M., Wood, E., Laliberte, N., Hogg, R.S., Li, K., Heath, K., Tyndall, M.W., O'Shaughnessy, M.V., Schechter, M.T., 2003. Risk factors for elevated HIV incidence among Aboriginal injection drug users in Vancouver. *CMAJ*. 168, 19-24.
- Kim-Goodwin, V. S., Bechtel, G.A., 2004. Stress among migrant and seasonal farmworkers in rural southeast North Carolina. *J. Rural Health*. 20, 271-278.
- Hogg, R.S., Strathdee, S.A., Kerr, T., Wood, E., Remis, R., 2005. HIV prevalence among Aboriginal British Columbians. *Harm Reduct. J.* 2, 26.
- Lenton, S., Single, E., 1998. The definition of harm reduction. *Drug Alcohol Rev.* 17, 213-219.
- Marlatt, G.A., 1996. Harm reduction: come as you are. *Addict. Behav.* 21, 779-788.
- Millson, P., Myers, T., Calzavara, L., Wallace, E., Major, C., Degani, N., 2003. Regional variation in HIV prevalence and risk behaviours in Ontario injection drug users (IDU). *Can. J. Public Health* 94, 431-435.
- Paschane, D., Fisher, D.G., 2000. Etiology of limited transmission diseases among drug users: does recent migration magnify the risk of sharing injection equipment. *Soc. Sci. Med.* 50, 1091-1097.

Rhodes, T., Kimber, J., Small, W., Fitzgerald, J., Kerr, T., Hickman, M., Holloway, G.,
2006. Public injecting and the need for 'safer environment interventions' in the
reduction of drug-related harm. *Addiction* 101, 1384-1393.

Wood, E., Spittal, P.M 2003. Maximizing the effectiveness of harm reduction programs.
Int. J. Drug Policy 14, 291-292.

Wood, E., Tyndall, M.W., Spittal, P.M, Li, K., Anis, A.H., Hogg, R.S., Montaner, J.S.,
O'Shaughnessy, M.V., Schechter, M.T., 2003. Supply-side policies for control of
illicit drugs in the face of the AIDS and overdose epidemics: investigation of a
massive heroin seizure. *CMAJ*. 168, 165-169.

Figure 5.1. Potential service structure based on threshold level and community need



APPENDIX 1: HUMAN ETHICS APPROVAL



PROVIDENCE HEALTH CARE
Research Institute

*UBC-Providence Health Care
 Research Institute
 Office of Research Services
 11th Floor Hornby Site - SPH
 c/o 1081 Burrard St.
 Vancouver, BC V6Z 1Y6
 Tel: (604) 806-8567
 Fax: (604) 806-8568*

ETHICS CERTIFICATE OF EXPEDITED APPROVAL

PRINCIPAL INVESTIGATOR: Evan Wood	DEPARTMENT: Medicine- Infectious Diseases	UBC-PHC REB NUMBER: H07-01580
INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:		
Institution		Site
Providence Health Care Other locations where the research will be conducted: N/A		St. Paul's Hospital
COINVESTIGATOR(S): Beth S. Rachlis		
SPONSORING AGENCIES: University of British Columbia		
PROJECT TITLE: The impact of migration on drug and HIV-related risk behaviours among injection drug users: Evidence from the Vancouver Injection Drug Users Study		

THE CURRENT UBC-PHC REB APPROVAL FOR THIS STUDY EXPIRES: July 9, 2008

<p>The UBC-PHC Research Ethics Board Chair or Associate Chair, has reviewed the above described research project, including associated documentation noted below, and finds the research project acceptable on ethical grounds for research involving human subjects and hereby grants approval.</p>		
DOCUMENTS INCLUDED IN THIS APPROVAL:		APPROVAL DATE: July 9, 2007
Document Name	Version	Date
Protocol: Protocol: Thesis proposal (Rachlis)	N/A	June 15, 2007
CERTIFICATION:		
<ol style="list-style-type: none"> 1. The membership of the UBC-PHC REB complies with the membership requirements for research ethics boards defined in Part C Division 5 of the Food and Drug Regulations of Canada. 2. The UBC-PHC REB carries out its functions in a manner fully consistent with Good Clinical Practices. 3. The UBC-PHC REB has reviewed and approved the research project named on this Certificate of Approval including any associated consent form and taken the action noted above. This research project is to be conducted by the principal investigator named above at the specified research site(s). This review of the UBC-PHC REB have been documented in writing. 		

APPENDIX 2: LIST OF ALL LOCATIONS PARTICIPANTS MIGRATED TO

Greater Vancouver (28)	Abbotsford, Agassiz, Aldergrove, Burnaby, Chilliwack, Davis Bay, Delta, Gibsons, Harrison Mills, Hatzic, Hope, Ladner, Langley, Maple Ridge, Matsqui, Mission, Pitt Meadows, Port Moody, Powell River, Roberts Creek, RHC-Matsqui, Sechelt, Skatin, Squamish, Sumas, Sunshine Coast, Surrey, White Rock
Other BC (52)	70 mile house, Alert Bay, Atlin, Atlin Lake, Adams Lake, Burns Lake, Campbell River, Castlegar, Chase, Chetwynd, Coombs, Cortes, Courtney, Cranbrook, D'Arcy, Dawson's Creek, Dawson's Landing, Fort Rupert, Gabriola Island, Greenville, Haisla, Kamloops, Kelowna, Kitlatla, Kitimat, Maramata, Merritt, Nanaimo, New Aiyansh, Okanagan Falls, Oliver, Pentictition, Port Alberni, Port Hardy, Princeton, Prince George, Prince Rupert, Reserve near Fort. St. James, Reserve near Vanderhoof, River inlet, Salt Spring Island, Smithers, Sunshine Valley, Terrace, Trail, Vanderhoof, Vancouver Island, Vernon, Victoria, Victoria VIRCC, Waisla, Williams Lake
Alberta (12)	Calgary, Camrose, Cannoe, Edmonton, Fort Saskatchewan, Grand Prairie, Gunn, Lethbridge, Lethbridge Jail, Lacombe, Priddis, Red Deer
Saskatchewan (5)	Brood View Regina, Cowessess, Creighton, Fort Qu'Appelle, Regina
Manitoba (2)	Winnipeg, Thompson
Ontario (17)	Cameron, Cambellford, Guelph, Hamilton, Lindsay, Kitchener, Markham, North Bay, Oshawa, Outside Sudbury, Ottawa, Peterborough, Sudbury, Toronto, Waterloo, Wahnapiatae, Windsor
Quebec (4)	Longueil, Montreal, Val Dor, Victoriaville
Yukon (4)	Mayo, Old Crow, Pelly Crossing, Whitehorse
Newfoundland (4)	Conception Bay, Cornerbrook, Deer Lake, St. Phillips
Nova Scotia (2)	Dartmouth, Halifax
USA (17)	Albuquerque NM, Austin TX; Bozeman MT, California, Davenport IA, Eugene OR, Los Angeles CA, Minneapolis MN, Montana, New Mexico, New Orleans LA, New York NY, Olympia WA, Portland OR, Seattle WA, Tacoma WA, Tucson AZ
Other Country (2)	El Salvador, Guatemala