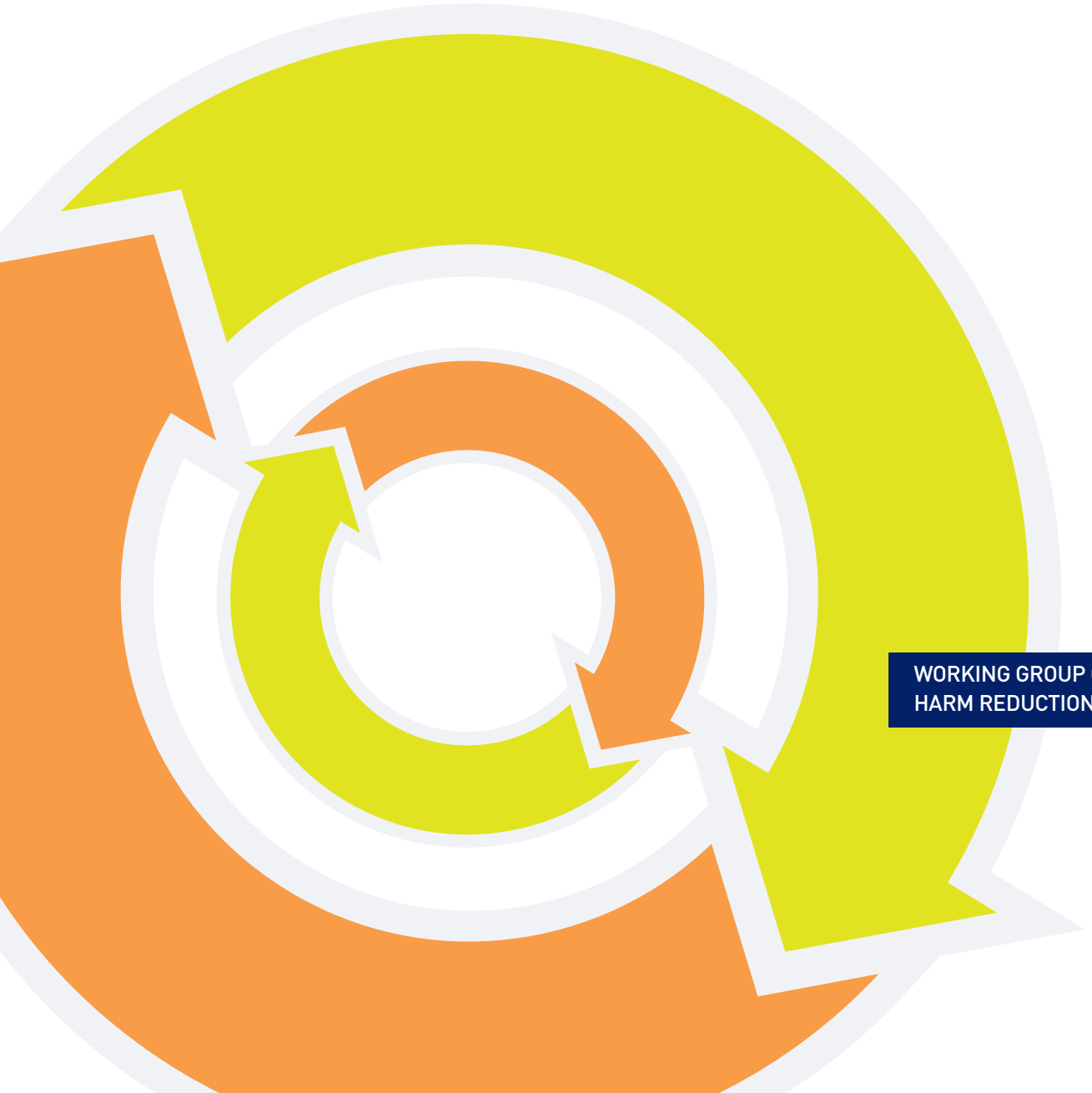
Best Practice Recommendations

FOR CANADIAN HARM REDUCTION PROGRAMS THAT PROVIDE SERVICE TO PEOPLE WHO USE DRUGS AND ARE AT RISK FOR HIV, HCV, AND OTHER HARMS: PART 1



WORKING GROUP ON BEST PRACTICE FOR HARM REDUCTION PROGRAMS IN CANADA

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Disclaimer

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Overview of the Best Practice Recommendations: Part 1

The goal of the Best Practice Recommendations is to improve the effectiveness of harm reduction programs that deliver prevention services to people who use drugs and are at risk for human immunodeficiency virus (HIV), hepatitis C (HCV), hepatitis B (HBV), and other harms. These recommendations aim to assist programs and communities to:

- Improve effectiveness of harm reduction programs
- Reduce transmission of HIV, HCV, HBV, and other harms
- Improve the quality and consistency of harm reduction services
- Inform decisions about the use of resources for effective and efficient practice
- Advocate for better resources in harm reduction services
- Provide benchmarks to evaluate their services
- Identify targets for improvement at the individual program and systems levels

The Best Practice Recommendations are divided into two parts. In Part 1, we reviewed and synthesised into user-friendly, evidence-based, national best practice recommendations the most up-to-date scientific evidence available about the distribution of injection and smoking equipment, safer drug use education, and overdose prevention (see Appendix A for a full description of our methods). Part 2 will focus on program models, testing and vaccination, first aid, referrals and counseling, and relationships with police and other organizations and is scheduled be completed in the latter part of 2014 – stay tuned!

These recommendations are intended to replace those previously disseminated by British Columbia (BCCDC, 2008; Buxton et al., 2008) and Ontario (Strike et al., 2006). Evaluations of these two documents demonstrate impressive implementation of the recommendations (Buxton et al., 2008; Strike et al., 2011); we hope to achieve more widespread uptake of our current comprehensive recommendations.

What are 'best practice recommendations' and how to use them?

Best practices are a series of recommendations for service design and delivery, based on the best available scientific evidence. The recommendations represent a tool to transfer knowledge developed through research to the delivery of service and development of policy. Each section of the recommendations begins with a set of definitive best practice statements. Our goal is to enable programs to use evidence to move towards best practices, if these are not already in place. It is also our goal to help programs advocate for better resources and services by providing a document that contains empirical evidence that they can reference.

Harm reduction programs develop over time and best practice recommendations can be used to guide development from new to experienced, multi-faceted programs. Many harm reduction programs face financial and other constraints. As such, some programs may have more resources or established partnerships to help implement particular best practice components compared to other programs. While the ideal harm reduction program would include all components, an inability to provide all components should not be used to discourage development and implementation to the best of a program's ability.

Why are best practice recommendations necessary?

Drug use practices that can lead to transmission of HIV and other harms (i.e., reuse and sharing of injection and smoking equipment) are a critical public health issue affecting communities across Canada (Public Health Agency of Canada, 2006, 2009). International evidence demonstrates that effective communicable disease prevention programming for people who use drugs can reduce transmission of HIV, HCV, HBV, and other harms related to drug use. Injection drug use is associated with many negative health and social outcomes. Harm reduction programs, like needle and syringe programs (NSPs), lead to reduced HIV incidence and prevalence, reduced needle and equipment reuse, and are cost-effective (Holtgrave et al., 1998; Laufer, 2001; Wodak & Cooney, 2006). NSPs distribute new and dispose of used injection equipment, distribute safer sex materials, and provide prevention education related to HIV, HCV, other patho-

gens, skin and vein problems, and overdose. Many programs provide a wide array of formal and informal services using varied service models and link clients to health and social services in their communities (McKnight et al., 2007; Paone et al., 1999; Strike et al., 2002).

Harms related to unsafe crack cocaine smoking are extensive and increasingly documented in the scientific literature (Gyarmathy et al., 2002; Haydon & Fischer, 2005; Leonard et al. 2008; Porter & Bonilla, 1993; Tortu et al., 2001, 2004). Research points to the elevated risk of HCV and HIV transmission among people who smoke crack cocaine (DeBeck et al., 2009). Safer crack cocaine smoking kits are distributed to help reduce the risks of HIV, HCV, and other harms (Canadian HIV/AIDS Legal Network, 2008). Safer crack cocaine equipment distribution programs also aim to reach marginalised people who use drugs and provide support and education to reduce equipment sharing (Leonard et al., 2008; Malchy et al. 2011).

There is an urgent, community-identified need to better inform and implement safer practice recommendations for people who smoke crack cocaine. In Canada, safer crack cocaine equipment distribution programs are not as well or consistently implemented as programs that distribute safer injection equipment and are completely lacking in many jurisdictions (Canadian AIDS Society & Canadian Harm Reduction Network, 2008; Canadian HIV/AIDS Legal Network, 2007). These programs are often poorly funded and have been subject to political opposition and controversy as well (Canadian HIV/AIDS Legal Network, 2008; Ivsins et al., 2011; Strike et al., 2011). Where possible, harm reduction programs across Canada have expanded their mandates to distribute safer crack cocaine smoking supplies. Our synthesis of evidence on safer crack cocaine smoking equipment represents a substantially expanded section of best practice recommendations.

Intended audience

We developed this set of recommendations for service providers, managers and policy makers who deliver harm reduction programs for people who use drugs and are at risk for HIV, HCV, HBV, and other harms. We hope that these recommendations will be useful to develop, review, redesign, and evaluate your programs.

Our team - Working Group on Best Practice for Harm Reduction Programs in Canada

Based on the principles of community-based research, our project arose from a community-identified need. From inception to dissemination, this project has involved community members and service providers. Members of the team joined based on their interest, expertise (i.e., people with lived experience, service providers, policy makers, and researchers) and their roles as representatives within their communities, stakeholder groups and/or regions. We used a consensus-based process whereby all team members contribute to the design and implementation of the project.

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1 Needle and syringe distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of a sterile needle and syringe for each injection and reduce transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), hepatitis B (HBV), and other pathogens:

- **Provide sterile needles in the quantities requested by clients without requiring clients to return used needles**
- **Place no limit on the number of needles provided per client, per visit (one-for-one exchange is not recommended)**
- **Encourage clients to return and/or properly dispose of used needles and syringes**
- **Offer a variety of needle and syringe types by gauge, size, and brand that meet the needs of clients and educate clients about the proper use of different syringes**
- **Educate clients about the risks of using non-sterile needles**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**

Description of how needles and syringes are used

Needles are used to inject drugs into veins (i.e., intravenous), muscles (i.e., intramuscular), and under the skin (i.e., subcutaneous). To inject drugs with a needle, the drugs are first mixed with water to form a solution in a container ('cooker'/spoon). Often the solution is heated and then drawn through a filter through the needle and into the syringe. Some drugs are mixed directly in the syringe. When multiple people are sharing a drug solution, the solution may be drawn from a common container into multiple needles/syringes or the solution may be squirted from one needle/syringe through the front or back of another needle /syringe (also known as frontloading or backloading, respectively). There is a risk of disease transmission when any of the pieces of equipment used to prepare, share, or inject the drug solution are contaminated with HIV, HCV, HBV, or other pathogens.

To reduce the risk of transmission from contaminated needles, clients need to use a new needle each time they inject. Many needle and syringe programs (NSPs) distribute sterile needles; that is, needles that are free from microorganisms, including pathogens, and come in commercially sealed packages that have never been opened. If a package has been opened or damaged and its seal broken, the needle may no longer be sterile. If a needle has been used and has been cleaned (which can be done with a variety of cleaning agents), the needle is not sterile. Only a process of sterilization that effectively kills all microorganisms results in a sterile needle. Needle cleaning practices performed by people who inject drugs may reduce the number of pathogens found in and on used needles, but the majority of these practices cannot effectively remove all pathogens.

Evidence of needles and syringes as vectors of HIV, HCV, and HBV transmission

Injection with a previously used needle puts people who inject drugs at high risk for infection with pathogens such as HIV, HCV, and HBV. Studies have found evidence of these viruses in used needles.

Abdala and colleagues found that under laboratory conditions HIV can survive in blood in needles for up to 30 days or longer. Their studies show that recovery of viable HIV is affected by factors including: volume of blood, storage temperature, and duration of storage (Abdala et al., 1999; 2000; Heimer & Abdala, 2000). At temperatures between 4oC and 22oC, HIV was recovered following storage for up to 42 days (Abdala et al., 2000; Heimer & Abdala 2000). Among needles collected from shooting galleries in Florida, 20% to 94% of visibly contaminated needles showed evidence of HIV (i.e., HIV-1 antibodies, proteins, RNA, DNA; Chitwood et al., 1990; Shah et al., 1996; Shapshak et al., 2000). In New Haven, Connecticut, samples of needles were tested and showed varying prevalence of HIV proviral DNA depending

on the source: among the "street" needles tested, prevalence of HIV was 67.5% (n=160), for "illegal exchange" needles it was 62.8% (n=180), and for "shooting gallery" needles it was 91.7% (n=48; Heimer et al., 1993). Among returned NSP needles, the prevalence of HIV was 63.9% when the program opened in November 1990 (Heimer et al., 1993) and declined to 41.1% by May 1992 (Kaplan & Heimer, 1994; 1995). The presence of HIV antibodies suggests that a previous user was HIV-positive. It should be noted that the presence of HIV RNA, DNA, and proviral DNA indicate that virus particles are present in the needles, but the virus may or may not be infectious.

HCV is more resilient than HIV and more infectious through blood contact. Like HIV, HCV can be transmitted via blood-to-blood contact; however, it is ten times more easily transmitted through a contaminated needle than HIV (Kiyosawa et al., 1991; Mitsui et al., 1992). HCV has also been detected in used needles. In an Australian study, Crofts et al. (2000) detected the presence of HCV RNA in rinses from 70% (14 of 20) of needles collected from 10 injecting sites. As well, HCV may remain viable in syringes for prolonged periods of time and has been observed to survive up to 63 days in tuberculin syringes; HCV survival appears to vary depending on syringe type, time, and temperature (Paintsil et al., 2010). Pouget et al. (2011) conducted a systematic review of studies reporting HCV seroincidence as part of the HCV Synthesis Project. Results of their meta-analysis found an association between HCV seroconversion and syringe sharing (PRR = 1.94, 95% CI) 1.53, 2.46). In their meta-regression analysis, studies reporting a higher HCV seroprevalance in the sample population found larger effects of syringe sharing on HCV seroconversion (Pouget et al., 2011).

HBV is also a resilient and virulent virus. HBV can survive in dried blood at room temperature for at least a week and is easily transmitted through needle sharing (Thompson et al., 2003). According to the Public Health Agency of Canada (PHAC), HBV can survive in dried blood for weeks and remain stable on environmental surfaces for at least a week (http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/hepatitis-b-eng.php). However, HBV can be prevented by an effective vaccine (http://www.phac-aspc.gc.ca/publicat/cig-gci/p04-hepb-eng.php#sched).

The risk of transmission is greater in the context of needle sharing among people who inject drugs than it is for accidental needlesticks that occur in the community. For example, a Montreal study found that there were no HIV, HCV, or HBV seroconversions among 274 community pediatric needlestick injuries (Papenburg et al., 2008).

Evidence of risk behaviours

Reductions in needle sharing have been documented in some jurisdictions in Canada. However, needle sharing does continue and varies across the country.

Data from Canadian studies have shown that the percentages of people who inject drugs with a used needle have varied from just under 9% to 27% (Fischer et al., 2005; 2006; PHAC, 2006). Studies from different parts of the country have reported declines in needle sharing. In Ontario, trend data show that needle sharing has declined since the early 1990s. In Toronto, the percentage of people who inject drugs who reported sharing needles declined from 42% in 1991 to 24% in 2003 (Millson et al., 2005). Among youth who inject drugs in Montreal, needle sharing and sharing of other drug use equipment decreased significantly between 1995 and 2004 (Roy et al., 2007). Between 1996 and 2007, rates of used syringe sharing also decreased in Vancouver (Roy et al., 2007; Urban Health Research Initiative, 2009). More recent, unpublished data (2011) from Vancouver found that among people who inject drugs 1.5% reported difficulty accessing syringes, 1.3% reported syringe lending, and 1.7% reported syringe borrowing. In comparison, needle sharing in nearby Victoria reportedly increased from below 10% in early 2008 to 20% in late 2010, though during this timeframe the city's only fixed-site NSP was shut down (Ivsins et al., 2012). Unpublished data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that 14.6% of 953 people who inject drugs had borrowed needles (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario).

Epidemiologic data provide evidence of HIV, HCV, and HBV transmission risk associated with needle sharing. Toronto data from the WHO study (1991-1994) show that sharing injection equipment in the previous 6 months was associated with higher HIV prevalence (OR=2.0 $p<0.01$; Millson et al., 2005). In Ottawa, data from two studies show that injecting with a used needle was a predictor of HIV infection at baseline. In the Ottawa POINT Project, participants with a history of injecting with a used needle had a three-fold elevated risk for HIV infection (AOR=2.8; 95%CI: 1.3-6.1; Leonard et al., 2005). The SurvIDU Study (1996-2003) found a three-fold elevated risk among women (AOR=3.0; 95%CI: 1.3-7.1) and a slightly lower risk for men (AOR=2.5; 95%CI: 1.6-3.7; Millson et al., 2005). HIV seroprevalence was also associated with backloading in a study with 660 people who inject drugs in New York City (OR=2.2; 95%CI: 1.5-3.1; Jose et al., 1993).

Data from a cross-sectional study with 437 "street youth" (14-25 years; 200 people who inject drugs) in Montreal (1995-1996) show that injecting drugs was an independent risk factor for HCV infection (Adjusted OR=28.4; 95%CI: 6.6-121.4; Roy et al., 2001). In Seattle, needle sharing among a cohort of 317 people who inject drugs was associated with a three-fold increased risk of HCV seroconversion at one-year follow-up (RR 2.94; 95%CI: 1.6-5.3; Hagan et al., 2001). Similarly, a cross-sectional study of 308 young people who inject drugs in San Francisco found that risk factors for HCV antibodies included ever borrowing a needle (OR=2.56; 95%CI: 1.18-5.53) and daily injecting (OR=3.85; 95%CI: 2.07-7.17; Hahn et al., 2001).

If the needle or syringe used for the preparation and transfer has been previously used, blood or other residues can be transferred along with the shared drugs. Backloading (as well as frontloading) refers to a method of transferring a drug solution (see above for description). For instance, among participants in the Seattle study (Hagan et al., 2001) who reported injecting with a used needle during the one-year follow-up period, backloading was associated with a two-fold non-significant risk of HCV seroconversion (RR 2.1, 95%CI: 0.9-4.5;). Furthermore, among a cohort of 353 young people who inject drugs in Chicago who tested HCV negative at baseline, receptive needle sharing and backloading were associated with elevated non-significant risks of seroconversion (Thorpe et al., 2002).

HBV transmission is a concern for people who inject drugs who have not been immunized or are not immune as a result of previous exposure to the virus. In the cross-sectional study of Montreal "street youth" mentioned above, after controlling for immunization status participants who had a history of injection drug use (n=200) had 3.5 times the rate of HBV infection of those who reported no drug use (AOR=3.5, 95%CI: 1.5-8.3; Roy et al., 1999).

According to PHAC, "Universal immunization against HBV is now part of the publicly funded vaccine programs offered in all provinces and territories. The age at which children and adolescents are offered HBV vaccine varies from jurisdiction to jurisdiction." (http://www.phac-aspc.gc.ca/publicat/cig-gci/p04-hepb-eng.php#sched) However, it should be noted that people whose schooling was interrupted or who attended school irregularly and newcomers to Canada may not have been immunized. In a study of street-recruited people who inject drugs under age 30 in San Francisco, it was found that more than half of the participants had not been effectively immunized against HBV (Lum et al., 2008). Although HBV immunization programs extend coverage, rates of immunization may not be as high as public health predictions for the general population, especially among people who inject drugs (Day et al., 2010). For information on immunization programs across the provinces and territories, see http://www.phac-aspc.gc.ca/im/ptimprog-progimpt/table-1-eng.php.

Correlates of risk behaviours

Knowing the correlates of risk behaviours enhances our understanding of why needle sharing may continue. Distributive sharing (i.e., passing on a used needle to someone else) and receptive sharing (using a used needle to inject) are associated with some similar factors including perceived risks and type of injecting partners (Bailey et al., 2007; Golub et al., 2007).

Data from British Columbia suggest that unstable housing is associated with risk behaviours like needle sharing (Corneil et al., 2006; Gibson et al., 2011). Those without stable housing may engage in risk behaviours including using used syringes in order to avoid encounters with others or the police on the street (Wagner et al., 2010).

Age appears to be an important correlate as well. Young people from marginalized populations (including Aboriginal, LGBTQ, and street involved) are especially vulnerable to risk factors that increase the likelihood of acquiring HIV and HCV (unpublished data/personal communication, Challacombe). Young, travelling people who inject drugs may engage in more risk behaviours, including more sexual and injecting partners and backloading syringes (Hahn et al., 2008). Data from Vancouver suggests that people who inject crystal methamphetamine may be younger and show more risk behaviours like syringe borrowing and lending (Fairbairn et al., 2007). Other data also suggest that young people who inject methamphetamine may be more likely to share syringes (Marshall et al., 2011).

Increased risk of HIV and HCV transmission are also associated with backloading (Hagan et al., 2001), longer injecting careers (Hahn et al., 2001), crack or cocaine use (Millson et al., 2005; Monterroso et al., 2000; Roy et al., 2001) and frequent or 'binge' injecting (Millson et al., 2005; Thorpe et al., 2002; Hahn et al., 2001).

Personal risk behaviours happen in social contexts; social network characteristics, such as network size and peer norms regarding injecting, contribute to risk behaviours and also

need to be considered by prevention programs (De et al., 2007; Golub et al., 2007; Latkin et al., 2010; Shaw et al., 2007; Wylie et al., 2006). Reports from Saskatchewan document the risk of sharing behaviours in social contexts. A summary about injection drug use in Saskatchewan explains that, "Most inject with their regular sex partners, close friends, or family. They inject mostly in their own homes, or at friends' or relatives' places. Injection drug users know not to share needles but may interpret this to mean only not with people close to them" (Laurence Thompson Strategic Consulting, 2008, p. 26).

Incidence and prevalence of HIV, HCV and HBV among people who inject drugs in Canada

Tracking and estimating numbers of HIV, HCV, and HBV infections in the general population and in specific exposure categories is challenging, especially on a national scale. There are national estimates for HIV (see Table 1.1) and HCV (see Table 1.2) and below we provide the numbers for people who inject drugs.

Table 1.1 HIV prevalence and incidence in Canada overall and among groups of people who inject drugs

	MSM-IDU	IDU	TOTAL
Estimated # of prevalent HIV infections 2008	2,030	11,180	65,000
Range of uncertainty for estimated # of prevalent HIV infections 2008	(1,400-2,700)	(9,000-13,400)	(54,000-76,000)
Percentage of total prevalent HIV infections 2008	3%	17%	100%
Estimated # of prevalent HIV infections 2005	1,820	10,100	57,000
Range of uncertainty for estimated # of prevalent HIV infections 2005	(1,200-2,400)	(8,100-12,100)	(47,000-67,000)
Percentage of total prevalent HIV infections 2005	3%	18%	100%
Estimated range of uncertainty for number of incident HIV infections 2008	50-130	390-750	2,300-4,300
Percentage of total new HIV infections 2008	3%	17%	100%
Estimated range of uncertainty for number of incident HIV infections 2005	40-130	360-680	2,200-4,200
Percentage of total new HIV infections 2005	3%	16%	100%

Source: Public Health Agency of Canada, 2010. MSM: men who have sex with men. IDU: people who inject drugs. Point estimates, ranges, and percentages are rounded. *(*table modified from original source)*

HIV incidence is not uniform across the country and has declined in some jurisdictions. Surveillance data indicates that HIV incidence among people who inject drugs has declined in eastern central Canada (Roy et al., 2011). Similarly, a study of a large cohort of people who inject drugs in Montreal found declining HIV incidence between 1992 and 2008 (Bruneau et al., 2011). In terms of prevalence among I-Track (PHAC, 2006) participants, 13.2% were HIV positive, ranging from 2.9% in Regina to 23.8% in Edmonton. In British Columbia, observed decreases in new positive HIV tests among people who inject drugs has been interpreted as representing actual declines in HIV incidence (Gilbert et al., 2011).HIV incidence is also not uniform across groups. Aboriginal people who use drugs have higher HIV incidence compared to non-Aboriginal people who use drugs (Duncan et al., 2011). HIV incidence has increased more rapidly among Aboriginal people over the last decade than any other group in Canada and in 2008 66% of new HIV infections among Aboriginal people were attributed to injection drug use (PHAC, 2010). In addition, there are concerns about women who inject drugs. In 2008, there were an estimated 600 to 1,120 new HIV infections among women in Canada and 29% may be attributed to injection drug use, slightly up from 27% in 2005 (PHAC, 2010). It is worth noting that in some areas globally there are notable differences in HIV prevalence between women and men who inject drugs. Des Jarlais et al. (2012) conducted a systematic review and meta-analysis of studies from 14 countries with high (>20%) seroprevalence HIV epidemics among people who inject drugs and found higher HIV prevalence among women than men. Canada was not one of the countries examined. These authors also reported wide variation across the studies and noted that further research would be needed to compare the findings to low or moderate HIV seroprevalence settings.

Table 1.2 Modelled prevalence and incidence of HCV infection and HCV/HIV co-infection in the general population and among people who inject drugs in Canada, 2007

	Sex	Population	HCV Prevalence		HIV Co-infection Prevalence		HCV Incidence		HIV Co-infection Incidence	
			n	rate	n	rate	n	rate	n	rate
IDU	M	56,626	35,373	62.5%	3,765	6.6%	4,481	21.1%	571	1.1%
	F	27,735	17,139	61.8%	1,788	6.4%	2,126	20.1%	270	1.0%
	Total*	84,361	52,512	62.2%	5,553	6.6%	6,607	20.7%	841	1.1%
Total	M	15,413,109	146,781	0.95%	7,140	0.046%	5,185	0.034%	571	0.0%
	F	15,807,346	95,740	0.61%	3,318	0.021%	2,760	0.018%	270	0.0%
	Total*	31,220,455	242,521	0.78%	10,458	0.033%	7,945	0.026%	841	0.0%

Source: Remis, 2007. IDU: people who inject drugs. *Numbers may not add up exactly due to modelling uncertainties and use of rounded whole numbers in the calculations. *(*table modified from original source)*

In Canada, most new HCV infections are attributed to injection drug use (PHAC, 2011; Remis, 2007). In a cross-sectional Canadian study on men who have sex with men it was found that the largest contribution to HCV and HCV-HIV co-infection was injection drug use (Myers et al., 2009). Among I-Track (PHAC, 2006) participants, 65.7% were HCV-positive, ranging from 61.8% in Winnipeg to 68.5% in Sudbury and Victoria. For people who inject drugs, HCV incidence in Canada has not declined to the same extent as HIV which could be due to several factors, including the scenario where people who inject drugs become infected with HCV before they access prevention services like NSPs (Fischer et al., 2006). Studies have reported high risk of acquiring HCV shortly after beginning to inject drugs (Hagan et al., 2007), thus early intervention for new users is important. Evidence from Amsterdam has shown that participation in both NSPs and methadone programs is associated with decreased risk of acquiring HIV and HCV among people who have ever injected drugs (Van Den Berg et al., 2007).

Aboriginal people in Canada are also disproportionately affected by HCV (PHAC, 2011). Aboriginal groups in Canada show higher HCV seroconversion rates compared to other groups (Lelutiu-Weinberger et al., 2009). Young people who have started injecting drugs are at increased risk for HCV (Maher et al., 2007).

Data on HBV infection from the provinces and territories are sent to the Public Health Agency of Canada regularly; however, reporting practices across the country are inconsistent and risk factor information has not always been collected (PHAC, 2011). Data collected between 2005 and 2010 from the Enhanced Hepatitis Strain Surveillance System (EHSSS) across national sites indicates that the incidence rate of reported acute HBV infection has declined (PHAC, 2011). Of 262 cases of acute HBV infection, injection drug use accounted for 12.2% while high-risk sexual behaviours accounted for 30.1% (PHAC, 2011).

Reported incidence rates of HBV were higher for Aboriginal people compared to non-Aboriginal people (PHAC, 2011). Given that HIV, HCV, and HBV disproportionately affect Aboriginal people in Canada, NSPs should consider how to best tailor needle distribution to meet the needs of this diverse population.

Other health-related harms

HIV, HCV, and HBV transmission are not the only concerns associated with reusing needles. Injecting with a used needle, including one's own needle, puts people who inject drugs at risk for other infections as well as skin and vein damage (Kaushik et al., 2011; Khalil et al., 2008; Lloyd-Smith et al., 2010). People who already have depressed immune systems are at an elevated risk of infection. Injecting with a needle contaminated with bacteria and debris can lead to various infections like endocarditis, septicemia, and potentially syphilis.

A study by Morrison et al. (1997) showed that injection-related harms were common among people who inject drugs recruited from NSPs in Glasgow. Among the 147 participants in the study, 21% had abscesses (i.e., injection site infections), 49% had thrombosis (i.e., vein clots), 84% had bruising at an injection site(s), and 87% had other injection-related problems such as fasciitis (i.e., deeper injection site infection), arterial damage and/or limited venous access. In the four weeks prior to the survey, 52% of participants had no contact with a health service other than an NSP and 30% had not attended a health service in the past 6 months. Despite the frequency of injection-related harms, only 27% had recently sought assistance stating that these issues were normal (62%) or they were reluctant to seek assistance because of unpleasant past experiences (28%). When the NSP referred people who inject drugs, 34% did not attend the service to which they were referred. Morrison et al. (1997) concluded that people who inject drugs will avoid seeking treatment until faced with a crisis and that NSPs need to be more proactive and encourage clients to seek medical assistance.

Among a sample of 200 people who inject drugs in Sydney, participants reported using a mean of 3.1 injection sites in the past 6 months (Darke et al., 2001). Fully 97% reported a history of injection-related problems with a mean of 2.3 injection-related issues in the past 6 months including scarring/bruising (84%), lumps/swelling (64%), difficulty injecting (49%), and hitting an artery (10%). More recently, Salmon et al. (2009) examined self-reported data from 9552 people who inject drugs who registered to use the supervised injection facility in Sydney and found that 26% (2469) of the sample had experienced injection-related problems and 10% (972) had experienced injecting-related injury and disease. The most common injection-related problems were trouble finding a vein (18%), prominent scarring or bruising (14%), and swelling of the hands or feet (7%). The most common injecting-related injury and disease were abscesses or skin infection (6%), thrombosis (4%), septicemia (2%), and endocarditis (1%; Salmon et al., 2009). Other injection-related harms such as wound botulism (Passaro et al.,

1998), vascular complications (Woodburn & Murie, 1996), and eye infections (Shankland & Richardson, 1998) have been reported in the literature as well.

Convenience, ease of access, skill, and other factors influence the choice of injection sites. As well, vein damage and infections can reduce the accessibility of some veins and lead people to inject into other sites on the body. The places where people inject into their bodies can increase or decrease the chances of damage, injury, and infection. Commonly used sites for injection include: the arms, legs, neck, groin, fingers, toes, and abdomen. However, some sites are safer and less likely than others to lead to injury and/or infection. To help clients select safer injection sites, some agencies have developed resources that contain information about risk levels associated with injecting into different parts of the body. For example, CATIE has a numbered diagram that indicates that one should never inject into the head and neck, and groin and genital areas (http://www.hepcinfo.ca/sites/default/files/pdf/1362_CATIE_revised_sharpshooters_ENG_0.pdf).

Injection into the jugular vein in the neck is especially risky given the potential for serious health-related harms, including venous trauma and infection. Hoda et al. (2008) sought to examine the prevalence and risk factors associated with jugular injection among a sample of people who inject drugs in Vancouver. Among the 780 participants included in the analysis, 198 (25%) reported jugular injection in the last 6 months. Factors independently associated with this practice included being female, daily heroin use, daily cocaine use, needing help with injecting, and sex-trade involvement (Hoda et al., 2008).

Groin injection is also considered risky practice as the potential for venous damage and other complications is high. Using ultrasound scanners, Senbanjo et al. (2012) performed 160 groin scans in 84 people who inject in the groin from community drug treatment centres in South East England. The scanning revealed significant femoral vein damage in 72.5% of the groins scanned; "severe" or "very severe"' damage in 41.8% of the veins. Estimated time to developing femoral vein damage varied widely, including ranges of 1 to 116 months for minimal damage and 12 to 240 months for very severe damage (Senbanjo et al., 2012). Another study that compared 67 people who inject in the groin with severe femoral vein damage and 86 people with minimal/moderate damage reported that severe femoral vein damage was associated with longer duration of groin injection, using thick needles, benzodiazepine injection, history of and recurrent deep vein thrombosis (DVT), having a depressed groin scar, and chronic venous disease (Senbanjo & Strang, 2011). Needle size and DVT were found to be the main predictors of severe damage.

Using data from 92 people who inject drugs who attended an NSP in Bristol, United Kingdom, Maliphant and Scott (2005) reported on the prevalence of groin injection. Of those interviewed, 51% injected into the femoral vein. The mean length of time from first injection to groin injection was 7 years; however, a small number started this practice early in their injection career. Ease of access and perceived lack of other usable or convenient sites encouraged groin injection. Fear of losing a hit or difficulty injecting with the non-dominant hand deterred rotation of injection sites. Other studies have also found that people who inject drugs may turn to groin injecting once venous access becomes difficult (Harris & Rhodes, 2012). In a qualitative study of 44 people in the United Kingdom who inject crack-heroin speedballs, Rhodes et al. (2007) reported that older and longer-term injectors viewed groin injecting differently than younger injectors; the former saw it as a "last resort" whereas the latter tended to give reasons for injecting in the groin. Some participants explained that groin injection results in a 'better rush' and can be discreet and convenient. While most seemed aware of health risks and complications, participants explained some strategies they use to reduce risk when using the groin as an injection site (e.g., seeking help from others).

In a comprehensive review of bacterial infections in people who use drugs, a number of important findings were highlighted by Gordon and Lowy (2005). Most of the bacterial infections in people who inject drugs were a result of germs that are on the surface of their own skin, use of dirty needles, failing to clean skin before injecting, as well as "booting" (flushing and pulling back during injecting), which may increase risk of abscess formation (Gordon & Lowy, 2005). A number of other factors have been linked to soft tissue infection and infection in other parts of the body including lack of injecting experience, skin popping (subcutaneous or intramuscular injection), repeated injection into soft tissue, use of tap water and saliva for mixing drugs, injection of speedballs, higher frequency of injecting, and needle licking which may double the risk of cellulitis or abscess formation (Gordon & Lowy, 2005).

Needle licking before injection may be a relatively common practice. One study of 40 people who inject drugs reported that 13 had said that they lick their needles before injecting

(Deutscher & Perlman, 2008). Reasons behind this practice were varied and included ritualistic practices, "cleaning" the needle, enjoying the taste of the drug, and checking the state of the needle. HCV has been found in saliva (Ferreiro et al., 2005; Hermida et al., 2002; Lins et al., 2005; Wang et al., 2006) and HBV has also been detected in saliva (Hui et al., 2005; van der Eijk et al., 2004). Therefore, it might be possible that licking needles prior to injection can contaminate the needles with these pathogens that then could be transmitted if the needles were shared. Licking may also contaminate needles with bacteria and oral flora. People who lick their needles prior to injection may be at increased risk for abscesses or cellulitis (Binswanger et al., 2000).

Khalil et al. (2008) reviewed cases of skin and soft tissue abscesses treated in an emergency department between 2005 and 2007 and conducted a literature search of skin and soft tissue abscesses in people who inject drugs. They presented a treatment algorithm for skin and soft tissue abscesses in people who inject drugs and reported that the type of drugs injected (such as heroin-cocaine mixtures), injection technique, attendant circumstances, and immunological status were important factors for the development of abscesses.

There have been reports of abscesses infected with MRSA (Methicillin Resistant Staphylococcus Aureus) related to injecting drugs. MRSA is a bacterium that is resistant to many antibiotics and requires careful medical management. Stenstrom et al. (2009) reported that 54% of the soft tissue infections in a Vancouver-area emergency department tested positive for the pathogen and a risk factor for an MRSA-related-soft tissue infection was injection drug use (OR=4.6, 95% CI 1.4-16.1). Huang et al. (2008) reported a similar association between MRSA and injecting drugs. Lloyd-Smith et al. (2010) reported that 29% of community-recruited people who inject drugs had wounds and that more than a quarter (27%) tested positive for MRSA. Further, wound botulism outbreaks have been reported among people who inject black tar heroin (Kaushik et al., 2011).

Injection drug use can lead to infective endocarditis (inflammation of the heart tissues due to an infection). The risk of developing this condition may be increased by the presence of abscesses and a previous diagnosis of the condition (Gordon & Lowy, 2005). Infections within the circulatory system such as in the heart, veins, or in the general bloodstream (sepsis or bacteremia) are very serious and require immediate hospitalization.

An international report of syphilis transmission associated with sharing of needles has highlighted the potential for transmission through this route (Loza et al., 2010). Infection with syphilis places an individual at an elevated risk for contracting HIV or HCV because of the ulcers associated with this disease.

Finally, each time a needle is used the point becomes more dull (or "barbed") and injecting with a dull needle can cause skin, tissue, and vein injury, as well as infection including abscesses, cellulitis, and vein collapse.

Needle distribution policies

Policies that limit the number of needles distributed limit the effectiveness of NSPs to prevent HIV and HCV transmission (Bluthenthal et al., 2007a; Heimer et al., 2002; Shaw et al., 2007; Small et al., 2010). NSP one-for-one exchange policies, whereby programs give clients one new needle for each used needle returned, reflect restrictive and unsatisfactory practice. Ideally, NSPs should distribute sufficient needles to provide a new sterile needle for each injection (i.e., 100% coverage; Brahmbhatt et al., 2000; Tempalski et al., 2008).

Bluthenthal et al. (2007b) examined data from 24 NSPs in California and observed five types of exchange, ranging from least to most restrictive:

- unlimited needs-based distribution
- unlimited one-for-one plus some additional syringes
- per-visit limited one-for-one plus some additional syringes
- unlimited one-for-one
- per-visit limited one-for-one

They found that lower percentages of syringe coverage (<50%) were associated with increased odds of both receptive and distributive syringe sharing. They also found that NSP clients with percentage of syringe coverage of 150% or more were significantly less likely to share syringes than those with coverage between 100% and 149%, suggesting that achieving greater than 100% coverage may maximize benefits. These authors found that NSPs with less restrictive policies provided more syringe coverage to clients. According to Turner et al. (2011), high NSP coverage (defined in their study as greater than or equal to 100% needles per injection) coupled with receiving opioid substitution therapy (OST) can substantially reduce the odds of new HCV infection among people who inject drugs.

While 100% coverage may not always be feasible, the move away from exchange policies towards distribution policies that allow clients access to more needles is an important goal. Canadian evidence includes a study of syringe sharing and lending and HIV incidence among a cohort of 1228 people who inject drugs in Vancouver (Kerr et al., 2010). Further evidence comes from a survey of 435 people who inject drugs in Winnipeg which found that people who had difficulty accessing new syringes were 3.6 times more likely to share used ones (Shaw et al., 2007).

In Ontario, the vast majority of NSPs (including all core NSP programs) no longer follow one-for-one exchange policies, in accordance with best practice recommendations (Strike et al., 2011). Providing clients with the number of needles they request is more likely to meet the recommendation for a new sterile needle for each injection, thereby reducing the risk of disease transmission. This may involve bulk distribution, as some clients may prefer to stockpile needles to ensure they have sufficient sterile needles on hand (Strike et al., 2005). Some people may also collect needles for peer distribution – an important secondary distribution strategy to reach people who inject drugs who may not use NSPs (Bryant & Hopwood, 2009).

Those potentially affected by NSP exchange policies include homeless people who may not have needles to exchange and/or are unable to properly store needles until they attend an NSP. In a study of three US cities, Green et al. (2010) found that factors associated with transitions to direct NSP use included homelessness and police contact involving drug use equipment possession. Homelessness was associated with moving away from direct NSP use. Police contact was associated with beginning and maintaining direct NSP use, although there were transitions away from direct NSP use for some types of clients in cities that had a syringe distribution policy change. Other research has found that people may be unwilling to carry needles due to fear of police contact (e.g., Cooper et al., 2005; Maher & Dixon, 1999), so police contact in the context of NSP policy changes may have different impacts on NSP use.

Meeting client preferences for needle type

People who inject drugs have individual preferences for needle gauge, syringe volume, and brand, and may not use NSP services if they cannot obtain their preferred types. In the empirical literature, little attention has been paid to needle and syringe preferences among people who inject drugs. Existing research and insights from harm reduction workers and program managers raise important considerations regarding these preferences.

Needles with a higher gauge are thinner (i.e., have a smaller diameter) than needles with a lower gauge. Many people who inject drugs prefer higher-gauge needles because they are often less painful and less likely to result in vein damage (Zule et al., 2002). People who are experienced with injecting drugs may prefer lower-gauge needles because these needles are less likely to clog and are better able to pierce through thick scar tissue (Zule et al., 2002). Some NSPs in Canada are offering a range of needle sizes (e.g., in Montreal, they offer gauges of 18, 21, 23, 25, 26, 27, and 30) and brands and volumes (also in Montreal, Terumo and BD™ syringes in ½, 1 or 3cc; Lebounga Vouma, personal communication, 2012).

A small sample of interviews with harm reduction service providers in British Columbia revealed that, "Most clients use 0.5 or 1 cc syringes with needles attached" (Buxton et al., 2008). According to anecdotal reports, people who mix their drugs within their syringes tend to prefer larger syringes. In terms of brand, there is a variety of needle brands on the market, though BD™ appears to be among the most popular brand used by NSPs in certain provinces (Keough; Heywood; Lockie; Zurba - all personal communications, 2012). Some people may find certain brands to be more comfortable to inject with and easier to manipulate than others (Harm Reduction Coalition, 2010). Because people who inject drugs may have their own preferences for needle type and brand that they develop out of experience, it is important that NSPs distribute a variety of needles and syringes to meet client needs. If NSPs enter contracts that allow for only one brand of needles to be purchased, programs could potentially see less service uptake. Supply shortages of particular needle brands and types may raise similar concerns and programs will potentially need to assist clients through supply transitions.

People who inject drugs may like syringes with detachable needles for several reasons, including the ability to remove the needle during the preparation of the drug solution and to replace if the needle becomes clogged (Zule et al., 2002). However, others may prefer permanently attached needles because the lower dead-space may result in less wasted drugs (Zule et al., 2002). Importantly, high dead-space syringes (HDSS) present greater risk of blood-borne infection transmission while low dead-space syringes (LDSS) may be associated with reduced risk. *(see section on dead-space syringes below)*

Coverage

According to the World Health Organization (WHO et al., 2009), coverage refers to the "number of syringes distributed per IDU [person who injects drugs] per year" (p. 13). Calculating the quantity of needles required for 100% coverage is challenging as it is affected by a number of variables including estimates of the number of people who inject drugs in the community (non-NSP clients as well as NSP clients), type(s) of drug used, and frequency of injection. However, U.S. researchers estimate that approximately 1000 needles are required per person who injects drugs, per year (Lurie et al., 1998; Holtgrave et al., 1998).

Further, coverage can be calculated on an individual level or population level as Bryant et al. (2012) have noted. These authors examined individual-level coverage based on cross-sectional data from 417 people who inject drugs and who receive syringes from community pharmacies in New South Wales, Australia. About half of participants (51%) had 150% or greater coverage and, overall, about two-thirds (63%) had adequate coverage (Bryant et al., 2012). Bivariate analysis showed some people were significantly more likely to have inadequate coverage including men, younger participants, daily or frequent injectors, those who receptively share syringes, and those who had not used an NSP to obtain syringes in the last month. Multivariate analysis revealed that people who had not accessed an NSP in the last month were twice as likely to report inadequate coverage. Bryant et al. (2012) also mentioned something important about high coverage: calculations of 100% or greater may be inaccurate for people who require more than one needle per injection (e.g., those who have lost needles or had needles confiscated; older, long-term injectors who require more than one syringe to successfully inject). In another recent Australian study that examined national cross-sectional data on NSP clients where coverage was defined as "proportion of monthly injections covered by a new syringe", Iversen et al. (2012) found that syringe reuse (including personal syringe reuse) was associated with less than 100% coverage; the median number of syringes per person per year was 720 (2 per day).

Available coverage estimates not only point to wide variation across world regions and countries, but also suggest that coverage is very low (Mathers et al., 2010). National data about NSPs in Canada is lacking. We can employ numbers from British Columbia (Table 1.3) as an example of needle distribution volume and numbers from Ontario and British Columbia (Table 1.4) as examples of other injection equipment distribution volume. This type of information is made possible by having central distribution programs and tracking systems.

Table 1.1 HIV prevalence and incidence in Canada overall and among groups of people who inject drugs

2006	2007	2008	2009	2010	2011	2012
4,182,900	5,066,400	4,526,200	6,030,600	5,295,300	5,940,500	6,953,600
BC province totals include order numbers by five regional health authorities. Counts include syringes with needles attached and syringes without needles.						

Source: Supply Update, Syringe Distribution by Health Authority. *(table modified from original source)*

Table 1.4 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
Cookers[a]	2,560,000	1,027,000
Filters	19,109,750	N/A[d]
Ascorbic acid	1,038,000	542,000
Sterile water[b]	4,838,100	3,616,000
Alcohol swabs	10,652,000	7,147,400
Tourniquets	603,000	357,100

a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

In Ontario, NSPs report a wide variation in levels of needle distribution. For instance in 2002, coverage ranged between 1 and 474 needles per person who injects drugs per year (Millson et al., 2005). On average in Ontario, it was estimated that 53 needles were distributed per person who injects drugs per year (Millson et al., 2005). In Montreal, Remis et al. (1998) estimated that NSPs distribute approximately 5% of the sterile needles required by people who inject drugs. Similarly, in Ottawa, Leonard et al. (2004) calculated that NSPs distribute 5% of the sterile needles required by people who inject drugs in that community.

Contextual differences between Canada and the United States (e.g., drug of choice, availability of needles from other sources and legislative differences) make needle coverage comparisons problematic. Nevertheless, U.S. NSPs also distribute a small proportion of the sterile needles required. A total of approximately 154 NSPs were in existence in the U.S. in 2000 (Des Jarlais et al., in Riehman et al., 2004). In a survey of 84 NSPs, Paone et al. (1999) found that only 10 exchanged 500,000 or more needles per year, and the most needles exchanged was approximately 1.5 million per year. A new sterile needle for each injection would require between 1.25 and 1.6 billion needles per year (Drucker et al., in Brahmbatt et al., 2000; Heimer 1998).

Being available when and where people need needles

Evidence from a Toronto study (Strike et al., 2005) showed that clients engage in different needle acquisition patterns. Some stockpile large numbers, others make sure they have enough for a week or two while others acquire needles on a daily basis. Of these, day-to-day access is the most problematic because this group is more likely to reuse, share or borrow needles. NSPs can facilitate access to sterile needles with varied modes of program delivery including fixed sites with extended open hours, mobile needle distribution, pharmacy distribution, peer distributors, home delivery, and vending machines. Vending machines, in particular, can offer increased access to sterile syringes during times when NSPs and other harm reduction services are closed (Islam et al., 2007, 2008; McDonald, 2009). Implementing NSPs where they are needed matters too. In a study of 456 people who inject drugs in Montreal, it was found that distance from NSP services was associated with high-risk injecting behaviour and the authors suggested that this finding confirms that NSPs were established where they are needed (Bruneau et al., 2008).

Other issues specific to needles

Dead-space syringes

All syringes contain some fluid or "dead-space" when the plunger is depressed (Strauss et al., 2006), but the amount of fluid depends on whether the needle is permanently attached or detachable. Syringes that have detachable needles are usually high dead-space syringes (HDSS) as they retain fluid in the needle, needle hub, and syringe tip (Zule et al., 2009). Syringes with permanently attached needles are typically low dead-space syringes (LDSS) as fluid is only contained in the needle when the plunger is depressed (Zule et al., 2009). Needle gauge and length also affect the amount of dead space.

The dead-space in a syringe has important implications for risk of HIV and HCV transmission if the syringe is shared. There is a risk of transmission if fluid remaining in the dead space is contaminated with HIV, HCV and/or HBV and the syringe is reused by someone who is not already infected. After rinsing, HDSS can retain 1000 times more blood compared to LDSS (Zule et al., 2009). Studies have shown links between sharing HDSS and HIV and HCV prevalence (Zule et al., 2002, 2009). A mathematical modelling study suggests that even a small percentage of syringe-sharing involving HDSS can substantially increase the spread of HIV, especially in high-risk populations (Bobashev & Zule, 2010). HCV has been observed to survive in HDSS for up to 63 days (Paintsil et al., 2010), thus these types of syringes may be much more likely to transmit the virus. Zule et al. (2013) suggest that switching from HDSS to LDSS would be a simple and low-cost intervention that may help reduce HIV transmission "in countries with injection-driven epidemics" (p. 6) and recommend additional research.

Safety-engineered syringes

Safety-engineered syringes – also known as difficult to reuse syringes, single-use syringes, and one-use syringes – are designed to be used only once (e.g., the plunger cannot be retracted once it has been depressed or the needle retracts into the syringe). These devices can be "passive" whereby the user does not need to perform extra steps to engage the safety feature, or "active" whereby the user actively engages the safety feature. Potential benefits of safety-engineered syringes may include the prevention of needle reuse and sharing (and thereby less transmission of pathogens) and prevention of needlestick injury, including potential injury from publicly discarded needles. Existing empirical literature does not contain much information regarding the use of safety-engineered syringes among people who use drugs attending harm reduction programs; most of the literature focuses on their use to prevent needlestick injuries among healthcare workers in other health settings (e.g., Tosini et al., 2010; Whitby et al., 2008). In British Columbia, WorkSafeBC's Occupational Health and Safety Regulations now require that safety-engineered needles be used for medical procedures to reduce needlestick injuries to healthcare workers; an exception to this is where "either the medical practitioner or patient would be at increased risk of injury" (http://www2.worksafebc.com/PDFs/healthcare/faq_safety_engineered_needles.pdf).

Research on the use of safety-engineered syringes among people who inject drugs has highlighted a number of concerns. Des Jarlais (1998, 2000) reviewed the existing literature on difficult to reuse syringe use among people who inject drugs and raised the following points:

- Any needle, regardless of design, can be reused.
- Difficult to reuse syringes are difficult to disinfect.
- A faulty mechanism may misfire, resulting in the loss of drugs.
- The mechanism prevents people who inject drugs from aspirating or "registering", i.e., drawing blood into the syringe to check whether they have found a usable vein and then continuing with injection.
- Difficult to reuse syringes prevent "booting" or "flagging" – a process of injecting part of the drug solution, then retracting the plunger to draw blood into the drug mixture and injecting again. It has been anecdotally reported that booting, flagging, and registering may be associated with risk for embolism. However, booting and flagging serve to extend the pleasurable effects of drug injection and people who inject drugs may want to repeat this process several times.
- A person cannot recover the drug if something goes wrong with an injection, e.g., if a vein collapses.

In Ottawa, a study looked at first impressions and reactions towards a safety-engineered product (the New Medical Technology Safety Syringe) among 50 NSP clients (Oickle, 2008). Many participants made comments about plunger stiffness and difficulty with retracting the needle. As well, a concern arose around vein safety. At the time, it was recommended that the program not distribute safety-engineered syringes on the basis of safety, feasibility, liability, and cost concerns. Oickle (2008) also states that, "According to communication with other NSPs in Canada, the US and Australia and a preliminary review of worldwide studies, there are currently no programs distributing single-use safety syringes to the injection drug using (IDU) population" (p. 5). Overall, the report suggests that introduction of safety-engineered syringes would require further investigation and offers several other products as potential options for evaluation. A market scan subsequent to the report did not find any new products on the market (Oickle, personal communication, 2012).

Other organizations have published cautions regarding safety-engineered syringes as part of harm reduction among people who inject drugs (e.g., http://www.exchangesupplies.org/article_retractable_and_safety_syringe_debate.php). Given that NSP clients may not like or be able

to effectively use safety-engineered syringes, offering these syringes in place of regular syringes could potentially lead to regular syringes being reused and shared. Safety-engineered needles are also more costly than standard syringes (Harm Reduction Coalition, 2010), so they may not be cost-effective for NSPs.

Use of bleach to disinfect injection equipment

In 2004, the WHO reviewed the scientific evidence concerning the effectiveness of bleach to disinfect used injection equipment and stated that bleach and other methods of disinfection are not supported with good evidence for reducing HIV transmission. As well, the WHO (2004) states that studies in the field cast doubt that disinfection procedures could ever be effective:

> *At best, these strategies can only be regarded as acceptable in community or correctional settings where the introduction of NSPs is considered impossible because of fear or hostility on the part of community members or authorities. Public health practitioners in these settings should continue to advocate for the introduction of NSPs as the most reliable and evidence-based way of maintaining control of HIV among IDUs. (WHO, 2004, p. 28)*

PHAC (2004) reviewed the evidence regarding the use of bleach to prevent the transmission of HCV, HBV, and HIV. PHAC (2004) concluded that although there is partial effectiveness, bleach disinfection offers little benefit to prevent HCV transmission among people who inject drugs. This report states, "Bleach distribution and education programs for people who use injection drugs must be careful not to impart a false sense of security regarding bleach's protective efficacy" (p. 16). Since the publication of these two reports, there have been no new studies evaluating the impact of bleach to disinfect equipment.

A study of 2,302 people who use drugs in six urban sites in the United States (Monterroso et al., 2000) found that those who reported ever cleaning a needle with bleach were 3.70 times more likely (95%CI: 1.34-10.0) to become HIV infected than other people who inject drugs. Monterroso et al. (2000) suggest that people who inject drugs who had tried to protect themselves from HIV transmission may not have done so consistently or correctly, or both.

Needle and syringe distribution evidence summary

The evidence that informs this chapter and its recommendations came from a variety of studies. Laboratory studies involving virologic testing have contributed much knowledge regarding the transmissibility of HIV, HCV, and other blood-borne pathogens via needles. Cross-sectional studies and prospective cohort studies were the main types of studies to contribute evidence on injection risk behaviours, while some qualitative interview studies have deepened our understanding of such risky practices. A few articles relied on randomized controlled trial (RCT) designs to provide data on injection risk behaviours. While RCTs are generally considered to provide the highest quality evidence for interventions, it is not always feasible or ethical to conduct this type of research within populations or with harm reduction programs. This is recognised by a number of public health experts and authorities, for example:

[T]he difficulty of conducting a strictly randomized controlled trial to evaluate a public health intervention such as a NSP should not be underestimated. Potential sources of bias and confounding are impossible to control because of insurmountable ethical and logistical impediments. (WHO, 2004, p. 5)

[I]n some cases it is impossible for researchers to conduct RCTs since to do so would be unethical. Further, given the complexity of causal chains in public health, the external validity of RCT findings often has to be enhanced by observational studies. (NICE, 2009, p. 17)

Review papers – including a few systematic and meta-analytic reviews – have covered a variety of topics including HIV and HCV seroconversion, infections and other health-related harms among people who inject drugs, and program coverage. Other study designs (e.g., case-control, cost-effectiveness, modelling) and other materials (e.g., manuals) provided information, but less frequently. Much of the evidence we reviewed for this chapter came from observational and other studies.

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2 Cooker distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of a sterile cooker for each injection and reduce transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), and other pathogens:

- **Provide individually pre-packaged, sterile cookers with flat bottoms for even heat distribution and heat-resistant handles in the quantities requested by clients with no limit on the number of cookers provided per client, per visit**
- **Offer a sterile cooker with each needle provided**
- **Offer a variety of cookers that meet the needs of clients**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**
- **Dispose of used cookers and other injection equipment in accordance with local regulations for biomedical waste**
- **Educate clients about the risks associated with sharing and reuse of cookers and the correct single-person use of cookers**
- **Educate clients about the proper disposal of used cookers**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Description of how cookers are used

Prior to injection, drugs in powder form (e.g., cocaine, white heroin), solid form (e.g., crack cocaine, black tar heroin), and tablet form (e.g., Dilaudid, PCP, OxyContin) need to be mixed with water to make a solution that can be injected. A container is needed for this mixing process. These containers are often called 'cookers' as the solution may be heated to further dissolve the drug so that the solution is of the right consistency for injection. People who inject drugs will often use items such as spoons and bottle caps as cookers.

A person may use their needle/syringe to draw up water from a new, sterile water vial and then squirt it into the cooker for mixing with the drug of choice. It is common for drugs to be collectively purchased and then shared. Distribution of a 'share' is often accomplished when the drug is mixed into a solution and amounts can be measured out. There is a risk of disease transmission when cookers or any of the pieces of equipment used to prepare, share, or inject the drug solution are contaminated with HIV, HCV, HBV, or other pathogens. To reduce the risk of transmission from contaminated cookers, clients need to use a new cooker each time. Also, to ensure that the cooker and its contents are not contaminated, all other pieces of equipment (i.e., needle, filter, water, etc.) must be unused and clean.

Evidence of cookers as vectors of HIV, HCV, and HBV transmission

It is possible that HIV and HCV may be transmitted between people who inject drugs by the shared use of cookers.

Virologic research has documented the presence of HIV on cookers that have been removed from settings where people inject drugs. In a 1996 study, Shah et al. (1996) examined previously used injecting equipment from shooting galleries in Miami, Florida, for the presence of HIV-1. Antibodies to HIV-1 were detected in three (14%) of 21 rinses from cookers. Components of HIV-1 were detected in six (46%) and seven (54%) of the 13 cookers examined (Shah et al., 1996).

Epidemiologic studies also document increased HIV risk through sharing previously used cookers. Significant differences in cooker-sharing behaviour related to HIV-positive status were observed among 355 people who inject drugs who completed both a baseline and a two-week follow-up interview as participants in the evaluation of Baltimore's needle and syringe program (NSP) between August 1994 and August 1995 (Vlahov et al., 1997). People who inject drugs who tested HIV-positive at their baseline interview were more likely to report sharing cookers (71%) than those testing HIV-negative at their baseline interview (56%; Vlahov et al., 1997).

Various studies have examined associations between HCV risk and cookers and other injection-related equipment. For example, Crofts et al. (2000) examined previously used injecting equipment from 10 Australian injecting settings for the presence of HCV RNA. HCV RNA was detected on 25% (1/4) of the spoons tested. In addition to this virologic study, epidemiologic studies have also documented increased HCV risk through sharing and reusing cookers. In a cohort study of 353 HCV-negative people aged 18 to 30 years who inject drugs recruited from the greater Chicago area, Illinois, Thorpe et al. (2002) found the sharing of cookers to be a statistically significant predictor of HCV seroconversion. Sharing a cooker in the six months prior to the follow-up interview elevated the risk of HCV seroconversion among this group of younger people who inject drugs four-fold (adjusted relative hazard (ARH)=4.1; 95%CI: 1.4-11.8). After adjustment for syringe-sharing, sharing cookers remained the strongest predictor of HCV seroconversion, elevating the risk of seroconversion three-fold (ARH=3.5; 95%CI 1.3-9.9; Thorpe et al., 2002). Similarly, Hagan et al. (2001) measured HCV seroconversion among a cohort of 317 Seattle people who inject drugs who tested negative for HCV antibody at recruitment into their study. Among the 123 people who inject drugs who did not share syringes, sharing cookers and cotton (combined) elevated the risk of HCV seroconversion six-fold (adjusted relative risk (ARR)=5.9; 95%CI: 1.1-31.7; Hagan et al., 2001). Doerrbecker et al. (2011) showed that HCV on a spoon, simulating the heating of a drug solution, can survive temperatures up to 65 degrees Celsius, and HCV could be eliminated between 65 and 70 degrees Celsius.

A review of research on the link between drug preparation equipment sharing and HCV reports that there are few studies that have been designed "to allow an adequate assessment of the individual contributions of containers, filters and water to HCV incidence" (De et al., 2008, p. 279). This review found that risk estimates from studies indicate a positive association between HCV seroconversion and equipment sharing. However, a number of methodological concerns with the reviewed studies – including small sample sizes, confounders, short follow-up times, and how people who inject drugs were defined – were highlighted (De et al., 2008). In other words, it is difficult to measure the magnitude of the risk of HCV transmission from equipment sharing and this consideration should be kept in mind when examining the evidence regarding other pieces of injection-related equipment. A more recent meta-analysis reported an association between HCV seroconversion and sharing of drug preparation containers (PRR = 2.42, 95% CI 1.89, 3.10; Pouget et al., 2011).

A case-control study on risk factors for HBV infection among people who inject methamphetamine in Wyoming found that sharing spoons was not significantly associated with acute HBV infection (Vogt et al., 2006). However, there is little research on injection-related equipment sharing and risk of HBV.

Evidence of risk behaviours

Data from Canadian and international studies document that cooker sharing is common among people who inject drugs. In Ottawa, Leonard et al. (2005) examined cooker sharing among 418 men and 85 women who inject drugs participating in the POINT Project between October 2002 and January 2003. The majority of both men (59%) and women (68%) had injected with previously used equipment at some point in their injection drug use history. The majority of both men (82%) and women (76%) who had injected with previously used equipment in the six months prior to their baseline interview had shared another person's cooker or spoon (Leonard et al., 2005). A cross-sectional study of 145 people who inject drugs in London, Ontario found that more participants gave cookers (45%) to someone else than used needles (36%) or other types of equipment (water 36%, filters 29%, and swabs 8%; Strike et al., 2010). Thirty-seven percent also reported that they had reused someone's cooker. More recent data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that 25.6% of the 953 people who inject drugs sampled had borrowed cookers (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario; unpublished data).

In a study examining the multi-person use of injection-drug equipment among 794 street-recruited people who inject drugs in Chicago, Huo et al. (2005) found that 65% of participants shared cookers with others at the time of their baseline interview. At follow-up, participation in an NSP was associated with the reduction of needle sharing but not associated with the reduction of sharing cookers. This suggests that despite awareness efforts, the risks of indirect sharing among people who inject drugs remains under-recognized or difficult to avoid (Huo et al., 2005). It has been noted elsewhere that cooker sharing is more common than syringe sharing (Latkin et al., 2010).

Several studies have found that people share cookers more frequently than other items of drug preparation equipment (Beardsley et al., 1999; Gossop et al., 1997; Koester et al., 1990, 1996; Scottish Drugs Forum and Glasgow Involvement Group, 2004; Thorpe et al., 2002). Clatts et al. (1999) report-

ed from their direct observations of injecting episodes that people who inject drugs tend to retain and reuse cookers longer than either filters or rinse water. Seventy-eight percent of cookers examined showed evidence of previous use, and 90% of the cookers were retained for future use (Clatts et al., 1999).

People who use their own sterile needles for injection may share cookers during drug preparation. For example, Hunter et al. (1995) studied the injection-related risk behaviours of 2,062 people who inject drugs in Greater London, United Kingdom, from 1990 to 1993. In 1992 and 1993, over 50% of the respondents reported sharing cookers and/or filters in the six months prior to the interview. More than 33% of those who reported that they had not shared needles during the previous six months had shared cookers and filters during that time period (Hunter et al., 1995).

In a study of 321 people who inject drugs in Montreal (86% of whom were recruited from NSPs), many considered containers (i.e., cookers; 85%), filters (82%), and water (82%) as potentially high-risk modes of infection transmission (Cox et al., 2008).

Correlates of risk behaviours

Risk perception and peer norms among people who inject drugs have been associated with sharing cookers. Latkin et al. (2010) found that people who inject drugs in 'cooker-sharing networks' perceived sexual and injection-related risks differently than people in multiple needle-sharing networks. Cooker-sharing networks were associated with norms that discouraged people from engaging in certain HIV risk behaviours. Thus, there appears to be some groups of people who will share cookers, but do not share or endorse sharing needles. However, while some people who share cookers would not share their needles, they would benefit from education about the risks associated with cooker reuse and sharing.

People with a history of mental health problems who inject drugs appear to be more likely to inject using previously used cookers. Morse et al. (2001) found that among a cohort of 2,198 people who inject drugs aged 18 to 30 from five U.S. cities, people with a history of mental health hospitalization (OR=1.5; 95%CI: 1.2-1.8) or with suicidal ideation (OR=1. 6; 95%CI: 1.3-1.9) were more likely to report sharing cookers. Reyes et al. (2007) found that in a sample of 557 people who inject drugs in Puerto Rico, those with severe anxiety symptoms were almost four times more likely to share filters/cookers compared to those with minimal anxiety symptoms. Strike et al. (2010) found that factors associated with distributing used cookers included a score on the Addiction Severity Index (ASI) indicative of a mental health problem. These authors also found that a history of cocaine/crack injection and being older than age 30 were associated with distributing used cookers (Strike et al., 2010). Aspinall et al. (2012) reported that in their survey of 2,037 people who inject drugs, a multivariate model showed that spoon sharing was significantly associated with age greater than 30 years, homelessness in the last 6 months, having not injected in the last 4 weeks, exclusive heroin injecting, and injecting more than once a day.

People who engage in secondary syringe exchange (SSE) may be more likely to share cookers. In a study of SSE practices and risk behaviours among people who attended 23 NSPs in California it was found that SSE participants were more likely than non-participants to share cookers and needles in the previous six months (Lorvick et al., 2006). The authors suggest that NSPs should inform SSE participants about the importance of not sharing injection equipment.

Incidence and prevalence of HIV, HCV and HBV in Canada

National incidence and prevalence data specifically on people who share cookers are unavailable. *(See incidence and prevalence among people who inject drugs in Canada tables in the chapter on needle and syringe distribution)*

Other health-related harms

Health concerns regarding cooker sharing are primarily focused on transmission of blood-borne pathogens as discussed above.

Cooker distribution policies

There may be greater opportunity for contaminating cookers with HIV and HCV compared to other injection-related equipment given the above evidence that people who inject drugs tend to retain and reuse cookers longer than filters or rinse water, share cookers more frequently than other equipment, and share cookers even when a sterile needle is used for injection. Therefore, the distribution of cookers is an important way for NSPs to reduce the risks associated with sharing or reusing cookers. In a systematic review, Gillies et al. (2010) suggested that there is limited evidence to show that providing other sterile injection-related equip-

ment reduces HCV transmission. Although, in a more recent cross-sectional survey of Scottish people who inject drugs, Aspinall et al. (2012) found that those who reported uptake of at least one spoon from injection equipment provision services in a typical week during the last 6 months had significantly lower odds of sharing spoons during that time compared to people who had not obtained these items. Further, those who experienced a shortfall in spoons had increased odds of sharing spoons. These findings point to a relationship between uptake and availability of cookers from programs and risk behaviours.

Between 2006 and 2008, there was a significant increase in the number of core and satellite NSPs in Ontario that were distributing cookers (Strike et al., 2011). In 2008, all core NSPs and 85% of satellite NSPs that responded to the survey and were distributing cookers were doing so without limits on the number provided to clients (Strike et al., 2011). These changes were in line with Ontario's existing best practice recommendations.

Even when cookers are available from NSPs, people may still make their own or use other items. In an evaluation of the Ontario Harm Reduction Distribution Program (OHRDP), Leonard and Germain (2009) found that the greatest number of participants reported making their own cookers, although a decline was observed between final participants (76%) and baseline participants (82%) in the study. These authors also reported an increase in the proportion of participants who collected new cookers on at least one occasion from an NSP between baseline and final outcomes. Data from 275 people who inject drugs in Montreal indicates that use of sterile containers is low compared to use of sterile syringes and water; however, this was a predominantly cocaine-injecting group and they may use other types of containers (Morissette et al., 2007). In this study, factors associated with sterile container use were having at least high school education, injecting heroin, injecting alone, older age, and being HCV-negative.

The OHRDP provides two types of cookers – the Spoon and the Stericup – that heat more evenly and quickly than most makeshift cooker items (www.ohrdp.ca). BC Harm Reduction Strategies and Services also provides the Stericup which is designed to be used only once (http://towardtheheart.com/product/cooker).

Coverage

While reported increases in cooker distribution among Ontario NSPs are encouraging, the availability of cookers across this and other provinces may not be uniform. National data about NSP cooker distribution in Canada is lacking. A study from British Columbia notes that determining reach and availability of harm reduction supplies is challenging (Buxton et al., 2008). British Columbia has been collecting numbers on cookers since these items began to be distributed in the province in 2010. We can employ numbers from Ontario and British Columbia (Table 2.1) as examples of cooker distribution volume. This type of information is made possible by having central distribution programs and tracking systems. The OHRDP has suggested provision of 1000 cookers per person per year to match the coverage suggestion regarding needles (www.ohrdp.ca).

Table 2.1 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
Cookers[a]	2,560,000	1,027,000
Filters	19,109,750	N/A[d]
Ascorbic acid	1,038,000	542,000
Sterile water[b]	4,838,100	3,616,000
Alcohol swabs	10,652,000	7,147,400
Tourniquets	603,000	357,100

a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

Other issues specific to cookers

Empirical literature on additional cooker-related issues was lacking.

Additional evidence

Numerous studies have examined injection-related equipment, but did not examine behaviours related to or the role of each piece of equipment separately. For example, in some studies participants were asked if they ever shared a "cooker, filter, or water." As a result, it is difficult to determine from these studies if cookers are more likely than other pieces of injection equipment to be shared and therefore contribute greater or lesser potential risk of HIV or HCV transmission. Please see Appendix B, Other Injection-related Equipment Supporting Evidence.

Cooker distribution evidence summary

The evidence that informs this chapter came from predominantly observational studies. Other types of studies were employed less frequently. Cross-sectional studies were the main type of study to contribute evidence on risk behaviours such as sharing injection equipment. Prospective cohort studies were also fairly common in this literature. Laboratory studies – particularly virologic testing of cookers, filters, water, tourniquets, and/or swabs collected from community and clinical settings – have contributed knowledge regarding the potential transmissibility of HIV, HCV, and other pathogens via injecting equipment. Review papers, including a few systematic reviews, have covered a variety of related topics and some clinical case reports/studies have provided information on infections among people who inject drugs. We did not find reports of randomized controlled trials (RCTs) or other experimental designs that were applicable for this chapter. As noted previously in this document, although RCTs are considered to provide the highest quality evidence, it is not always feasible to conduct this type of research with harm reduction programs.

Although the evidence base has grown in recent years, there are notable gaps in the literature on other injecting equipment. Studies that are well designed to measure the magnitude of risk of HIV, HCV, and other bloodborne pathogen transmission from sharing each item of injecting equipment are needed. There are also few empirical studies that address injecting equipment distribution policies and coverage.

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3 Filter distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of a sterile filter for each injection and reduce transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), hepatitis B (HBV), and other pathogens, and to prevent other health complications, such as deep vein thrombosis (DVT), from the non-use and/or reuse of filters:

- **Provide pre-packaged, sterile .22 µm filters that retain as little drug solution as possible in the quantities requested by clients with no limit on the number of filters provided per client, per visit**
- **Offer a filter with each needle provided**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**
- **Dispose of used filters and other injection equipment in accordance with local regulations for biomedical waste**
- **Educate clients about the risks associated with not using filters, sharing filters, making 'washes' from filters, the risks of bacterial contamination and DVT if a new filter is not used, and the correct single-person use of filters**
- **Educate clients about the proper disposal of used filters**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Description of how filters are used

Prior to injection, drugs in powder, solid, or tablet form are mixed with water to make a solution that can be injected. A needle is placed in the mixing container and the solution is then drawn up into the syringe. Filters are used on the tips of the needles to prevent any undissolved particles of the drug, other debris (e.g., cornstarch and wax from crushed pharmaceutical tablets), and/or bacteria from being drawn into the syringe and potentially injected into a vein.

Household items made of cotton or cotton wool are often used as filters. Cigarette filters are also commonly used for this purpose. In addition, there are anecdotal reports of people who inject drugs using tampons, cigarette rolling paper, and cotton buds as filters. Although these filters may prevent large particles from getting into the syringe, these items are not sterile, may not be clean, and will not prevent the entry of smaller particles and small organisms like bacteria. Sometimes people who inject drugs will not use any filter for various reasons including concern that the filter will block or they will lose some of the drug by using a filter. Unfiltered drug solutions contain many particles that can lead to health-related harms.

There is a risk of disease transmission when filters or any of the pieces of equipment used to prepare, share, or inject the drug solution are contaminated with HIV, HCV, HBV, or other pathogens. To reduce the risk of transmission from contaminated filters, clients need to use a new filter each time.

Evidence of filters as vectors of HIV, HCV, and HBV transmission

When a filter is shared among people who inject drugs, the syringe of the second person – even if it is a sterile syringe – may become contaminated with blood or other biological material left in the filter. Even filters with a small pore width available from harm reduction programs are unable to filter out viruses (McLean et al., 2009). Therefore, when shared, filters of any pore width could potentially transmit HIV, HCV, HBV, and other viruses.

HIV may be transmitted between people who inject drugs by the shared use of filters. In a 1996 study, Shah et al. (1996) examined used injection equipment from shooting galleries in Miami, Florida, for the presence of HIV-1. Antibodies to HIV-1 were detected in three (18%) of 17 rinses made from filters (cottons). Components of HIV-1 were detected in three (27%) and four (36%) of the 11 filters examined respectively (Shah et al., 1996).

Epidemiologic studies also document increased HIV risk through injecting with previously used filters. Among 355 people who inject drugs who completed both a baseline and

a two-week follow-up interview for the evaluation of Baltimore's Needle Exchange Program (August 1994 to August 1995), significant differences in cotton-sharing behaviour related to HIV-positive status were observed (Vlahov et al., 1997). People who inject drugs who tested HIV-positive at their baseline interview were more likely to report sharing cotton (52%) than those who tested HIV-negative at their baseline interview (43%; Vlahov et al., 1997).

It is also possible that HCV may be transmitted between people who inject drugs via the shared use of filters. One study examined used injection equipment from 10 Australian injection settings for the presence of HCV RNA. HCV RNA was detected on 40% (2/5) of the filters tested (Crofts et al., 2000). However, in another study from France, HCV RNA was not detected on 10 used filters collected from multiple sites (Thibault et al., 2011).

Epidemiologic studies have documented increased HCV risk through the sharing of filters. Lucidarme et al. (2004), in a study carried out between March 1999 and July 2000, examined the factors associated with HCV seroconversion among 165 HCV-negative people who inject drugs attending care centres in Northern and Eastern France. In this study, injection with a used cotton filter was a significant independent predictor of HCV seroconversion. Injection with a used cotton filter increased the risk of acquiring HCV infection more than 16-fold (adjusted relative risk (ARR)=16.4; 95%CI: 1.4-190.6; Lucidarme et al., 2004).

Sharing cotton filters was also a significant independent predictor of HCV seroconversion in a study carried out by Thorpe et al. (2002) from 1997 to 1999 among 353 HCV-negative people who inject drugs aged 18 to 30 years recruited from the greater Chicago area, Illinois. Sharing a cotton filter in the six months prior to the follow-up interview doubled the risk of HCV seroconversion among this group of young adults who inject drugs (adjusted relative hazard (ARH)=2.4; 95%CI: 1.1-5.0; Thorpe et al., 2002). Similarly, Hagan et al. (2001) measured HCV seroconversion among a cohort of 317 people who inject drugs in Seattle, Washington who tested negative for the HCV antibody at recruitment into their study. Among the 123 people who inject drugs who did not share syringes, sharing cookers and cotton elevated the risk of HCV seroconversion six-fold (ARR=5.9; 95%CI: 1.1-31.7; Hagan et al., 2001). In a study of people who inject drugs in New South Wales, Australia, independent predictors of HCV seroconversion included, among other factors, shared use of filters (Maher et al., 2006).

A review of research on the link between drug preparation equipment sharing and HCV reports that there are few studies that have been designed "to allow an adequate assessment of the individual contributions of containers, filters and water to HCV incidence" (De et al., 2008, p. 279). This review found that risk estimates from studies indicate a positive association between HCV seroconversion and equipment sharing. However, a number of methodological concerns with the reviewed studies – including small sample sizes, confounders, short follow-up times, and how people who inject drugs were defined – were highlighted (De et al., 2008). In other words, it is difficult to measure the magnitude of the risk of HCV transmission from equipment sharing and this consideration should be kept in mind when examining the evidence regarding other pieces of injection-related equipment. A meta-analysis conducted as part of the HCV Synthesis Project reported an association between HCV seroconversion and shared use of filters (PRR = 2.61, 95% CI 1.91, 3.56; Pouget et al., 2011). Doerrbecker et al. (2013) performed a more recent experimental analysis to examine HCV transmission risk and filters. These authors found that up to 10% of initial viral infectivity was associated with filters and this association increased if contaminated filters were wrapped in foil (which was noted as a practice among some people who inject drugs). In other words, wrapping filters in foil helped preserve the stability of HCV in this lab study. Although we are unsure whether this is a practice in Canada, people who inject drugs should be advised not to save filters for reuse in this way as it may increase HCV risk.

A study on risk factors for HBV infection among people who inject methamphetamine in Wyoming found that sharing cotton filters was statistically associated with HBV infection (89% of case-patients versus 52% of controls; Vogt et al., 2006).

After use, filters can retain a residue of the drug solution. By using one or several used filters and water, people who inject drugs may make what is termed a 'wash,' which is subsequently injected so that any remaining drug solution in the filter(s) is not wasted. The use of a filter with a pore width of 0.22 µm is able to soak up only about one drop of liquid (≤ 50 µL; Caflisch, et al., 1999). Use of a filter with this pore width may reduce filter sharing. It is unclear whether use of this filter would deter making washes since multiple filters may be used for this purpose. Regardless, filters should not be saved and reused as they can become contaminated with particles and bacteria (especially if stored in a damp place), which can lead to infection.

Evidence of risk behaviours

Data from international studies document the high frequency of reuse or sharing of filters; studies also document the frequency of injecting washes obtained from previously used filters.

There is evidence of filter sharing among people who inject drugs in Canada. Leonard et al. (2005) examined filter or cotton sharing among 418 men and 85 women who inject drugs who participated in the POINT Project in Ottawa between October 2002 and January 2003. The majority of both men (59%) and women (68%) had injected with previously used equipment at some point in their injection drug use history. Among this group, the majority of both men (68%) and women (72%) who had injected with previously used equipment in the six months prior to their baseline interview had shared another person's filter or cotton (Leonard et al., 2005). More recently, a cross-sectional study of 145 people who inject drugs in London, Ontario found that 29% distributed used filters in the past six months (Strike et al., 2010). Reuse of filters was also reported by 18% of the study's participants (Strike et al., 2010). More recent data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that 13.3% of the 953 people who inject drugs who participated had borrowed filters (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario; unpublished data).

In an ethnographic study that examined drug acquisition and the sharing of injection equipment in 54 "networks" of people who inject drugs selected from six American cities and Puerto Rico, cotton filters were shared 77% of the time (Needle et al., 1998). Moreover, when drugs were purchased by a higher-risk group (defined in the study as having at least one group member who engaged in behaviours such as reusing a previously used syringe), cotton filters were always shared (Needle et al., 1998). Similarly, Hunter et al. (1995) studied the injection-related risk behaviours of 2062 people who inject drugs in Greater London, United Kingdom. In 1992 and 1993, over 50% of people reported sharing filters and/or spoons in the six months prior to the interview. More than 33% of those who reported that they had not shared needles during the previous six months had shared filters and spoons during that time period (Hunter et al., 1995).

Filters, particularly cigarette filters, can absorb some of the drug solution. People who inject drugs sometimes give these drug solution-soaked filters to others who may have collected several such filters from different sources. These filters are mixed with water and the resultant "wash" is injected. This practice was observed by Bourgois and Pearson (1998) in an observational study of HIV injection-related risk behaviours among a network of 46 people who use heroin in San Francisco. In this group, people considered to be 'lower' in the network hierarchy would ask for "cotton shots" referring to the use of a cotton remnant from a previous injection episode (potentially containing blood and residual heroin) to prepare a solution for injection (Bourgois & Pearson, 1998). Power et al. (1994) observed that it was common practice for people who inject drugs to leave used filters as payment in kind for being permitted to inject in another person's home. Thus, there are different ways that people may obtain used filters. The HIV and HCV status of people who previously used the filters may be unknown, presenting potential for transmission.

Correlates of risk behaviours

People with a history of mental health problems who inject drugs appear to be more likely to inject using previously used cotton filters. For example, Morse et al. (2001) found that among a cohort of 2,198 people who inject drugs aged 18 to 30 from five U.S. cities, those with a history of mental health hospitalization (OR=1.38; 95%CI:1.12-1.68) or with suicidal ideation (OR=1.62; 95%CI:1.36-1.94) were more likely to report sharing cotton. A study of 557 people who inject drugs in Puerto Rico, found that, compared to those with minimal anxiety symptoms, people with severe anxiety symptoms were almost four times more likely to share filters/cookers (Reyes et al., 2007). Strike et al. (2010) found that factors associated with distributing used filters included having injected cocaine/crack or having stayed on the street or in some other public place overnight. In multivariate analysis in a cross-sectional study of people who inject drugs in Scotland, Aspinall et al. (2012) found that filter sharing was significantly associated with being female, age greater than 30 years, homelessness in the last 6 months, having not injected in the last 4 weeks, exclusive heroin injecting, and injecting more than once a day.

Incidence and prevalence of HIV, HCV and HBV among people who inject drugs in Canada

National incidence and prevalence data specifically on people who share filters are unavailable. *(See incidence and prevalence among people who inject drugs in Canada tables in the chapter on needle and syringe distribution)*

Other health-related harms

'Cotton fever'

People who inject drugs are prone to a condition called 'cotton fever'. The exact cause of cotton fever is unknown, however, the condition has been documented in association with injection drug use and the use of cotton filters (Harrison & Walls, 1990; Kaushik et al., 2011). Cotton has been known to provoke an inflammatory and pyrogenic (inducing fever) response, creating symptoms such as headache, chills and rigors, dyspnea, palpitations, nausea, emesis, abdominal pain, and other fever symptoms that can even mimic sepsis (Harrison & Walls, 1990).

Shragg (1978) studied two heroin users with febrile symptoms after they had boiled a previously used cotton filter in order to retrieve and inject residual drugs. No cause of fever could be determined other than that believed to be caused by the filter itself (Shragg, 1978). Ferguson and colleagues reported a case of cotton fever in a person who injects drugs who had used cotton to filter heroin and concluded that the bacterial organism Enterobacter agglomerans was likely the causal agent of cotton fever (Ferguson et al., 1993). The concern is that people who use drugs experiencing these symptoms may be suffering from a more serious illness such as pneumonia, endocarditis, or hepatitis and therefore it is recommended that all febrile cases be hospitalized as a measure of precaution, which presents a significant burden on the healthcare system (Harrison & Walls, 1990).

Although a relatively small amount of research has examined cotton fever, it is important to advise clients not to use household items like cotton balls and Q-tips as filters. These items are not sold in sterile packaging and therefore may contain bacteria even when not reused. Of course, once sterile cotton is removed from packaging it too becomes exposed to potential bacterial contamination from the surrounding area. Depending on the type of filters provided and assembly of safer injection kits, NSP staff may want to consider handling filters has little as possible and do so while wearing clean gloves.

Bacterial infection

Microbiological studies that have examined the injection equipment of people who use heroin have found bacteria in their needles, most notably variations of the Streptococcus and Staphylococcus bacterium. These are the two bacteria responsible for the formation of abscesses (Caflisch et al., 1999).

In a study carried out in 1997, Caflisch and colleagues measured the bacterial growth in sterile syringes after they had been used for injection with three different types of filters. Bacterial contamination was found in 23 of 24 syringes used with a cigarette filter; in 20 of 24 syringes used with a filter with a pore width of 20 µm; and in only 6 of 24 syringes when a filter with a pore width of 0.22 µm was used. The authors concluded that a filter with a pore width of 0.22 µm was significantly more effective in preventing bacterial contamination of syringes than both cigarette and larger pore width filters (relative risk (RR)=18.0) and the 20-µm filter (RR=4.5; Caflisch et al., 1999).

Particles entering the body

Foreign particles entering the body through injection drug use can lead to deep vein thrombosis (DVT) and other health complications. Injection drug use was observed as a risk factor for DVT in a study that examined the cause of venous thromboembolism among 322 women aged 16 to 70 years accessing hospital care in Glasgow, Scotland for vein thrombosis (McColl et al., 2001). Injection drug use was associated with 21% of all cases of DVT observed among this group. Among women under 40 years of age, the DVT-related risk attributed to injection drug use was even more pronounced. Among this younger group of women, injection drug use was associated with 52% of cases of DVT, leading the study authors to conclude that injection drug use may be the most common risk factor for DVT in their region (McColl et al., 2001).

When some types of drugs are prepared for injection (especially drugs that are not intended for injection, but were formulated for swallowing), there may be increased risk of large particles entering the body. Pharmaceutical tablets contain fillers like talc or cornstarch that can enter the bloodstream and may cause pulmonary emboli and other complications (Roux et al., 2011). A study in France compared the effectiveness of use of a filter with a pore size of 10 µm versus no filter at reducing particles in solutions containing dissolved generic buprenorphine and Ritaline® (Roux et al., 2011). The authors found that filtering both drug solutions was effective at significantly reducing the number of large particles. McLean et al. (2009) examined filtration of solutions made from slow-release morphine tablets. They found that cigarette filters removed most large particles, but not smaller particles. Commercially available syringe filters (0.45 and 0.22 µm) substantially reduced the number of particles, though would sometimes block. Another complication may arise with heating drug solutions made from pharmaceuti-

cal tablets. Waxy components of some tablets can be melted down and will pass through filters, but upon cooling these waxy components may re-solidify and potentially cause harms (Anex Bulletin, 2011; McLean et al., 2009).

Intravascular talcosis ('chalk lung') and talc retinopathy

Failure to properly filter out impurities and filler materials such as talc can lead to a condition known as intravascular talcosis (talcum powder deposited into the blood vessels of the lungs; Griffith et al., 2012). An unfiltered drug solution prepared from oral medications may deposit talc in the lungs, liver, and/or heart valves; from the lungs, the talc may eventually access and lodge within the eyes (Drenser et al., 2006).

Filter distribution policies

The distribution of filters is an important way for NSPs to reduce the risks associated with sharing or reusing filters. Filters with small pore widths help prevent particles and, if small enough, bacteria, from entering the body which can lead to health-related harms like abscesses and DVT. A systematic review by Gillies et al. (2010) suggested that more research is needed regarding evidence that demonstrates that providing sterile injection-related equipment reduces HCV transmission. Aspinall et al. (2012) found a dose-response relationship between filter uptake and filter sharing. Among a sample of 2,037 people who inject drugs in Scotland, those who had obtained more than 30 filters in a typical week during the last 6 months had significantly lower odds of filter sharing in that time compared to those who did not obtain filters (Aspinall et al., 2012). In another multivariate model, participants who experienced a shortfall of more than 10 filters in a typical week had increased odds of sharing filters. These findings suggest a connection between filter provision, uptake, and risk behaviours.

The number of core and satellite NSPs in Ontario that were distributing filters significantly increased between 2006 and 2008, after the release of provincial best practice recommendations (Strike et al., 2011). In 2008, 90% of core NSPs and 93% of satellite NSPs that were distributing filters were doing so without placing limits on the number provided to clients (Strike et al., 2011).

In an evaluation of the OHRDP, Leonard and Germain (2009) found that nearly all baseline participants (94%) and final participants (95%) reported filtering before injection in the previous six months. Most of these participants reported using non-recommended filters as their most frequently used filter materials (where the recommended filter was 0.22 µm). However, there was a statistically significant decrease in the proportion of final participants who reported using non-recommended materials and an increase in the proportion of final participants who reported using only recommended materials most frequently compared to baseline. It should be noted that the OHRDP provides 100% cotton filters that come in two sizes, medium and large, though they had previously offered a small size as well. Their offered filters have a larger pore width than the recommended 0.22 µm due to "availability, client preference and cost" (www.ohrdp.ca).

A study of 275 people who inject drugs in Montreal found that sterile filters were reportedly used for at least half of all injecting episodes by 23% of participants (Morissette et al., 2007). In this study, factors associated with sterile filter use were having at least high school education, injecting heroin, and injecting alone.

Another study, undertaken in France, used qualitative (241 questionnaires from people who inject drugs and focus groups with a total of 23 people who inject drugs) and quantitative analyses to examine filter preferences (Keijzer & Imbert, 2011). They found that 72% of participants reported using a Sterifilt filter "always" or "frequently" with at least one of the substances they injected in the last month. The filter was used more often by people who inject at least 2 to 7 days a week. A majority of people who inject buprenorphine (64%) reported using the filter. Keijzer and Imbert (2011) found that reasons for not using the Sterifilt included filter membrane clogging, filtration preparation time, beliefs that cocaine and heroin filtration were not as important as buprenorphine filtration, and the availability of the filters (which were not accessible from vending machines or pharmacies). The main reasons for using the Sterifilt were quality of the filter and beliefs that using it would help prevent health-related harms (Keijzer & Imbert, 2011).

There are programs in South Australia that offer a range of filters, where 0.22 µm filters are considered bacterial filters and 5.0 µm filters are intended to get rid of chalk from certain tablet preparations (Anex Bulletin, 2011).

Coverage

While reported increases in filter distribution among Ontario NSPs are encouraging, the availability of filters across this and other provinces may not be uniform. National data about NSP filter distribution in Canada is lacking. A study from British Columbia notes that determining reach and availability of harm reduction supplies is challenging (Buxton et al., 2008). We can employ numbers from Ontario (Table 3.1) as an example of filter distribution volume. This type of information is made possible by having central distribution programs and tracking systems.

Table 3.1 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
Cookers[a]	2,560,000	1,027,000
Filters	19,109,750	N/A[d]
Ascorbic acid	1,038,000	542,000
Sterile water[b]	4,838,100	3,616,000
Alcohol swabs	10,652,000	7,147,400
Tourniquets	603,000	357,100

a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

Other issues specific to filters

Not only are cigarette filters not effective filters, they may contain small glass particles (www.ohrdp.ca). Further, if the cigarette where the filter came from was smoked the filter may contain other harmful substances (www.ohrdp.ca).

Additional evidence

Numerous studies have examined injection-related equipment, but did not examine behaviours related to or the role of each piece of equipment separately. For example, in some studies participants were asked if they ever shared a "cooker, filter, or water." As a result, it is difficult to determine from these studies if filters are more likely than other pieces of injection equipment to be shared and therefore contribute greater or lesser potential risk of HIV or HCV transmission. Please see Appendix B, Other Injection-related Equipment Supporting Evidence.

Filter distribution evidence summary

The evidence that informs this chapter came from predominantly observational studies. Other types of studies were employed less frequently. Cross-sectional studies were the main type of study to contribute evidence on risk behaviours such as sharing injection equipment. Prospective cohort studies were also fairly common in this literature. Laboratory studies – particularly virologic testing of cookers, filters, water, tourniquets, and/or swabs collected from community and clinical settings – have contributed knowledge regarding the potential transmissibility of HIV, HCV, and other pathogens via injecting equipment. Review papers, including a few systematic reviews, have covered a variety of related topics and some clinical case reports/studies have provided information on infections among people who inject drugs. We did not find reports of randomized controlled trials (RCTs) or other experimental designs that were applicable for this chapter. As noted previously in this document, although RCTs are considered to provide the highest quality evidence, it is not always feasible to conduct this type of research with harm reduction programs.

Although the evidence base has grown in recent years, there are notable gaps in the literature on other injecting equipment. Studies that are well designed to measure the magnitude of risk of HIV, HCV, and other bloodborne pathogen transmission from sharing each item of injecting equipment are needed. There are also few empirical studies that address injecting equipment distribution policies and coverage.

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4 Ascorbic acid distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of ascorbic acid to dissolve drugs (e.g., crack cocaine, some forms of heroin) and to reduce the risk of vein damage and bacterial and fungal infections associated with use of other types of acidifiers:

- **Ask clients if ascorbic acid is required to dissolve the drug(s) to be injected**
- **If needed, provide single-use sachets of ascorbic acid in the quantities requested by clients with no limit on the number of sachets provided per client, per visit**
- **If needed, offer acidifiers with each needle provided**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**
- **Educate clients about the potential HIV- and HCV-related risks associated with sharing acidifiers, the risks of fungal infections associated with using spore-contaminated lemon juice and other acids like acetic acid, and the correct single-person use of acidifiers including instruction on how to determine the amount of acid that is needed to dissolve the drug of choice**
- **Educate clients about the proper disposal of used acidifiers**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Description of how acidifiers are used

To inject some drugs such as crack cocaine and some forms of heroin, people who inject drugs must first convert the drug into a water-soluble form by adding an acid. The acidifier is added to the drug and water solution in the container or "cooker" to dissolve the drug before injection. Common acidifiers include ascorbic, citric, and acetic acids.

Pure ascorbic (vitamin C) or citric acids are not always available. When these acids are not available, people who inject drugs may use more common and accessible acids such as lemon juice – fresh and from plastic bottles – which can introduce risks of bacterial infection (Gallo et al., 1985; Shankland & Richardson, 1988). Some programs in Canada are currently investigating whether other acids, like vinegar, may also be recommended as safer-use acidifiers (Lebounga Vouma, personal communication, 2012). There is no evidence in the literature that using vinegar as an acidifier to dissolve some drugs is harmful. There is a risk of disease transmission when acidifiers or any of the pieces of equipment used to prepare, share, or inject the drug solution are contaminated with HIV, HCV, HBV, or other pathogens. To reduce the risk of transmission from contaminated acidifier sources, clients need to use a new acidifier each time.

Evidence of acidifiers as vectors of HIV and HCV transmission

HCV and HIV can be transmitted through the sharing of contaminated injection-related equipment (Hagan et al., 2001; Shah et al., 1996; Thorpe et al., 2000, 2002; Vlahov et al., 1997). If several people who inject drugs were to use the same acidifier source for their injections, the acidifiers could be possible reservoirs for pathogens. If a person living with HIV or HCV loaded their previously used syringe from a communal acidifier source, the other members of the injection group would thus be exposed to the blood-borne pathogen upon drawing up the contaminated acid.

The sachets of acidifiers offered by some programs are designed to provide an individual with enough acid for only one injection (www.exchangesupplies.org), thus discouraging multi-person use of acidifiers and reducing the possibility of HIV or HCV infection. Single-use sachets may also encourage frequent visits to pharmacies and NSPs, allowing for frequent contact between people who inject drugs and knowledgeable staff.

Evidence of risk behaviours

Preparing a drug with an acidifier is a common practice among people who inject drugs. Garden et al. (2004) evaluated the provision of single-use citric acid sachets among a group of 360 people who inject drugs (280 men and 80 women between the ages of 17 and 52) in Glasgow, Scotland and found that 94% reported using an acidifier to dissolve their drug prior to injection. All participants had at one point used single-use citric acid sachets. Two thirds of the sample had tried using lemon juice as an acidifier.

Evidence is more mixed, albeit limited, regarding whether sharing acidifiers is common practice. Survey data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that 5.6% of the 953 people who inject drugs sampled had borrowed acidifiers (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario; unpublished data). In 2004, the Scottish Drugs Forum and the Glasgow Involvement Group surveyed 76 people who inject drugs to gain feedback on existing needle exchange provisions. Ninety-one percent of respondents shared spoons and acidifiers (combined) most frequently, indicating a potential risk of infection with HIV or HCV through indirect sharing. The authors also found that 41% of respondents included acidifiers as one of their top five provision requests (Scottish Drugs Forum and Glasgow Involvement Group, 2004).

Correlates of risk behaviours

In the study mentioned above by Garden et al. (2004), men were significantly more likely to use lemon juice compared to women ($p<0.05$). People who injected more frequently ($p<0.05$) and those with longer injecting careers ($p<0.001$) were also significantly more likely to inject using other acidifiers.

Incidence and prevalence of HIV, HCV and HBV among people who inject drugs in Canada

National incidence and prevalence data specifically on people who share acidifiers are unavailable. *(See incidence and prevalence among people who inject drugs in Canada tables in the chapter on needle and syringe distribution)*

Other health-related harms

Bacterial and fungal infection

Some common household acids like lemon juice have the properties of a growth medium for certain bacteria and fungi (Gallo et al., 1985). These organisms can infect the heart in the form of endocarditis and the eyes in the form of candidal endophthalmitis, which can lead to blindness (Gallo et al., 1985; Garden et al., 2004).

Shankland and Richardson (1988) examined the epidemiology of an outbreak of candidal endophthalmitis among people who use heroin in the United Kingdom. Isolates of the organism Candida albicans were found in the lemon juice used by the affected people who inject drugs. Similarly, Garden et al. (2004) in the study described previously found that 38% of people who inject drugs who reported using an acidifier had experienced some sort of eye problem, and those who injected more frequently were significantly more likely to experience eye problems than those who injected less frequently ($p<0.001$).

McGuigan et al. (2002) examined the presence of Clostridium novyi type A and other spore-forming organisms among a group of 60 Scottish people who inject drugs during an outbreak between April and August 2000. Clostridium novyi is a bacterial strain that can lead to necrotizing fasciitis (flesh-eating disease), a potentially fatal condition. In this study, 31 cases involved women, the majority of whom had injected heroin and citric acid extravascularly. The predominant symptoms included soft-tissue infection, necrotizing fasciitis, and multiple organ failure leading to death. Twenty-three people died, likely as a result of a toxin-producing organism. The authors hypothesised that this was an opportunistic infection involving the extravascular injection of heroin and citric acid contaminated with C. novyi type A spores. The acidic solution damaged the soft tissue and the associated toxin led to severe local inflammation (McGuigan et al., 2002).

Vein damage

Any acid injected into the bloodstream is likely to cause vessel irritation and possible local vein damage. It is important therefore to use the smallest amount of acid possible in order to dissolve a drug and avoid vascular harm (Scott et al., 2000). For this reason and other hygienic reasons, citric and ascorbic acids are sometimes packaged into single-use, airtight, and water-resistant sachets of 100 mg and 300 mg, respectively. Ascorbic acid (vitamin C) is often recom-

mended and provided to people who inject drugs by harm reduction programs (e.g., www.ohrdp.ca; www.towardtheheart.com) as it is less irritating to the veins and has a large margin of safety, which is why we recommend it over citric acid. This margin allows more room for "error" as a small amount of extra ascorbic acid will be unlikely to cause vessel damage. Anecdotal accounts have suggested that vitamin C is perceived as less irritating for veins (Scott, 2010). However, citric acid can be distributed in a pure form that is readily available (i.e., not in tablet form) and of consistent strength, therefore making it relatively easy to use (Garden et al., 2004). It is important that people who inject drugs are aware that vitamin C sachets are three times the size of citric acid sachets since vitamin C is a weaker acid. Thus, if people who inject drugs were to switch from using vitamin C to using citric acid, they should be made aware of the difference in strength and reduce the amount of acid used for injection in order to avoid experiencing pain and vein damage. Exchange Supplies has an instructional video available from their website that shows a lab experiment designed to help people who inject drugs know how much acidifier to add (www.exchangesupplies.org). BC Harm Reduction Strategies and Services recommends that for crack cocaine the amount of vitamin C needed is about one-quarter the size of the rock; although they also note that the amount of vitamin C needed to fully dissolve drugs like crack cocaine and brown or black tar heroin will vary with drug purity (www.towardtheheart.com).

Other concerns

A concern for people who use ascorbic acid is evident from hospital data which document that large infusions of vitamin C have been linked to the formation of kidney stones. However, this is not usually a concern for people who inject drugs since the amount of acid used per injection is relatively small (Garden et al., 2004).

Due to the potential risk of all acidifier-related problems, once a sachet has been opened, any leftover acid should be disposed of so that it does not become contaminated and potentially lead to infection.

Some NSP clients may ask about ingesting vitamin C with water. Clients should be made aware that all types of acidifiers distributed by NSPs are meant for injection purposes only.

Acidifier distribution policies

The distribution of single-use sachets of ascorbic acid is the best way for NSPs to reduce HCV- and HIV-related risks associated with sharing acidifiers and to prevent the bacterial and fungal infections associated with using spore-contaminated lemon juice or other liquid acids as acidifiers. Although, it has been suggested that, "There is no evidence that the citric acid reduces harm for [people who inject drugs]; however, some believe that providing it would improve the use of services" (Matheson et al., 2008, p. 137).

Compared to 2006, in 2008 more core and satellite NSPs in Ontario were distributing acidifiers recommended by best practices (Strike et al., 2011). In 2008, 96% of core NSPs and 87% of satellite NSPs that responded to the survey and were distributing acidifiers were doing so without placing limits on the number provided to clients (Strike et al., 2011).

Leonard and Germain (2009), in an evaluation of the OHRDP, found that the greatest proportions of people who inject drugs in their sample reported making acidifiers from different sources; however, there was a decline in this reported practice observed between final participants (71%) and baseline participants (77%). There was also an increase observed in the proportion of final participants (51%) who reported that on at least one occasion they had collected acidifiers from an NSP compared to baseline (37%). In a UK study, Beynon et al. (2007) reported that the introduction of citrate (citric acid) at NSPs did not negatively affect NSP attendance and that people who attended pre- and post-citrate visited more frequently post citrate, giving staff more opportunities for intervention and referrals.

Coverage

While reported increases in acidifier distribution among Ontario NSPs are encouraging, the availability of acidifiers across this and other provinces may not be uniform. National data about NSP acidifier distribution in Canada is lacking. A study from British Columbia notes that determining reach and availability of harm reduction supplies is challenging (Buxton et al., 2008). We can employ numbers from Ontario and British Columbia (Table 4.1) as examples of ascorbic acid distribution volume. This type of information is made possible by having central distribution programs and tracking systems.

Table 4.1 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
Cookers[a]	2,560,000	1,027,000
Filters	19,109,750	N/A[d]
Ascorbic acid	1,038,000	542,000
Sterile water[b]	4,838,100	3,616,000
Alcohol swabs	10,652,000	7,147,400
Tourniquets	603,000	357,100

a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

Other issues specific to acidifiers

The OHRDP advises programs to rotate their acidifier inventories to make sure that products have not expired prior to distribution (www.ohrdp.ca). The OHRDP also recommends that programs consider their injection kit content as not all types of drugs require an acidifier – thus, including sachets in every kit may be wasteful and not cost-effective. In this regard, clients should also be asked if ascorbic acid is required to dissolve the drug(s) to be injected.

Ascorbic acid distribution evidence summary

The evidence that informs this chapter came from predominantly observational studies. Other types of studies were employed less frequently. Cross-sectional studies were the main type of study to contribute evidence on risk behaviours. Laboratory studies have contributed knowledge regarding the potential transmissibility of HIV, HCV, and other pathogens via injecting equipment. Clinical case reports/studies have provided information on infections among people who inject drugs. We did not find reports of randomized controlled trials (RCTs) or other experimental designs that were applicable for this chapter. As noted previously in this document, although RCTs are considered to provide the highest quality evidence, it is not always feasible to conduct this type of research with harm reduction programs.

Although the evidence base has grown in recent years, there are notable gaps in the literature on other injecting equipment. Studies that are well designed to measure the magnitude of risk of HIV, HCV, and other bloodborne pathogen transmission from sharing each item of injecting equipment are needed. There are also few empirical studies that address injecting equipment distribution policies and coverage.

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5 Sterile water distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of injection-grade sterile water for each injection and reduce transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), hepatitis B (HBV), and other pathogens, and to prevent bacterial infection from the use of non-sterile water and other fluids:

- **Provide single-use, 2 mL plastic vials with twist-off caps of sterile water for injection in the quantities requested by clients with no limit on the number of vials provided per client, per visit. If 2 mL vials of sterile water for injection are not available, distribute the smallest size of vial available.**
- **Offer a sterile water vial with each needle provided**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**
- **Dispose of empty water vials in accordance with local regulations for biomedical waste**
- **Educate clients about the HIV- and HCV-related risks associated with sharing mixing and rinse waters, the risks of using non-sterile water (such as tap, bottled, rain, puddle, and urinal water) and other fluids (such as saliva and urine), and the correct single-person use of mixing and rinse water**
- **Educate clients about the proper disposal of used water**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Description of how sterile water is used

Prior to injection, drugs in powder, solid, or tablet form need to be mixed with water to make a solution that can be injected into the bloodstream. A needle is often placed into a water source and water is drawn up into the syringe. The water is then squirted into a container – usually a spoon or 'cooker' – for mixing with and dissolving the drug. However, inserting a needle into a water vial may dull or 'barb' the needle which can lead to skin and vein damage, so water vials should be designed to be opened in a manner (e.g., easy twist-off cap) that allows a person to drip the water directly into the cooker.

While a new, sterile needle for each injection is recommended, some people who inject drugs may rinse their needles between injections by flushing the needle with water to remove any blood from the previous injection. Other injection equipment, such as cookers, may also be rinsed between uses. Needles from different users may be placed into the same water source for drawing up water for either mixing or rinsing purposes. There is a risk of disease transmission when water or any of the pieces of equipment used to prepare, share, or inject the drug solution are contaminated with HIV, HCV, HBV, or other pathogens. To reduce the risk of transmission from contaminated water, clients need to use a new, sterile water source each time.

Evidence of water as a vector of HIV, HCV, and HBV transmission

When a water source is shared or used by more than one person, there is a chance that small amounts of blood from any piece of equipment that comes in contact with the water will be deposited into the water and create risks for HIV, HCV, HBV, or bacterial transmission.

Water for mixing and rinsing can potentially become contaminated with HIV if a person who injects drugs who is HIV-positive places a previously used needle into a communal water source. Shah et al. (1996) examined previously used injection equipment from shooting galleries in Miami, Florida for the presence of HIV-1. Antibodies to HIV-1 were detected in one (6%) of 17 rinse waters. Components of HIV-1 were detected in 38% (5/13) and 67% (10/15), respectively, of the rinse waters examined (Shah et al., 1996).

Small amounts of blood in rinse water can potentially be enough to transmit HCV between people who inject drugs. Crofts et al. (1999) examined previously used injection equipment from 10 Australian injection settings for the presence of HCV RNA which HCV was detected in 33% (1/3) of the water samples tested. In a study from France, HCV RNA was not detected on used water vials (70 vials in total) collected from multiple sites (Thibault et al., 2011). Doerrbecker et al. (2013) performed an experimental analysis to examine HCV stability in water and viral association with different types of water container materials (i.e., plastic, aluminum, and glass). These authors found that, depending on the dose of the virus, HCV can survive in water for up to 3 weeks and longer. No residual virus was detected in the glass container; HCV was most strongly associated with the aluminum container followed by the plastic container. Thus, even water container material may present a risk of HCV transmission in instances where previously used containers are emptied and/or washed out and refilled with water. Such findings underscore the need for people who inject drugs to have their own, single-use sources of water.

Epidemiologic studies have documented increased HCV risk through injecting with previously used water. Evidence from cohort studies documents an elevated risk of HCV seroconversion attributed to sharing rinse water. Hagan et al. (2001) measured HCV seroconversion among a cohort of 317 people who inject drugs in Seattle who tested negative for HCV antibody at recruitment. The risk of HCV seroconversion was elevated for those who shared rinse water, although it was not statistically significant (Hagan et al., 2001). Similarly, Thorpe et al. (2000) measured HCV incidence among a cohort of 700 people who inject drugs aged 18 to 30 in Chicago between 1997 and 1999. Sharing rinse water doubled the risk of HCV seroconversion among study participants. The adjusted relative hazard (ARH) of HCV seroconversion was highest for sharing cookers (ARH=3.48; 95%CI: 1.43-8.48), immediately followed by sharing rinse water (ARH=2.21; 95%CI: 1.06-4.63; Thorpe et al., 2000). Finally, a recent review of studies reporting HCV seroincidence found an association between HCV seroconversion and sharing of rinse water (PRR = 1.98, 95% CI 1.54, 2.56; Pouget et al., 2011).

A study on risk factors for HBV infection among people who inject methamphetamine in Wyoming found that sharing water used for mixing or rinsing was statistically associated with HBV infection (94% of case-patients versus 44% of controls; Vogt et al., 2006). In hypothesis-generating interviews, people who inject drugs noted that often rinse water was not changed between injecting episodes "and was sometimes contaminated visibly with blood" (Vogt et al., 2006, p. 729).

Evidence of risk behaviours

The sharing of mixing and rinse water is a frequent practice among people who inject drugs. The POINT Project conducted by Leonard et al. (2005) examined injection-related risk behaviours among 418 men and 85 women who inject drugs in Ottawa. Seventeen percent of study participants reported using water from a container into which another person had put a used syringe in the six months prior to their baseline interview, and women were significantly more likely than men to have shared someone else's rinse water ($p<0.001$). Sharing of water persisted even among those who do not share needles. Among the 402 participants who had not injected with a used needle in the six months prior to their baseline interview, 15% reported using water from a container into which someone else had put a used syringe in the six months prior to their baseline interview, and 9% had done so in the month prior to their baseline interview (Leonard et al., 2005). In a study of 145 people who inject drugs in London, Ontario, 36% of participants distributed used water in the past six months (Strike et al., 2010). Reuse of water was reported by 19% of participants (Strike et al., 2010). More recent survey data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that 15.5% of the 953 people who inject drugs who participated had borrowed water (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario; unpublished data).

Other studies have reported nearly half of study participants shared rinse water (Huo et al., 2005; Thorpe et al., 2001). Koester et al. (1990) conducted a study examining the risk of HIV transmission from shared drug equipment among 280 people who inject drugs in three racially distinct neighbourhoods in Denver, Colorado. Seventy-five percent of participants had shared rinse water, and among this group, 47% reported sharing rinse water more than half the time (Koester et al., 1990). Similarly, Wang et al. (1998) analyzed the results from two 1997 studies among people who use opiates in Zurich, Switzerland. Fifty percent of people who inject drugs had shared water from a communal container, and participants measured the water using their own syringes which had been used more than once 83% of the time (Wang et al., 1998).

These practices are a concern as communal water can become contaminated if an individual living with HCV or HIV

were to place a previously used needle into the water, potentially exposing other members of the group to infection.

Correlates of risk behaviours

Rinse water was shared 77% of the time in an ethnographic study that examined drug acquisition and the sharing of injection drug equipment in 54 "networks" of people who inject drugs selected from six American cities and Puerto Rico (Needle et al., 1998). Sharing rinse water was found to be a more frequent practice among the lower-risk networks which were defined as groups that did not share drug solutions or needles, but had at least one member who injected with previously used injection drug equipment. When drugs were purchased by a lower-risk group, rinse water was shared five times out of six episodes (Needle et al., 1998).

People who inject drugs and have a history of mental health problems appear to be more likely to share rinse water. In examining the relationship between a history of mental health problems and HIV- and HCV-related risk behaviours among a cohort of 2,198 people who inject drugs aged 18 to 30 from five U.S. cities, Morse et al. (2001) found that those with a history of mental health hospitalization (OR=1.48; 95%CI: 1.21-1.81) or suicidal ideation (OR=1.72; 95%CI: 1.44-2.05) were more likely to report sharing rinse water. Other factors may be associated with sharing water too. Strike et al. (2010) found that factors associated with giving away used water included being male, having injected methadone, injected other stimulants, and moved three or more times in the past 6 months. In a study of unsafe practices among people who inject drugs in Vancouver, Rachlis et al. (2010) found that frequent reporting of using a used water capsule was associated with requiring help injecting, being HIV-positive, and daily heroin injection. In a cross-sectional survey of 2,037 people who inject drugs in Scotland, sharing water was significantly associated with being female, homelessness in the last 6 months, having not injected in the last 4 weeks, exclusive heroin injecting, and injecting more than once a day (Aspinall et al., 2012).

Incidence and prevalence of HIV, HCV and HBV among people who inject drugs in Canada

National incidence and prevalence data specifically on people who share mixing and rinse water are unavailable. *(See incidence and prevalence among people who inject drugs in Canada tables in the chapter on needle and syringe distribution)*

Other health-related harms

To avoid the risks associated with sharing water, some people may purchase their own sterile water from a local pharmacy or try to prepare it at home by boiling tap water and storing it in a sealed container (Sorge & Kershnar, 1998). However, as some people who inject drugs will not have the financial resources to buy sterile water or have access to a stove, some may turn to non-sterile water sources such as tap, bottled, rain, puddle, or urinal water. Non-sterile and/or shared water can become contaminated with bacteria that can lead to other health-related harms such as abscesses and infections such as endocarditis. These bacterial infections can have serious, even fatal, health implications for people who inject drugs.

The use of non-sterile fluids such as urine or saliva, or tap, bottled, rain, puddle, or urinal water may expose a person to bacteria and other organisms causing infection or illness. Pseudomonas aeruginosa is an organism found in non-sterile water sources such as toilets and was found to be the organism responsible for 10% of 180 cases of sternoclavicular septic arthritis (inflammation caused by infection in the joints of the clavicle and sternum) reviewed by Ross and Shamsuddin (2004). The authors found that injection drug use was the most common risk factor for this condition.

Other studies have found a relatively high prevalence of organisms normally found in the mouth in drug-related, soft-tissue abscesses as a result of using saliva to prepare a drug solution (Calder & Severyn, 2003; Gonzalez et al., 1993; Henriksen et al., 1994; Murphy et al., 2001). For example, Gonzalez et al. (1993) conducted a four-year retrospective review of 59 people who inject drugs with drug-related abscesses and reported that most of the organisms cultured were oral or skin flora.

Sterile water distribution policies

Provision of single-use vials of sterile water for injection is the best method to eliminate the risk of HIV and HCV transmission through sharing mixing and rinse water and to prevent bacterial infections through the use of non-sterile water. Sterile water for injection vials should contain enough water to mix drugs into an injectable form. The sterile water vials are only effective if provided in sufficient quantity to ensure that each injection is prepared with a vial of sterile water. Gillies et al. (2010) suggested in a systematic review that more research is needed to demonstrate that providing sterile injection-related equipment reduces risk of HCV

transmission. Aspinall et al. (2012) conducted a cross-sectional survey of people who inject drugs in Scotland and found that those who had obtained sterile water in a typical week during the last 6 months had significantly lower odds of sharing water compared to those who did not obtain any sterile water. In another multivariate model, these authors found that participants who had a shortfall of sterile water in a typical week during the last 6 months had increased odds of sharing water.

The Scottish Drugs Forum and the Glasgow Involvement Group surveyed 76 people who inject drugs in Glasgow in 2004 in order to gain feedback on existing needle exchange provisions. The authors reported that 26% of respondents included water as one of their top five provision requests. The number of core and satellite NSPs in Ontario that were distributing sterile water vials significantly increased between 2006 and 2008 (Strike et al., 2011). All core NSPs were distributing sterile water in 2008. Ninety-four percent of core NSPs and 92% of satellite NSPs that responded to the survey and were distributing sterile water at the time were doing so without placing limits on the number of vials provided to clients (Strike et al., 2011). In an OHRDP evaluation, Leonard and Germain (2009) reported a significant change in the pattern of sterile water sources accessed by people who inject drugs. Compared to baseline participants (55%), a greater proportion of final participants (62%) had accessed an NSP to obtain sterile water on at least one occasion; fewer final participants (5%) compared to baseline participants (7%) reported accessing a community agency for sterile water. At the final evaluation point, however, many participants (65%) still reported using other sources of water. In another study of 275 people who inject drugs in Montreal, sterile water was reportedly used for at least half of all injecting episodes by 75% of participants (Morissette et al., 2007). In this study, using sterile water was associated with daily injecting and being HCV-negative.

Single-use vials of water have advantages over other types of containers of water because the vials cannot be recapped once opened, eliminating the opportunity for contamination and reuse. There has been debate about the size of vials and grade of sterile water suitable for NSP distribution. There have been no formal investigations of the role that water vial size may have in sharing water. Frontline workers have reported that clients may share from 10 mL vials of water. Thus, distributing smaller vials of water, such as a 2 mL vial, is recommended.

A distinction between types of sterile water should be noted. Sterile water for injection is designed for injection as it contains no added substances or microbial agents; however, it is sometimes packaged in a 10 mL format which is not desirable because of concerns about sharing water (www.ohrdp.ca; www.towardtheheart.com). Non-pyrogenic, sterile water for inhalation is available in a smaller volume format and is distributed for injection by some harm reduction programs in Canada and the United States (www.ohrdp.ca). This water is not specifically manufactured for injection, but due to its smaller vial size this product may be better for promoting single use. NSP managers in Canada have requested that single-use 2 mL vials of sterile water for injection become available (Hopkins, personal communication, 2012). Exchange Supplies have single-use 2 mL water for injection in glass vials (and also supply "snappers" to prevent cuts from opening the glass vials), but cannot ship these to jurisdictions outside of the United Kingdom (www.exchangesupplies.org). At the time of preparing this document, 2 mL vials of sterile water for injection were undergoing testing to be made available in Canada.

Coverage

One sterile water vial should be available for each injection. In 2009/2010, half as many sterile water vials as syringes were distributed in British Columbia (www.towardtheheart.com). National data about NSP sterile water distribution in Canada is lacking. A study from British Columbia notes that determining reach and availability of harm reduction supplies is challenging (Buxton et al., 2008). We can employ numbers from Ontario and British Columbia (Table 5.1) as examples of sterile water distribution volume. This type of information is made possible by having central distribution programs and tracking systems.

Table 5.1 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
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Alcohol swabs	10,652,000	7,147,400
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a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

Other issues specific to sterile water

Plastic sterile water vials should be checked to ensure that they have not been punctured. There is a risk of freezing if sterile water is stored in colder temperatures. If sterile water is offered in containers with a gel cap, inserting the needle through this cap may contribute to dulling the needle (www.ohrdp.ca). Vials of sterile water for inhalation will have expiry dates, so programs should check their inventories (www.ohrdp.ca).

Additional evidence

Numerous studies have examined injection-related equipment, but did not examine behaviours related to or the role of each piece of equipment separately. For example, in some studies participants were asked if they ever shared a "cooker, filter, or water." As a result, it is difficult to determine from these studies if water sources are more likely than other pieces of injection equipment to be shared and therefore contribute greater or lesser potential risk of HIV or HCV transmission. Please see Appendix B, Other Injection-related Equipment Supporting Evidence.

Sterile water distribution evidence summary

The evidence that informs this chapter came from predominantly observational studies. Other types of studies were employed less frequently. Cross-sectional studies were the main type of study to contribute evidence on risk behaviours such as sharing injection equipment. Prospective cohort studies were also fairly common in this literature. Laboratory studies – particularly virologic testing of cookers, filters, water, tourniquets, and/or swabs collected from community and clinical settings – have contributed knowledge regarding the potential transmissibility of HIV, HCV, and other pathogens via injecting equipment. Review papers, including a few systematic reviews, have covered a variety of related topics and some clinical case reports/studies have provided information on infections among people who inject drugs. We did not find reports of randomized controlled trials (RCTs) or other experimental designs that were applicable for this chapter. As noted previously in this document, although RCTs are considered to provide the highest quality evidence, it is not always feasible to conduct this type of research with harm reduction programs.

Although the evidence base has grown in recent years, there are notable gaps in the literature on other injecting equipment. Studies that are well designed to measure the magnitude of risk of HIV, HCV, and other bloodborne pathogen transmission from sharing each item of injecting equipment are needed. There are also few empirical studies that address injecting equipment distribution policies and coverage.

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6 Alcohol swab distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of sterile alcohol swabs for each injection to reduce transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), and other pathogens, and to prevent bacterial infection from the reuse or non-use of swabs:

- **Provide single-use, individually pre-packaged, and sterile alcohol swabs in the quantities requested by clients with no limit on the number of swabs provided per client, per visit. If clients request large quantities of alcohol swabs, make efforts to ensure that the swabs are being used for injection and not for the consumption of the non-beverage alcohol in the swabs.**
- **Offer sterile alcohol swabs with each needle provided**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**
- **Dispose of used alcohol swabs and other injection equipment in accordance with local regulations for biomedical waste**
- **Educate clients about the HIV- and HCV-related risks associated with sharing swabs, the risks of bacterial infection if the injection site is not cleaned with an alcohol swab prior to injection, and the correct single-person use of swabs**
- **Educate clients about the proper disposal of used swabs**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Description of how alcohol swabs are used

Alcohol swabs are used by people who use drugs to clean an injection site before injection. Additionally, people may want to use a swab to clean their fingers and thumb before an injection and to remove any blood resulting from the injection on their fingers and other surfaces. There is a risk of disease transmission when alcohol swabs or any of the pieces of equipment used to prepare, share, or inject the drug solution are contaminated with HIV, HCV, HBV, or other pathogens. To reduce the risk of transmission from contaminated swabs, clients need to use new swabs every time.

Evidence of alcohol swabs as vectors of pathogen transmission

Swabs can be contaminated with microbial pathogens and as such HCV may be transmitted between people who inject drugs when alcohol swabs are shared. Crofts et al. (1999) examined previously used injection equipment from 10 Australian injection settings for the presence of HCV RNA. HCV RNA was detected on 67% (6/9) of the alcohol swabs tested (Crofts et al., 1999). In a more recent study from France that examined the presence of HCV on injection equipment collected from multiple sites, HCV was detected at a high rate in pools of swabs (82%), especially when compared to the rate of contaminated syringes (32%; Thibault et al., 2011). Further, the levels of contamination on swabs were often 10 times higher (median, 412 IU/mL; range, 12–4932) than those on the syringes (median, 12 IU/mL; range, 12–890). Residual blood tended to be visible on both swabs and syringes (Thibault et al., 2011). The authors suggested that the amount of residual blood on some swabs may have been greater than that in syringes; although they also noted that people tend to rinse syringes between uses. Because swabs may be a source for HCV contamination, the authors recommended that programs have strong messages about preventing the sharing of swabs.

Evidence of risk behaviours

Alcohol swabs are sometimes shared among people who inject drugs, but not as frequently as other equipment. For example, Scottish Drugs Forum and the Glasgow Involvement Group surveyed 76 people in Glasgow who inject drugs to gain feedback on existing needle exchange provisions. Twenty-three percent of study participants had shared alco-

hol swabs (Scottish Drugs Forum and Glasgow Involvement Group, 2004). In a study of 145 people who inject drugs in London, Ontario, distributive sharing of swabs in the past six months was reported by only 8% of participants and reuse of swabs was reported by 6% (Strike et al., 2010). More recent survey data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that only 3% of the 953 people who inject drugs sampled had borrowed swabs (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario; unpublished data).

Many people who inject drugs are aware of the importance of cleaning their skin with their own individual alcohol swab as evidenced by the demand for alcohol swabs at NSPs. A study that reported on data collected from 208 people who inject drugs from three US cities found that a majority of participants (92.5%) stated that they usually used alcohol pads to clean their injection site prior to injection (Grau et al., 2009). Schechter et al. (1999), in examining the association between NSP attendance and the spread of HIV among 694 Vancouver people who inject drugs, 50% reported receiving alcohol swabs from the NSP. In the Scottish study described above, 21% of the study participants included alcohol swabs as one of their top five provision requests from the NSP (Scottish Drugs Forum and Glasgow Involvement Group, 2004).

Correlates of risk behaviours

NSP attendance is an important factor when it comes to encouraging people to use their own swabs and clean their skin before injection. Longshore et al. (2001) investigated frequency of attendance at a Rhode Island NSP and its association with injection-related risk practices among 248 people who inject drugs. Those who visited the NSP less frequently were less likely to always clean their skin before injecting (AOR=0.33; 95%CI: 0.1-1.1, p<0.07). Although, as the authors note, the significance level falls just short of the conventional cut-off for statistical significance, likely due to small sample numbers (Longshore et al., 2001). Knittel et al. (2010), in an evaluation of a small NSP outside an urban area in Michigan, found that NSP follow-up participants were statistically more likely to clean their skin with alcohol before and after injecting compared to baseline.

Strike et al. (2010) found that factors associated with giving away used swabs included an Addiction Severity Index (ASI) score indicative of a mental health problem and being HCV negative.

Incidence and prevalence of HIV, HCV and HBV among people who inject drugs in Canada

National incidence and prevalence data specifically on people who share alcohol swabs are unavailable. *(See incidence and prevalence among people who inject drugs in Canada tables in the chapter on needle and syringe distribution)*

Other health-related harms

Using a sterile alcohol swab to clean the skin prior to injection can help reduce the occurrence of bacterial infections associated with injection drug use. Vlahov et al. (1992) surveyed 1,057 people who inject drugs in Baltimore, Maryland, and found that the occurrence of subcutaneous abscesses and endocarditis was less common among those who reported skin cleaning all the time. Although it should be noted that skin cleaning in this study also included methods other than use of alcohol swabs, such as use of soap and water.

Murphy et al. (2001) examined the risk factors for skin and soft-tissue abscesses among 418 people who inject drugs in San Francisco and reported that skin cleaning with alcohol was the only independent variable found to have a significantly protective effect against abscess formation (OR=0.48; 95%CI: 0.3-0.74, p<0.05).

A literature review that examined evidence on skin disinfection prior to intradermal, subcutaneous, and intramuscular (but not intravenous) injection found that there appeared to be little clear evidence to support the need for skin disinfection (Infection Control Team, 2006). It was recommended that soiled skin be cleaned with soap and water. Further, if disinfection is to be performed it can be done with a pre-medicated 70% alcohol swab and the injection site should be rubbed with the swab for 30 seconds and allowed to dry for another 30 seconds to render bacteria inactive (Infection Control Team, 2006). However, the evidence reviewed was often from clinical settings. People who inject drugs in community settings may not have access to soap and clean water and may inject in environments where there is a much greater presence of bacteria and debris compared to clinical settings. Therefore, people who inject drugs are advised to clean their skin prior to injection with alcohol swabs, especially if basic cleaning agents (i.e., soap and water) are unavailable. In their practice notes about pre-injection alcohol swabs, Exchange Supplies recommends that when cleaning the injection site the swab should be drawn across the skin only once and in one direction (http://www.exchangesupplies.org/shopdisp_A115.php?page=briefing). The reason for this is that when the swab is drawn across

the skin it becomes contaminated; drawing it back over the injection site will deposit bacteria back onto the injection site. Exchange Supplies also recommends letting the skin dry naturally before injection as allowing the alcohol to evaporate is what destroys the bacterial cell walls.

Alcohol swab distribution policies

The distribution of sterile alcohol swabs to clients is the best way for NSPs to reduce the HCV-related (and potential HIV-related) risks associated with either the reuse or sharing of alcohol swabs among people who inject drugs. Skin cleaning with alcohol prior to injection may also have a protective effect against the formation of abscesses and other bacterial infections. Because alcohol swabs are in high demand, NSPs providing them may attract more people who inject drugs whose attendance at programs can lead them to make contact with other health and social services.

NSPs are well placed to distribute alcohol swabs which should be individually wrapped in water-resistant packages. The number of satellite NSPs in Ontario that were distributing alcohol swabs significantly increased between 2006 and 2008 and, in 2008, 100% of core NSPs and all satellite NSPs that responded to a survey were distributing alcohol swabs (Strike et al., 2011). Ninety-four percent of NSPs and 97% of satellite NSPs that were distributing alcohol swabs in 2008 were doing so without placing limits on the number provided to clients (Strike et al., 2011).

Leonard and Germain (2009), in an evaluation of the OHRDP, found that compared to baseline participants (56%), a greater proportion of final participants (65%) reported use of sterile alcohol swabs at least once to clean the skin prior to injection. There was also a significant increase in the proportion of final participants (83%) reporting sterile alcohol swabs as their most frequently used materials to clean the skin before injection compared to baseline (75%).

Coverage

According to the OHRDP, people who inject drugs should have access to as many alcohol swabs as they request because swabs should be used to clean the skin when soap and water are not readily available. The OHRDP recommends that programs "estimate a minimum of two swabs per needle distributed" (www.ohrdp.ca). National data about NSP alcohol swab distribution in Canada is lacking. We can employ numbers from Ontario and British Columbia (Table 6.1) as examples of alcohol swab distribution volume. This type of information is made possible by having central distribution programs and tracking systems.

Table 6.1 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
Cookers[a]	2,560,000	1,027,000
Filters	19,109,750	N/A[d]
Ascorbic acid	1,038,000	542,000
Sterile water[b]	4,838,100	3,616,000
Alcohol swabs	10,652,000	7,147,400
Tourniquets	603,000	357,100

a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

Other issues specific to alcohol swabs

Alcohol swabs should be used to clean the skin prior to injection, but should not be used to stop blood flow after injection because alcohol hinders blood coagulation which could leave injection sites susceptible to infection (Grau et al., 2009; Treloar et al., 2008). Thibault et al. (2012), in a reply about a study they conducted, noted that they observed blood-tainted swabs, indicating improper use by people who inject drugs (i.e., post-injection use). Clients should be reminded that alcohol swabs are for skin cleaning prior to injection. To stop blood flow after injection, dry and absorbent pads may also be considered for distribution. The OHRDP conducted a small pilot study involving pre- and post-injection swab distribution (Zurba, personal communication, 2012). Twenty-five Ontario NSPs distributed the pre- and post-injection swabs to clients and provided feedback, which included concerns about the swab packaging. Although there is currently not enough evidence about post-injection swab distribution, feedback from this pilot suggests that if NSPs distribute both types of swabs the packaging should be clearly marked to differentiate them and clients should be offered guidance regarding the proper use of both swabs.

Reports of intoxication and poisoning related to non-beverage alcohols (e.g., rubbing alcohol) have highlighted the potential for alcohol swabs to be used as sources of alcohol for consumption. During the development of this document, this concern was raised by a number of stakeholders. There are reports in the medical literature of alcohol poisoning through consumption of surrogate alcohols such as hand sanitizers and rubbing alcohol (Blanchet et al., 2007; Bookstaver et al., 2008; Doyon & Welsh, 2007; Emadi & Coberly, 2007; Engel & Spiller, 2010; Francois et al., 2012; Gormley et al., 2012; Rich et al., 1990; Weiner, 2007). The term "surrogate alcohol" refers to substances "that contain ethanol or other potentially intoxicating liquids but are not intended for drinking, such as medicinal compounds, industrial spirits, automobile products, and cosmetics" (ICAP, 2010, p. 4). Included on this list are mouthwash and aftershave products. While there is no evidence to support or refute the potential for the misuse of alcohol swabs, program managers and workers need to remain vigilant in their distribution of alcohol swabs for their intended purpose and also monitor distribution of swabs, particularly in instances where clients are not accessing any other supplies.

Alcohol swab distribution evidence summary

The evidence that informs this chapter came from predominantly observational studies. Other types of studies were employed less frequently. Cross-sectional studies were the main type of study to contribute evidence on risk behaviours such as sharing injection equipment. Laboratory studies – particularly virologic testing of cookers, filters, water, tourniquets, and/or swabs collected from community and clinical settings – have contributed knowledge regarding the potential transmissibility of HIV, HCV, and other pathogens via injecting equipment. Review papers, including a few systematic reviews, have covered a variety of related topics and some clinical case reports/studies have provided information on infections among people who inject drugs. We did not find reports of randomized controlled trials (RCTs) or other experimental designs that were applicable for this chapter. As noted previously in this document, although RCTs are considered to provide the highest quality evidence, it is not always feasible to conduct this type of research with harm reduction programs.

Although the evidence base has grown in recent years, there are notable gaps in the literature on other injecting equipment. Studies that are well designed to measure the magnitude of risk of HIV, HCV, and other blood-borne pathogen transmission from sharing each item of injecting equipment are needed. There are also few empirical studies that address injecting equipment distribution policies and coverage.

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7 Tourniquet distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate use of a clean tourniquet for each injection and reduce the potential for contamination of tourniquets with bacteria that can cause illness and abscesses (e.g., MRSA), and to reduce trauma to veins and blood circulation impairment:

- **A tourniquet is considered unclean and needs to be replaced when:**
  - **There is visible blood and/or dirt**
  - **It has ever been used by someone else**
  - **There is a loss of elasticity**
- **Provide thin, pliable, easy-to-release, non-latex tourniquets with non-porous surfaces in the quantities requested by clients with no limit on the number of tourniquets provided per client, per visit**
- **Offer tourniquets with each needle provided**
- **Provide pre-packaged safer injection kits (needles/syringes, cookers, filters, ascorbic acid when required, sterile water for injection, alcohol swabs, tourniquets, condoms and lubricant) and also individual safer injection supplies concurrently**
- **Dispose of used tourniquets and other injection equipment in accordance with local regulations for biomedical waste**
- **Educate clients about the risks of bacterial contamination and HIV- and HCV-related risks associated with the reuse and sharing of tourniquets, the risks of tissue and vein damage and blood circulation impairment if a clean, quick-release tourniquet is not used, and the correct single-person use of tourniquets**
- **Educate clients about the proper disposal of used tourniquets**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Description of how tourniquets are used

Tourniquets or "ties" are used by people who inject drugs to "tie off" the vein; that is, to provide pressure to increase the blood flow into the preferred vein and facilitate injection. Not all people who inject drugs need to use tourniquets to help make their veins more evident, including people who are relatively new to injecting drugs.

In the absence of a thin, pliable, stretchy tourniquet with a non-porous surface that is easy to release, people who use drugs may substitute pieces of rope, shoelaces, wire, condoms, leather or terry cloth belts, or bandanas. The major disadvantage of these items is that they are not elastic enough for quick, easy release and may therefore cause trauma to the skin and veins (including vein rupture due to increased pressure), and may cause infiltration of blood and fluids into surrounding tissues. In addition, these items are hard to clean if they become splattered with blood.

BC Harm Reduction Strategies and Services have a useful diagram on their website showing a quick-release tourniquet method (http://towardtheheart.com/product/tourniquet).

Evidence of tourniquets as vectors of HIV, HCV, and HBV transmission

It is possible that HCV and HIV could be transmitted between people who inject drugs by the shared use of tourniquets, although the magnitude of risk has not been determined and may not be as high as it is for other types of injection-related equipment. In a microbiological study by Rourke et al. (2001), 36% (75/200) of tourniquets sampled had visible bloodstains.

Participant observation studies of people who inject drugs in Australia (Crofts et al., 1999) and Scotland (Taylor et al., 2004) have shown that tourniquets may be a potential source of exposure to blood-borne pathogens. For example, a person who injects drugs may use the tourniquet to stem the flow of blood after an injection. This person may then apply the tourniquet to an injecting partner's arm, depositing a smear of blood on the skin which is subsequently punctured by a needle. Passing the tourniquet over the injection site creates the opportunity for the blood of someone living with HCV or HIV to make contact with the blood of anoth-

er person. Any activity that introduces new pathogens to a person's skin, especially where there is an injection site, may plausibly elevate risk of infection.

The Australian National Council on AIDS, Hepatitis C and Related Diseases (2000) advised the Australian Federal Government that tourniquets, as well as other injecting equipment, clothing, and surfaces used while injecting may potentially spread HCV among people who inject drugs:

> *Even though a drug user may only get a small trace of blood on the tourniquet as they pass it over their injection site when removing it, we believe that this may be a sufficient amount of blood to transmit the hep C virus if the same tourniquet is then used by another drug user.*

The Australian Government Department of Health and Ageing (2008) has published a National Hepatitis C Resource Manual, a comprehensive resource developed in consultation with academic researchers, healthcare providers, and health councils across Australia (http://www.health.gov.au/internet/main/publishing.nsf/content/C312B159EA9CDE9FCA25744A001B58AE/$File/hepc-manual-2008a.pdf) The manual states that anyone who has shared any injection drug equipment with others, including tourniquets, has been at risk for acquiring HCV.

Evidence of risk behaviours

Research has shown that people who inject drugs share tourniquets. The Scottish Drugs Forum and the Glasgow Involvement Group (2004) surveyed 76 people who inject drugs in order to gain feedback on existing needle exchange provisions. Sixty percent of respondents had shared tourniquets, indicating the potential risk of infection with HIV or HCV by means of indirect sharing (Scottish Drugs Forum and Glasgow Involvement Group, 2004). More recent survey data from Ontario, collected between 2010 and 2012 as part of the I-Track Study, found that 25% of the 953 people who inject drugs sampled had borrowed tourniquets (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario; unpublished data).

Correlates of risk behaviours

No empirical literature was found regarding correlates of risk behaviours in the context of tourniquet use and sharing.

Incidence and prevalence of HIV, HCV and HBV among people who inject drugs in Canada

National incidence and prevalence data specifically on people who share tourniquets are unavailable. *(See incidence and prevalence among people who inject drugs in Canada tables in the chapter on needle and syringe distribution)*

Other health-related harms

Rourke et al. (2001) examined bacterial contamination of 200 tourniquets obtained over a two-week period in June 2000 from a cross section of healthcare professionals working in a 1,200-bed teaching hospital in Sheffield, United Kingdom. They found that 10 (5%) of the tourniquets sampled were contaminated with Staphylococcus bacteria, the organism responsible for the formation of abscesses (Rourke et al., 2001).

Similarly, Golder et al. (2000) examined 77 tourniquets from a London, United Kingdom teaching hospital in order to determine if previously used tourniquets could pose a cross-infection risk to patients. Fifty tourniquets were examined for bloodstains and culture-growth. Twenty-five tourniquets had visible bloodstains, all 50 grew heavy skin flora, and of these, 17 had cultured bacterial organisms. It was determined that tourniquets are a potential reservoir of pathogenic bacteria and are thus a cross-infection risk to patients (Golder et al., 2000).

Conroy (2004) supported this argument in a letter to the British Medical Journal, indicating that methicillin-resistant Staphylococcus aureus (MRSA) is likely transmitted from patient to patient by means of tourniquet reuse. Disposable tourniquets were advised in order to eliminate this risk of cross-infection (Conroy, 2004). Studies have found that used tourniquets in clinical settings can become contaminated with MRSA and thus pose a risk to patients (Elhassan & Dixon, 2012; Leitch et al., 2006).

Tourniquet distribution policies

Distributing thin, pliable, easy-to-release tourniquets with non-porous surfaces to clients in the quantities that they request is the best way for NSPs to reduce the HIV and HCV-related risks associated with tourniquet sharing, the potential for contamination of tourniquets by bacteria that can cause abscesses and other health harms, trauma to veins, and risk of blood circulation impairment. Programs in Ontario (www.ohrdp.ca) and British Columbia (www.towardtheheart.com) distribute these types of tourniquets.

Compared to 2006, in 2008 more core and satellite NSPs in Ontario were distributing the types of tourniquets recommended by best practices (Strike et al., 2011). Ninety percent of core NSPs and 95% of satellite NSPs that responded to the survey and were distributing tourniquets in 2008 were doing so without placing limits on the number of tourniquets provided to clients (Strike et al., 2011).

In the OHRDP final evaluation, Leonard and Germain (2009) found that there was a decline in the proportion of final participants (40%) compared to baseline participants (49%) who reported using non-recommended materials (e.g., belts, rope) as tourniquets. There was also an increase in the proportion of final participants (27%) who reported using only recommended materials as tourniquets compared to baseline (17%).

Coverage

National data about NSP tourniquet distribution in Canada is lacking. A study from British Columbia notes that determining reach and availability of harm reduction supplies is challenging (Buxton et al., 2008). We can employ numbers from Ontario and British Columbia (Table 7.1) as examples of tourniquet distribution volume. This type of information is made possible by having central distribution programs and tracking systems.

Table 7.1 Total other injection equipment ordered in 2012

Equipment	Ontario – Total units	British Columbia – Total units[c]
Cookers[a]	2,560,000	1,027,000
Filters	19,109,750	N/A[d]
Ascorbic acid	1,038,000	542,000
Sterile water[b]	4,838,100	3,616,000
Alcohol swabs	10,652,000	7,147,400
Tourniquets	603,000	357,100

a For Ontario, this includes Spoons (528,000), Stericups (395,000), and Stericups-MC (1,637,000) ordered.
b For Ontario, this includes 10 mL (19,100) and 3 mL (4,819,000) ordered.
c BC province totals include order numbers by five regional health authorities.
d Filters unfunded by BC program at the time.

Sources: OHRDP 2012 Summary of Product Units Ordered and BC Harm Reduction Supply by Health Authority (2012).
(modified from original sources)

Other issues specific to tourniquets

As some people are allergic to latex, non-latex tourniquets should be available from NSPs. The OHRDP recommends that tourniquets should only be used when they are needed. There are other techniques people who inject drugs can use to help access their veins, including clenching the fist, slapping the vein, applying a hot compress to the vein, "windmilling" (i.e., swinging) the arm, and letting the limb hang (www.ohrdp.ca).

Tourniquet distribution evidence summary

The evidence that informs this chapter came from predominantly observational studies. Other types of studies were employed less frequently. Cross-sectional studies were the main type of study to contribute evidence on risk behaviours such as sharing injection equipment. Laboratory studies – particularly virologic testing of cookers, filters, water, tourniquets, and/or swabs collected from community and clinical settings – have contributed knowledge regarding the potential transmissibility of HIV, HCV, and other pathogens via injecting equipment. Clinical case reports/studies have provided information on infections among people who inject drugs. We did not find reports of randomized controlled trials (RCTs) or other experimental designs that were applicable for this chapter. As noted previously in this document, although RCTs are considered to provide the highest quality evidence, it is not always feasible to conduct this type of research with harm reduction programs.

Although the evidence base has grown in recent years, there are notable gaps in the literature on other injecting equipment. Studies that are well designed to measure the magnitude of risk of HIV, HCV, and other blood-borne pathogen transmission from sharing each item of injecting equipment are needed. There are also few empirical studies that address injecting equipment distribution policies and coverage.

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8 Safer crack cocaine smoking equipment distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate smoking with a pipe – stem, mouthpiece, and screen – which is made from materials that are non-hazardous to health and have never been shared.

- **Provide safer smoking equipment - stems, mouthpieces, screens, and push sticks - in the quantities requested by clients without requiring clients to return used equipment**
- **Make available both pre-packaged kits and individual pieces of equipment**
- **Integrate distribution of safer smoking equipment into existing harm reduction programs and services, including within needle and syringe programs (NSPs)**
- **Provide safe disposal options, including personal sharps containers, and encourage clients to return and/or properly dispose of used or broken pipes**
- **Provide other harm reduction supplies, such as condoms and lubricant, in the quantities requested by clients with no limit on the number provided**
- **Educate clients about safer use of equipment, safer smoking practices, the risks of sharing smoking supplies, and safer sex**
- **Educate clients about the proper disposal of used safer smoking equipment**
- **Provide multiple, convenient locations for safe disposal of used equipment**

Equipment is considered unsafe and needs to be replaced when:

- The pipe and/or the mouthpiece have been used by anyone else
- The pipe is scratched, chipped or cracked
- The mouthpiece is burnt
- The screen shrinks and is loose in the stem

Distributing safer smoking equipment alongside safer injecting supplies

The provision of safer smoking supplies reduces the risk of contracting HIV, hepatitis C (HCV) and other blood-borne pathogens and provides an opportunity to engage a hard-to-reach, marginalized and vulnerable segment of the drug-using population (Haydon & Fischer, 2005; Fischer et al., 2010). Therefore, distribution of a variety of equipment at harm reduction programs may maximize their potential impact. People who smoke crack cocaine and do not inject drugs would benefit from access to safer smoking equipment and also the other services and supports provided by harm reduction programs such as referrals, counseling, education, short-term respite from the street (Haydon & Fischer, 2005).

Programs that offer a variety of harm reduction equipment can be more responsive to polydrug/substance use as well as changing patterns of drug use in the community. Reports from Calgary and Ottawa demonstrate transitions between different modes of drug consumption (Benjamin, 2011; Leonard et al., 2008). Werb and colleagues (2010) reported that increasing numbers of people who inject drugs in Vancouver are transitioning to crack cocaine smoking. These transitions may lead to bridging between different drug-using populations - from a group with high endemic levels of certain infections to one with lower levels (Strathdee & Stockman, 2010). This bridging may facilitate the transmission of viruses such as HIV and HCV through sharing equipment within social networks and sexual activities (Strathdee & Stockman, 2010). Shifting drug use patterns also require safer use education related to a number of different drugs and modes of consumption (i.e., smoking, injection, or snorting).

Smoking and injection of drugs are associated with different risks of infection. Believing that one route of drug con-

sumption is "safer" than another can provide a false sense of safety for people who consume drugs. While injecting drugs can introduce pathogens directly into the bloodstream, people who smoke crack cocaine experience different risks, social harms, and health issues than those who inject drugs (Malchy et al., 2008). Issues related to criminality and marginalization increase the vulnerability of people who smoke crack cocaine (Fischer et al., 2006). Therefore, offering safer smoking supplies alongside injecting supplies is responsive to polysubstance use, changing drug use patterns, and individual risks, and may increase access among individuals who only smoke crack cocaine to other services.

Description of safer smoking equipment and how it is used

Crack cocaine is a stimulant and is produced by converting powder cocaine to a cocaine base (Delas et al., 2010). The term 'crack' refers to the crackling sound that is made when the drug is heated (Cruz et al., 2006). When heated to high temperatures, crack cocaine first liquefies (or melts) and then vapourizes. The vapour is then inhaled through a pipe into the lungs. A screen is placed at one end of the pipe or stem to hold the melted crack cocaine in place and away from the mouth. Pipes can be crudely constructed from glass bottles, soft drink cans, plastic bottles, car aerials, metal pipes, and other materials in the absence of safer alternatives (Benjamin, 2011).

Self-made pipes increase risk for injury and burns. Mouth and lip burns can occur from the use of metal "straight shooters" made from metal pipes and car antennas (Porter & Bonilla, 1993). Plastic bottles give off toxic vapours when heated, which can be inhaled while smoking crack cocaine (Hopkins et al, 2012). Beverage cans are lined with plastic which can melt and give off toxic vapours. Lastly the use of metal wool (such as Brillo®) to hold the rock in place can result in small pieces of metal being inhaled, and cause damage to the oral cavity, throat and lungs (Meleca et al., 1997; Mayo-Smith & Spinale, 1997).

Evidence for the role of crack cocaine smoking in disease transmission

The risks related to smoking crack cocaine can be viewed as belonging to two broad categories that when combined increase the risk of acquiring diseases such as HIV, HCV, hepatitis B (HBV), other sexually transmitted infections (STIs) and respiratory infections such as tuberculosis and pneumonia. The first category contains physical injuries, inflammation and immunosuppression caused by smoking crack cocaine. The second category contains practices that are associated with increased risk of infection for individuals who smoke crack cocaine. It is hypothesized that transmission may occur if a pipe with bodily fluids (mucous, saliva and/or blood) contaminated with HBV, HCV, pneumonia or tuberculosis bacteria is used by more than one person. Evidence linking pipe sharing with disease transmission is limited but growing.

Glass and metal pipes conduct heat, resulting in burns to hands and lips while smoking crack cocaine. The hot vapours and metal wool particles (eg Brillo® particles) can also cause burns in the mouth and throat (Mayo-Smith & Spinale, 1997; Meleca et al., 1997; Osborne et al., 2003; de Lima, 2007; Zacharias et al., 2011). The anaesthetizing effects of cocaine on the surface of the oral cavity can diminish the sense of pain, therefore increasing the risk of injury and burns (Meleca et al., 1997). These injuries can act as an entry point for pathogens into the bloodstream.

People who smoke crack cocaine have heightened risks for disease transmission and infection compared to the general population due to effects of the smoke and heat on the oral cavity. Faruque and colleagues (1996) reported a higher prevalence of oral sores among individuals who smoked crack cocaine more than 3 times per week, for at least one month prior to the study. Such sores have also been reported in Campbell River, Nanaimo and Prince George, BC, and Ottawa, Ontario (Fischer et al., 2010; Leonard et al., 2006; 2010). Hot crack cocaine vapours along with metal particles can lead to inflammation in the oral cavity (Restrepo et al., 2007). Prolonged inflammation has been shown to increase risk of infection. Inflamed tissue contains large numbers of white blood cells that can act as hosts for HIV (Mayer & Venkatesh, 2011). Therefore, inflammation caused by smoking crack cocaine may present a risk of disease transmission similar to that found with STIs and other blood-borne diseases.

Communicable disease and smoking crack cocaine

Risk and prevalence of HIV transmission among people who smoke crack cocaine

The Safer Inhalation Program Final Evaluation from Ottawa reported that 46 to 75% of laboratory-confirmed HIV-positive clients shared crack cocaine pipes (Leonard, 2010); and it is hypothesized that this is a means through which infectious bodily fluids such as blood can be transferred between people who smoke crack cocaine. Inflammation, cuts, burns and

oral sores increase the likelihood of transmission of blood-borne infections. Prevalence rates of HIV reported among people who smoke crack cocaine in Canadian settings range from 19% in Vancouver to 6% in Toronto and to 10.6% in Ottawa (Bayoumi et al., 2012; Leonard, 2010; Shannon et al., 2008). The Toronto group included some people who used to inject drugs, although no one had injected in the previous 6 months. In comparison, the overall prevalence of HIV in the Canadian population was approximately 0.19% (PHAC, 2008). A recent study by Hagan and colleagues in New York City (2011) identified smoking crack cocaine as an independent predictor of HIV infection; participants who inhaled or smoked drugs were 4.2 times more likely to be HIV positive than those who had ever injected (95% confidence interval = 1.5–12.5) (Hagan et al., 2011). In a study from Washington D.C., HIV prevalence among people who smoke crack cocaine was 11.1% versus 9.5% in people who inject drugs (Kuo, et al., 2011). In both of these studies, the authors suggested that the high rates of HIV among people who smoke crack cocaine were related to risky sexual behaviours. Since the risk of transmission of HIV is highest for sharing of injection equipment, it can be difficult to attribute infection to crack cocaine smoking and/or sexual risk in people who used to inject drugs and it is important to separately study people who smoke crack cocaine who have never injected.

The smoking of crack cocaine and HIV transmission have been linked through high risk sexual behaviours (e.g., multiple sex partners, sex work and exchanging sex for drugs or shelter, and inconsistent condom use) and intensity and frequency of smoking crack cocaine (Hoffman et al., 2000; Kuo et al., 2011; Schonnesson, et al., 2008). Intensity of use refers to how much crack cocaine is smoked in a single setting; while frequency refers to the number of smoking episodes in a defined period of time. Daily smoking of crack cocaine increased the risk of HIV seroconversion in a study of Vancouver-area people who smoke crack cocaine (DeBeck et al., 2009). Continued smoking of crack cocaine has been associated with the progression of HIV infection to AIDS-related disease due to immune system compromise and higher viral loads (Cook et al., 2008; Kipp et al., 2011). Crack cocaine may also accelerate the progression of HIV/AIDS even while a person is on HAART (Highly Active Anti-Retroviral Therapy) (Baum et al., 2009; Kipp et al., 2011). Higher viral loads present a greater risk for HIV transmission if others are exposed to the affected individual's blood (CATIE, 2009); therefore individuals who smoke crack cocaine may be at an elevated risk for acquiring or transmitting HIV.

Risk and prevalence of HBV transmission in people who smoke crack cocaine

It is hypothesized that HBV may be transmitted through sharing of crack cocaine pipes because HBV can be spread through exposure of mucous membranes (e.g., mouth, genital area, rectum) and broken skin to infectious body fluids (blood, saliva, semen, vaginal fluids) and contaminated drug equipment (PHAC, 2010). Shared pipes may contain the blood or saliva of another person and therefore present a risk for HBV transmission, particularly since the virus can also survive for more than a week on inanimate surfaces (Kramer et al., 2006).

Hepatitis B can cause damage to the liver, and is present in high proportions in groups of highly sexually active individuals and individuals who inject drugs (PHAC, 2009). In Canada, the primary mode of transmission of the virus is through sexual contact and the current prevalence is between 0.7 to 0.9% (PHAC, 2009). Neaigus and colleagues (2007) reported that risk of HBV seroconversion was related to multiple sex partners and decreased safer sex practices. As noted previously, because smoking crack cocaine is associated with increased sexual activity, inconsistent condom use, and other riskier sexual behaviours, there is an increased risk of sexual exposure to HBV among people who smoke crack cocaine.

Risk and prevalence of HCV among people who smoke crack cocaine

Pipe sharing has been positively associated with the transmission of HCV (Macias et al., 2008; Neaigus et al., 2007). In a laboratory study by Fischer and colleagues (2008), HCV-RNA was isolated on a used crack cocaine pipe. It has been hypothesized that HCV particles can be transferred to a pipe in blood or saliva, thus presenting a risk for transmission if pipes are shared (Fischer et al, 2008). HCV particles were detected on inanimate surfaces after 7 days (Doerrboecker et al., 2011). Ciesek and colleagues concluded that due to the stability and infectivity of HCV at room temperature on various surfaces, it presented a substantial risk for transmission (2010). In this study HCV particles were detected 28 days after inoculation of plastic and metal surfaces and rubber gloves (Ciesek et al., 2010). A number of studies have reported HCV particles present in saliva (Hermeida et al., 2002; Lins et al., 2005; Suzuki et al., 2005; Wang et al., 2006); and in nasal secretions (Aaron et al., 2008; McMahon et al., 2004). Therefore there is also the potential for devices used to smoke or snort drugs (such as pipes and straws) to transfer pathogens among individuals. This is particularly important

if skin or mucous tissue integrity is compromised (smoking crack cocaine can damage the lips and tissues lining the oral cavity and throat).

The risk of acquiring HCV through sexual activity is low; however, damaged mucous membranes such as those in the mouth, vagina or rectum have been implicated in the transmission of the virus (Alter, 2011). Therefore riskier sexual behaviours among people who smoke crack cocaine may create an elevated risk for HCV infection.

The prevalence of HCV infection in Canada is 0.7% of the total population (Remis, 2007 as quoted by PHAC, 2009). In Ottawa the prevalence among people who smoked crack cocaine during Phase 1 of the Safer Inhalation Program was 36.5% and non-significant declines in prevalence of HCV were noted 11 months after implementation of the program (Leonard, 2010). Fifty-two to 62% of participants in the study with a positive HCV test reported lending their used pipes. This is a troubling finding in light of the association between pipe sharing and HCV infection. Shannon and colleagues reported that among people who smoke crack cocaine and inject drugs in Vancouver, the prevalence of HCV was 79%; for people who smoke crack cocaine only it was 43% (2008). Toronto I-Track results indicate that the prevalence of HCV among people who smoke cocaine was 29% (Bayoumi et al., 2012). Finally, in a study of sex workers in Miami, Florida, a significant predictor of being HCV-positive was daily crack cocaine use (OR=2.197, (1.28-3.76), p<0.004) (Inciardi, 2006).

Risk and prevalence of other STIs in people who smoke crack cocaine

In a report about Toronto-area people who smoke crack cocaine, Goodman noted that many respondents reported STIs among their highest concerns (2005); crack cocaine smoking has been associated with screening positive for concurrent STIs (Dehovitz et al., 1994; Miller et al., 2008). Crack cocaine has also been associated with detection of prevalent and incident infections of HPV (Minkoff et al., 2008); HSV-2 (DesJarlais et al., 2010); HIV and HSV (Herpes Simplex Virus) coinfections (Des Jarlais et al., 2010); LGV - Lymphogranuloma Venereum (Bauwens et al., 2002); Trichomoniasis (Sorvillo et al., 1998; Cu-Uvin et al., 2001; Gollub et al., 2010); and lastly syphilis (Ross et al., 2006; Seña et al., 2007). As noted previously, smoking crack cocaine can lead to inflammation in the oral cavity and increase the risk for acquiring an infection. Many STIs, including syphilis, herpes simplex-2 virus (HSV-2), chlamydia and gonorrhea, can also lead to ulcers and inflammation in the oral cavity (Venes, 2009). In a comprehensive review of HIV and STI transmission, Mayer & Venkatesh concluded that inflammation in mucous tissues can facilitate the transmission of HIV (2011).

Risk and prevalence of pneumonia and tuberculosis in people who smoke crack cocaine

It is hypothesized that pneumonia and tuberculosis (TB) may be transmitted through sharing or reusing crack pipes. Mycobacterium tuberculosis (the bacterium that causes tuberculosis in humans) can survive for up to 4 months on inanimate surfaces (Kramer et al., 2006). Phlegm or saliva can carry bacteria, and infectious saliva on shared pipes was posited as the cause of an outbreak of pneumonia in Vancouver among people who smoke crack cocaine (Romney, et al, 2008). In this study crack cocaine smoking was the single most important risk factor for developing severe pneumonia (OR=12.4, CI – 2.22-69.5); and it was proposed that transmission might have been accelerated by the depressed social conditions and marginalization of many people who smoke crack cocaine (Romney, et al, 2008).

Between 2006 and 2008, a tuberculosis outbreak occurred in British Columbia. Forty-one confirmed cases of tuberculosis were discovered, and genetic analysis of the tuberculosis strain revealed that it had been present in the region 5 years prior to the outbreak (Gardy et al., 2011). The investigators noted that the epidemic curve also matched the number of cocaine-related police investigations, and the number of crack cocaine smoking spaces in the region. The outbreak was subsequently attributed to crack cocaine smoking (Gardy et al., 2011). It is unclear from the study if infection was a result of pipe sharing or being exposed to sputum or phlegm (through coughing or sneezing). Shotgunning, the practice of blowing inhaled vapours directly into the mouth of another person (Haydon & Fischer, 2005), had previously been implicated in a TB outbreak among a group of people who smoked crack cocaine in South Dakota (McElroy, et al., 2003).

Review of TB outbreak investigations in the United States noted that transmission of TB is perpetuated through impairment of immune responses in the lungs due to crack cocaine smoking, prolonged infectious periods due to delays in seeking medical care, and drug equipment sharing in poorly ventilated spaces such as "crack houses" (Mitruka et al., 2012). The authors of this review also reported that poverty, unstable housing and overcrowding perpetuated transmission (Mitruka, et al., 2012). In a recent pilot study

involving people who smoke crack cocaine in Toronto, 95% (19/20) of the participants reported at least one respiratory complaint in the week before the study, 60% (12/20) had a diagnosis of chronic obstructive pulmonary disease (COPD), and 20% (4/20) had both asthma and COPD (Leece et al., 2012). While this was a small pilot study, asthma and COPD are associated with acquisition of respiratory infections (Soriano et al., 2005). Therefore it is important to consider the multiple risks associated with respiratory infections for people who smoke crack cocaine.

The immune system, levamisole, and crack cocaine

In 2008, five cases of severe neutropenia (low white blood cell count) linked to levamisole in cocaine were reported in Alberta (Knowles et al., 2009). A study reported 42 total cases of neutropenia in Alberta and British Columbia, with over 50% of those affected reporting cocaine use (Knowles et al., 2009). The main route of cocaine consumption among those with neutropenia was smoking (72%), and 50% reported recurrent cases of neutropenia following continued smoking of crack cocaine (Knowles et al., 2009). Most recently, Buxton and colleagues reported that between 2008 and February 2011, 45 incidents of neutropenia were reported by BC doctors, with at least three fatalities (2011). A recent U.S. report estimated that 69% of cocaine seized in the United States contains levamisole (Brackney et al., 2009). Since much of the cocaine found in Canada comes from the same sources as that found in the U.S, it is likely that similar concentrations of the adulterant are found in Canada.

Levamisole is a drug that is used to treat parasites in livestock, and can be added to crack cocaine during its production to increase the volume (Larocque & Hoffman, 2012). The adulterant may also be converted by the body into a chemical with amphetamine-like properties and may induce many of the same pleasant sensations that are attributed to cocaine (Bertol et al., 2011). Levamisole impairs the normal functioning of the immune system, resulting in a condition called agranulocytosis or neutropenia (a severe depletion of circulating white blood cells) and vasculitis (Larocque & Hoffman, 2012). If untreated, the condition can quickly progress to septicemia (infection in the blood) and is life-threatening. The adulterant has also been known to lead to small, darkened areas on the skin (purpura) as a result of necrosis (cell death).

Immune system dysfunction has long been associated with the use of cocaine in all of its forms (Cabral, 2006; Friedman et al., 2006). Crack cocaine use can therefore decrease the ability of an individual's body to fight off infections. Levamisole increases this risk and it is important to educate clients about the signs of infection, encourage regular check-ups with healthcare workers, and urge clients to seek medical attention if they notice any changes in their skin or feel feverish.

Risky crack cocaine smoking behaviours

Sharing pipes

The sharing of pipes, including stems and mouthpieces, has been reported in many evaluations of safer smoking supply distribution programs across Canada (Backe et al., 2011; Barnaby et al., 2010; Benjamin, 2011; Goodman, 2005; Leonard et al., 2007; Leonard & Germain, 2009). Pipe sharing has also been reported in a number of Canadian studies of people who smoke crack cocaine (Fischer et al., 2010; Ivsins et al., 2011; Leonard et al., 2008; Malchy et al., 2008;). While uptake rates of safer smoking supplies have been encouraging, a study from Vancouver reported that while 83% of respondents were using mouthpieces, 79% were sharing mouthpieces (Malchy et al., 2008). The presence of a mouthpiece (even if it is previously used) may prevent burns to the lips; however, it cannot protect against exposure to saliva, phlegm or blood from sores if it is shared. Education about the purpose and benefits of mouthpieces has been identified by front-line workers as essential to influence uptake and proper use of mouthpieces in Ottawa (Leonard, 2010). This education may need to incorporate more explicit information for people who smoke crack cocaine about the risks related to all equipment sharing – not only stems.

Factors such as smoking in small groups; allowing others to use one's pipe so that the owner can collect the "resin" (the residue that collects on the inside of a pipe while crack cocaine is being smoked); and intimate relationships influence sharing of pipes (Boyd et al., 2008). Respondents in a survey from Calgary reported that high cost of new pipes and lack of access to clean pipes promoted sharing in their community (Benjamin, 2011). Difficulty in accessing pipes has previously been associated with pipe sharing (OR=1.91; 95% CI: 1.51–2.41) (Ti et al., 2011). Shannon and colleagues (2008) found that female sex workers who shared drugs with clients had a greater risk of smoking with a used pipe; being intensive smokers of crack cocaine; using condoms inconsistently with clients; and being verbally, physically or sexually assaulted.

Sharing smoking supplies has been described by some as a ritualistic social practice (Fischer et al., 2010). Sharing may also be influenced by the physical form of the drug and the

difficulty in dividing it up if a number of individuals have pooled their money to purchase it. These factors may prove difficult to influence and they deserve consideration because of poverty associated with crack cocaine and group norms surrounding drug consumption. The grouping of individuals during smoking episodes and the incidence of sharing may result from a number of influences. In spite of increased distribution of safer crack cocaine kits in jurisdictions across the country, the sharing of pipes persists. Malchy and colleagues noted in a study of Vancouver area people who smoke crack cocaine that after implementation of the safer smoking distribution program, respondents reported an increase in their use of items that had been used by someone else (2011). The authors posited that drug sharing networks or lack of consistent access may explain this finding (Malchy et al., 2011).

Smoking intensity and frequency

Crack cocaine is associated with high intensity (large amounts) and frequency (high number of smoking episodes; Macias et al., 2008). Data from Canadian settings has revealed crack cocaine smoking episodes ranging from 1 to 70 per day (Fischer et al., 2010; Leece et al., 2012; Leonard & Germain, 2009). Impaired memory and disinhibition due to heavy use can lead to behaviours such as sharing drug use equipment and risky sexual practices (DeBeck et al., 2009). High-risk sexual behaviours such as multiple sex partners and inconsistent condom use have also been linked to frequency and intensity of crack cocaine smoking (Hoffman et al., 2000; Schonnesson et al., 2008). As noted previously, higher intensity of crack cocaine smoking is also associated with sharing drugs with clients, which can increase exposure to violence (Shannon et al., 2008).

Smoking practices

"Seconds" and "Shotgunning" are risky practices that can transmit disease. Shotgunning is the practice of blowing inhaled vapours directly into the mouth of another person (Haydon & Fischer, 2005). For "seconds", vapours are blown into condoms and re-inhaled or shared with others (Boyd et al., 2008). Having air/smoke blown into one's lungs, breathing in very fast, and holding the vapours for too long can lead to lung damage (Haim, 1995; Millroy & Parai, 2011). Shotgunning was implicated in a TB outbreak in South Dakota (McElroy et al., 2003). Therefore it is important to educate service providers and service users about disease transmission, as well as the physical risks of these practices.

Impact of distribution of safer smoking equipment on risk behaviours

Evidence shows Canadian safer smoking equipment programs have a positive impact on pipe sharing, use of hazardous equipment and binge drug use. The Safer Inhalation Program's evaluation revealed that distribution of clean supplies could reduce usage of a pipe from an average of 288 times to 40 before disposal (Leonard, 2010). Repeated use of a pipe increases the likelihood that it will crack or break (Hopkins et al., 2012); this in turn increases the likelihood of cuts. The evaluation also reported a downward trend in the proportion of respondents who shared pipes and decreases in use of non-recommended pipe components such as metal pipes, car aerials, soda cans and inhalers (Leonard, 2010). Evaluation of the safer crack kit distribution in Toronto and Winnipeg yielded similar findings (Backe et al., 2011; Hopkins et al., 2012).

Among people who smoke crack cocaine in Prince George, 97.6% reported obtaining safer smoking supplies from the local safer crack smoking supply distribution program (Fischer et al., 2010). Other evidence reflects the uptake of safer smoking supplies and practices by people who smoke crack cocaine. Ninety-two percent of Toronto participants in the I-Track study obtained safer smoking supplies from harm reduction programs (PHAC, 2006). In Prince George, people who smoke crack cocaine credited the safer supply distribution program with reducing their need to share pipes, use makeshift materials, and reliance on drug sellers for pipes (Fischer et al., 2010).

Regular access to safer smoking kits may also decrease bingeing. Increases in pipe sharing and smoking binges were reported in Calgary as a result of program cancellation (Benjamin, 2011). Scarcity of pipes and the need to consume larger quantities when rare opportunities to use arose were credited with driving people to binge (Benjamin, 2011). A number of factors hinder safer smoking practices, including harm reduction distribution sites where limited hours of operation may force clients to engage in unsafe smoking practices (Ti et al., 2012). Cancellation of The Safeworks Crack Kit Program in Calgary reportedly led to an increase in injecting drugs; demand for syringes increased by 5.9%, because they were free and readily available (Benjamin, 2011). This complements findings from an Ottawa study that reported that safer smoking supply distribution led to a decrease in injecting drugs (Leonard et al., 2008). These reports indicate that drug use in many contexts is changeable and can be influenced by provision of safer supplies.

Mouthpieces are currently promoted as an important piece of equipment for safer crack cocaine smoking. They insulate the pipe and help prevent cracks and burns to the lips. Cracks and burns can provide an entry into the client's bloodstream and present a risk for disease transmission. Backe and colleagues (2011) reported that since the distribution of kits that contained mouthpieces, 60% of the clients reported that incidents of cracked and burned lips declined.

Safer smoking equipment and distribution policies

Across Canada, safer smoking supply programs distribute the following pieces of equipment individually or in kits: glass stems, mouthpieces, push sticks, screens and alcohol swabs (Backe et al., 2011; Hopkins et al., 2012; Johnson et al., 2008; Leonard et al., 2006; Leonard, 2010; Leonard et al., 2008; Leonard & Germain, 2009). Kits may also include disposal education or resource materials, and additional items such as condoms, lubricant, lighters, matches, or adhesive bandages for small cuts or blisters. (Backe et al., 2011; Benjamin, 2012; Hopkins et al., 2012; Johnson et al., 2012; Leonard, 2010; Leonard et al., 2008).

Studies of safer crack distribution programs have not evaluated the degree to which each individual piece of equipment decreases harm to the people who smoke crack cocaine. For example, no scientific studies have compared the risks from use of Pyrex/borosilicate glass stems to stems/pipes made from other materials. As well, no studies have evaluated whether brass or stainless steel screens are indeed safer for clients to use than steel wool (i.e. significant reduction of inhalation of metal particles). Safer injection equipment (e.g., syringes and cookers) has been more extensively researched. Similar research is needed to evaluate the relative effectiveness and safety of crack cocaine smoking equipment.

Distribution of safer smoking equipment is based on client preference, historical precedent (e.g., glass rose vials have been used as pipes), sound judgment about risks associated with crack cocaine smoking, and trial and error. The choice of many current safer smoking supplies is based on their use in similar ways in other contexts. For example, the recommended brass screens are intended for smoking tobacco in pipes. Since they are safe to use in a situation where smoking is involved, they have been deemed appropriate in this context. Similarly, Pyrex/borosilicate glass is used in laboratory settings because of its heat resistance, strength, lack of coatings and non-reactivity.

Client preferences, existing best practice documents that relate to infection control, manufacturers' instructions for use and peer-reviewed research (where available) were used to develop the following recommendations. Individual programs and/or provincial equipment distribution programs will need to consult these same materials to determine pieces of equipment to purchase and distribute. Four items have been deemed to be core supplies for the purposes of safer smoking: a Pyrex/borosilicate stem, non-reactive and uncoated metal screens, a non-scratching push stick, and a food-grade mouthpiece. These four items are essential components because they are required to construct a complete pipe.

a) CORE: Borosilicate glass (Pyrex) stems

Borosilicate glass tubing contains at least 5% borosilicate which makes it resistant to high temperatures. This material is used to manufacture glass "straight-shooters" (stems) to smoke crack cocaine. The heat resistance of the glass and lack of any coatings that could burn or give off vapours makes stems of this material well-suited for smoking crack cocaine. Client preferences, mouthpiece diameter and cost may influence the physical characteristics of the stems (wall thickness, diameter of glass stems, and stem length). Wall thickness and diameters of glass tubes vary. Thicker walled stems may be more resistant to breakage if dropped and subsequently may last longer. Distribution of a standard stem is advisable; repeated changes in length, diameter or wall thickness require clients to learn how much heat is required to vapourize crack cocaine and to predict the point at which a pipe will be too hot to touch. Too much variation in the stem could lead to injury and also discourage replacement of stems that are damaged and hazardous. Borosilicate glass/Pyrex is not scratch-resistant, therefore use of metal objects such as wire hangers or car aerials to compact screens is not recommended. Scratches weaken the glass and increase the likelihood of breakage or shattering when exposed to heat (Care and Safe Handling of Laboratory Glassware - Corning, 2008). Eighty-one percent of respondents in a Vancouver study reported using split or cracked pipes and 59% reported a pipe exploding from smoking (Malchy et al., 2008); and it is important to highlight the need to replace cracked or scratched pipes since they increase the likelihood of explosion

Suggested stem features:

- Stems that meet ISO standard 3585 are resistant to high temperatures (when ordering stems refer to glass specification sheets available through supplier or manufacturer). Glass of this standard can withstand temperatures between 20°C to 300°C when properly manufactured and handled (International Standards Organization, 1998).
- Open on both ends with a light fire polish to remove sharp edge.

b) CORE: Mouthpieces

Mouthpieces are placed at one end of a crack pipe in order to insulate lips from the hot pipe and may reduce incidence of cuts from chipped edges (Goodman, 2005). Like other devices intended to come into contact with the mouth (i.e., baby bottle nipples, thermometers, etc.), this device needs to be made from a food or medical grade material. Medical grade vinyl tubing is widely available; mouthpieces made from this material are distributed in British Columbia and Toronto's safer smoking programs (BCCDC, 2008; Hopkins et al., 2012). The toxicity of mouthpieces composed of non-medical or non-food grade materials (e.g., rubber bands, spark plug boots, electrical tape, etc.) are unknown.

Suggested mouthpiece features:

- Composed of a food grade material.
- Available in variable lengths to meet client preference.
- Fit easily and securely over the end of the glass stem. More than one mouthpiece type may be necessary if the stems distributed vary in diameter.
- Easy to remove from a glass stem, even after it has been heated. (Removal of mouthpieces while stems are hot can result in burns to hands.)

Crack cocaine vapours can be easily deposited on the inside surface of a pipe. The longer the pipe or the mouthpiece, the greater the amount of resin that will form on the inside surface as the vapours cool and crystalize. Therefore, while longer stems and mouthpieces may protect the face and lips from being closer to sources of heat, they may also decrease the amount of the drug the person inhales. The SCORE evaluation included a statement from a person who reported that they preferred to not use the mouthpiece since it was difficult to remove resin from it if it was about "2 inches long" (Johnson et al., 2008). At a minimum, the length of the mouthpiece should prevent the entire surface of the lips being exposed to heat from the pipe. The length of the mouthpiece may require explicit input from people who smoke crack cocaine in order to encourage uptake and continued use.

Low uptake of mouthpieces has been previously reported (Hopkins et al., 2012; Johnson et al., 2008; Leonard, 2006). Resistance to utilizing the mouthpieces is linked with not understanding the purpose of the mouthpiece; inappropriate size matching (i.e., fit) between the stem and mouthpiece; and only using mouthpiece when sharing pipes with others (Johnson et al., 2008).

Mouthpieces cannot prevent formation of sores inside the oral cavity; their use does not prevent exposure of the mucous tissue in the mouth to crack cocaine vapours. Once the hot vapours enter the mouth, the risk of oral sores is ever-present (please refer to the discussion of changes that occur in the oral cavity upon exposure to crack cocaine vapours). The intention of application of a mouthpiece is to protect the lips from heat.

c) CORE: Push sticks

Push sticks are used to compact and (re)position screens and to recover the resin that accumulates on the inside of the pipe. Push sticks need to be made from a reusable material that will not scratch the interior or chip the stem. Wooden or bamboo chopsticks are less likely to scratch or chip glass stems or cause them to break when loading screens (Johnson et al., 2008). Borosilicate glass/Pyrex is not scratch-resistant, therefore use of metal objects (e.g. car aerials) may cause scratching of the stem. Scratches weaken glass and increase the likelihood of breakage as well as shattering when exposed to heat (Care and Safe Handling of Laboratory Glassware - Corning, 2008).

Malchy and colleagues (2011) reported that syringe plungers have been used to scrape resin out of pipes resulting in melted plastic in the pipe and unnecessary waste of unused needles and syringe barrels in the community. Eighty-seven percent of the respondents from this survey also reported using metal push sticks that can impair the integrity of the glass stems (Malchy et al., 2011). Wooden chopsticks and craft dowels (wooden rods) are distributed for this purpose since they will not scratch the stem; their use should be encouraged (Malchy et al., 2011).

Suggested push stick features:

- Made from wood or another material that will not scratch or chip glass or lead to stem breakage when loading screens.
- No rough edges that could lead to splinters and cause injuries to the skin.
- The length and thickness of push sticks need to match the length and inside diameter of the stem(s) distributed. Push sticks must be long enough to allow a comfortable grip on the stick while pushing screens from one end of the stem to the other As well, push sticks may need to be short enough to conceal when not in use (Johnson et al., 2008)
- Push sticks must be thick enough so as not to break when loading screens, but narrow enough so as not to collect and scrape the resin off the side of the pipe when it is being pushed through.

d) CORE: Screens

Screens are used to prevent crack cocaine crystals and the melting crack cocaine from being inhaled through the stem and into the mouth. Commonly used materials include metal wool (steel or copper) and copper cable wire. When smoking, these materials may break apart into fragments which are then inhaled and can cause injuries to the oral cavity and lungs. These fragments may be responsible for the black sputum (phlegm) reported by 75% of the participants in a recent study of respiratory issues among people who smoke crack cocaine in Toronto (Leece et al., 2012). Many of these materials are also coated with substances that are not intended to be inhaled such as soap and cleaning products (e.g., Brillo® and Chore Boy®).

Tobacco pipe screens that are made out of steel or brass are designed for smoking and are a safer alternative to these materials. Brass screens are currently distributed by many safer smoking programs across Canada. However, some have prickly edges and reports from clients indicate that this deters their use of them (Hopkins et al., 2012). Other options may need to be explored. However, educating clients on how to properly fold and compact screens has been reported to reduce reports of pricks (personal communication, Lampkin, 2012).

Reports and studies have recorded persistent use of metal steel wool such as Brillo® in pipes in spite of brass screen distribution in Canada (Hopkins et al., 2012; Ivsins et al., 2011; Leonard et al., 2006; Malchy et al., 2008). The continued use of metal wools such Brillo® has been attributed to its ease of use (Hopkins et al., 2012). In spite of its relative ease, it is coated with cleaning products that may be toxic and it disintegrates once exposed to heat; therefore it is not considered to be a safe option when compared to brass screens. Further education may be required for clients around the harms associated with use of metal wools.

Suggested screen features:

- A small gauge mesh or screen that can act as appropriate surface to hold the crack cocaine in the stem when compacted.
- Made from a non-reactive substance that has high heat resistance and no chemical coatings.
- Able to be easily manipulated by hand.
- Will not cause injuries to the hands when being loaded and also will not damage the glass stem.
- The number of screens necessary will be determined by the size of the stem. It has been recommended that several brass screens be layered, and compacted into the pipe (Leonard et al., 2010). This will ensure a larger surface area for the crack cocaine to melt into once heated.
- Screens per pipe need to be distributed in sufficient quantities so as to prevent inhalation of "rocks" and melted crack cocaine.

e) Other materials to distribute

Distribution of educational materials is recommended to provide clients with information about how to maintain a safe pipe, prevent injuries, engage in safer sex, and access services. It has been reported that clients find the tip cards contained in kits useful (Johnson et al., 2008). Distribution of condoms and lubricant with safer smoking equipment is recommended to assist clients to reduce harms from risky sexual behaviours.

Across Canada, many harm reduction programs offer supplies beyond the core supplies listed. This document is intended to provide guidance regarding safer supplies for crack cocaine smoking; therefore there are no recommendations about the following supplies. It is also unclear how the following supplies reduce injury and risk of disease transmission for people who smoke crack cocaine since there have been no evaluations of these supplies in safer crack cocaine kit distribution programs.

Other supplies distributed are listed below (Table 8.1) with a brief rationale for their inclusion.

Table 8.1 Safer crack cocaine smoking kit items

Item	Rationale
Alcohol swabs (BCHRSS, 2008; Johnson et al., 2008; Backe et al., 2011; Hopkins et al., 2012) Antiseptic wipes (Benjamin, 2012); Moist towellettes (Benjamin, 2012)	Can be used to remove surface/visible dirt from pipes and hands prior to smoking. NB: Topical antiseptic products such as alchohol swabs and wipes containing alcohol should not be used to clean wounds, sores, blisters, ulcers or cuts because they impair healing and therefore increase risk for infection (Atiyeh, Dibo & Hayek, 2009; McCord & Levy, 2006).
Lighter/matches (BCHRSS, 2008; Johnson et al., 2008)	May provide a more consistent heat source compared to matches. Lack of access to a lighter has been reported by people who smoke crack as increasing exposure to communal drug use situations and sharing of pipes and/or mouthpieces; public drug use and risk of victimization and/or arrest (Johnson et al., 2008).
Lip balm (Hopkins et al., 2012)	Lip balm has been distributed to moisturize dry, cracked lips that result from repeated exposure to heat.
Chewing gum (Hopkins et al., 2012)	It has been distributed to promote oral hygiene and prevent grinding of teeth.
Adhesive bandages (BCHRSS, 2008; Johnson et al., 2008)	Physical barrier to protect burns and cuts to the hands.

Program coverage

Program coverage can be assessed in numerous ways including: availability in a community, across a community over time, and as a proportion of pipes needed versus those distributed. Across Canada, availability and distribution of safer crack cocaine smoking equipment is reported to be low and difficult to assess because it is not systematically measured (Haydon & Fischer, 2005; Strike 2011). Available data shows that safer crack pipes are distributed in Vancouver, Whitehorse, Calgary, Winnipeg, Toronto, Ottawa, Montreal, Guelph and Halifax (Canadian AIDS Society, 2008; Canadian HIV/AIDS Legal Society, 2008; Leonard et al., 2008; Symington, 2007). However, the total number of programs that distribute safer crack cocaine smoking equipment is unknown. As well, some programs distribute only mouthpieces. British Columbia is the only province with a central distribution program for safer smoking supplies and the following table (Table 8.2) gives a sense of recent distribution volume.

Table 8.2 Total safer smoking equipment ordered in British Columbia in 2012

Equipment	Total units
Mouthpieces (tubing)	1,164
Screens	354,000
Push sticks	624,736
BC province totals include order numbers by five regional health authorities. Stems unfunded by BC program at the time.	

Source: BC Harm Reduction Supply by Health Authority (2012). *(table modified from original source)*

A number of factors have combined to restrict, limit or prevent the implementation of safer crack cocaine smoking kit programs, including: political and community opposition, questions regarding efficacy and need, lack of funding and municipal regulations (Bungay et al., 2009; Canadian AIDS Society, 2008; Canadian HIV/AIDS Legal Society, 2008; DeBeck et al., 2009; Haydon & Fischer, 2005; Hopkins et al., 2012; Ivsins et al., 2011; Johnson et al., 2008; Leonard et al., 2008; Shannon et al., 2008; Strike et al., 2011). Poor coverage can negatively impact attempts by individuals and communities to "adopt and maintain safer crack-smoking practices" (Leonard, 2010). Bayoumi et al. (2012) reported high

rates of crack pipe lending or selling and highlighted the capacity of safer smoking supplies to be used as currency in contexts where there is high demand and low supply. Clean stems may also be bartered for sex in these situations (Hopkins et al., 2012). Greater distribution is therefore needed to ensure that supply meets demand.

Evaluation of existing programs shows that, once implemented, people who smoke crack cocaine report increased access and utilization of the equipment (Backe et al., 2011; Benjamin, 2011; Hopkins et al., 2012; Johnson et al., 2008; Leonard, 2010; Malchy et al., 2011). When programs first opened, many reported insufficient quantities of equipment to meet demand, but many have since increased their distribution volumes (Backe et al., 2011; CAS, 2008; Johnson et al., 2008). Reports of outreach workers from the SCORE project being "swarmed'" on the street by clients for crack cocaine smoking kits pointed to great need in the face of limited quantities of safer smoking supplies (Johnson et al., 2008).

Data from evaluations point to accessibility issues related to limited program hours such as daytime-only hours of operation (Backe et al., 2011; Benjamin, 2011; Hopkins et al., 2012; Leonard 2010; Malchy et al., 2011). A desire for increased hours of service is a common theme coming from program evaluations (Backe et al., 2011; Benjamin, 2011; Hopkins et al., 2012; Leonard, 2010; Malchy et al., 2011). Clients report that when they cannot access safer smoking equipment they are more likely to share; and some turn to injecting their drugs instead (Hopkins et al., 2012; Leonard, 2010). However, data from the Toronto evaluation shows that clients can respond to limited hours of operation by requesting more smoking equipment per visit (Hopkins et al., 2012). The Toronto program has no limits on the quantity of equipment that can be obtained per visit and some clients are given boxes of stems (Hopkins et al., 2012).

Coverage can also be assessed in terms of reach beyond clients who attend a program. Data shows that clients often obtain supplies for themselves and also for others (Benjamin, 2011; CAS, 2008; Hopkins et al., 2012; Leonard, 2010). In Ottawa, 94% (n=157) of study participants reported obtaining supplies in this way after the program had been in operation for 12 months (Leonard et al., 2008). Leonard (2010) cautions, however, that people who access supplies exclusively through their peers will not have access to the services, supports and referrals provided by harm reduction service providers; therefore all individuals should also be encouraged to obtain their own safer smoking supplies.

Impact of safer crack equipment distribution program closure

Following public controversy, safer crack cocaine smoking kit programs in Nanaimo, Calgary and Ottawa were closed (Benjamin, 2011; Leonard et al., 2008; Rud, 2007). Evaluation reveals the program closure resulted in several important changes in the patterns of smoking (of crack cocaine) and injecting drugs but not the overall volume smoked. First, program closure is linked to increased sharing of crack cocaine pipes (Benjamin 2011). Second, program closure is followed by a reduction in the number of times crack cocaine is smoked; however, much more crack cocaine is smoked per occasion (Benjamin, 2011). Third, scarcity of pipes is linked with increased exposure to violence from those in need of pipes or those selling pipes (Benjamin, 2011). Fourth, programs report increased demand for injection drug use equipment and transitions or return to injection drug use (Benjamin, 2011). Programs in Ottawa and Calgary have been reinstated since their cancellation (Leonard et al., 2008; personal communication, Nielsen, 2012).

Population specific considerations

People who smoke crack cocaine report experiencing high degrees of stigma, discrimination and isolation, even among people who use drugs in general (Goodman, 2005). Below is a discussion about some of the population-specific issues encountered in the research for this document. It is intended to provide the reader with a background for special considerations when dealing with specific populations.

Aboriginal populations

Aboriginal peoples are over-represented among people who smoke crack cocaine in Canada (Bungay et al., 2009; Goodman, 2005; Johnson et al., 2008). Furthermore, rural Aboriginal people who smoke crack cocaine are particularly isolated from appropriate prevention, treatment and harm reduction interventions (Fischer et al., 2010). Mehrbadi and colleagues (2008) reported smoking crack cocaine (AOR=2.9; 95% CI: 1.6, 5.2) in the previous 6 months and lifetime sexual abuse (AOR=2.5; 95% CI: 1.4, 4.4) to be independently associated with sex work among Aboriginal females. Specific programming for Aboriginal women has been called for, as Aboriginal women may experience more violence and trauma, which has been linked to racism and colonization in Canada (Bungay et al., 2009).

Aboriginal peoples are also disproportionately represented across many of the categories of risk associated with crack cocaine smoking. In a review of homelessness in Canada, Hwang (2001) stated that 10 times as many Aboriginal people are homeless as any other group in the population. HBV rates between 1999 and 2008 were three times higher in Aboriginal populations; for Aboriginal women the rates were 4.34 times higher, and for men 1.86 times higher (PHAC, 2011). Between 2004 and 2008, rates of HCV were 5.5 times higher when compared to the general population (PHAC, 2009).

In a review of HIV incidence and prevalence in Aboriginal peoples in Canada, Duncan (2011) noted that the high prevalence of HIV among Aboriginal youth and female sex workers could be a result of unsafe sexual practices as well as illicit drug use. Factors such as engaging in sex work, presence of STIs, HIV, HCV, and homelessness have been associated with smoking crack cocaine. It is important therefore to develop harm reduction strategies and outreach programs that reflect the burden of health and social ills that Aboriginal individuals bear within our society. Inclusion of Aboriginal groups in planning and implementing harm reduction distribution is essential.

Women

Women are disproportionately affected by sexual health and drug use-related harms associated with crack cocaine (Khandor & Mason, 2007; Shannon et al., 2008). Many women who smoke crack cocaine trade sex for crack cocaine or money (Khandor & Mason, 2007). In a study of approximately 200 women in Vancouver who reported sex work, 81% (n=166) reported smoking crack cocaine in the last 6 months; 59% (n=121) reporting daily smoking of crack cocaine (Shannon et al., 2008). Women who smoke crack cocaine and are poor or homeless in Toronto and Vancouver have reported sexual assault, physical assault and robbery (Butters & Erickson, 2003; Khandor & Mason, 2007; Shannon et al., 2008). The victimization of women can also contribute to risky sharing behaviours. For example, women in a study from Vancouver reported that they experienced being forced to share smoking equipment and risked violence in retaliation if they refused (Bungay et al., 2010).

Among a group of women who smoke crack cocaine in Toronto, Butters and Erickson (2003) reported that all of the women in the study had exchanged sex for drugs, or sold sex. Many of the women in this study also reported being victimized since becoming involved with crack cocaine. They reported experiencing physical and sexual assault and rape by their dealers, customers, and sometimes boyfriends (Butters & Erickson, 2003). These women also reported that their most common physical complaints were respiratory ailments (asthma and pneumonia), and diseases such as HCV, and HIV/AIDS. This was in addition to mental health concerns and suicidal ideation (Butters & Erickson, 2003). Suicidal ideation has also been linked to current drug dependence among homeless women (Torchalia et al., 2011).

Systems that penalize women for their drug use instead of assisting them and providing support may contribute to increased crack cocaine-related harm. For example, El Bassel (1996) reported that if a woman had her child removed by children's services, she was 3.3 times more likely to regularly smoke crack cocaine. In addition, women who perceived themselves as having less social support were more likely to be regular smokers of crack cocaine. Social support has been correlated with more consistent condom use among a population of women who smoke crack cocaine (Montoya, 1998) and points to the important support roles that harm reduction workers may be able to provide for marginalized women. There is a need therefore to build more holistic women-centred programs that are cognizant of the multiple domains in which crack cocaine can affect the lives of women.

Sex workers

Smoking crack cocaine is positively associated with a greater number of partners and engaging in sex work for both genders (Jenness et al., 2011; Maranda, et al., 2004; Wilson, et al., 1998). Strega et al. (2009), in a review for drug treatment for female sex workers, noted that "in many instances, sex work and substance use are mutually reinforcing" (p.43). They also concluded that substance use is also a significant factor in the continued engagement in sex work. Women and transgendered individuals who engage in sex-work are particularly vulnerable in these situations (Strega et al, 2009). Women who smoke crack cocaine report engaging in sex work as a result of economic deprivation and barriers to other paid employment (Bungay et al., 2010). A study of violence against female sex workers reported that violence was independently correlated with homelessness, rape, inability to access drug treatment, servicing clients in cars or public spaces, prior assault by police, confiscation of drug use equipment by police, and moving working areas away from areas patrolled by the police (Shannon et al., 2009).

Males are also subject to risks related to smoking crack cocaine and sex work. In a study of sex trade participation and rates of HIV in gay and bisexual men in Vancouver, crack cocaine smoking was independently associated with sex work (OR=7.4, 95%, CI - 3.0-18.7) and sex workers also had a significantly higher HIV prevalence and incidence compared to non-sex workers (Weber et al., 2001). Sharing drugs with clients while working is associated with sharing pipes, intensive daily smoking of crack cocaine, inconsistent condom use by clients, and having a bad date (verbal, physical or sexual assault; Shannon et al., 2008). Criminalization of sex work and people who smoke crack cocaine perpetuates marginalization. Services that are supportive and provide greater safety for people who engage in sex work are much needed.

Youth

A number of Canadian reports and studies have raised concerns about vulnerability, homelessness, and substance use among youth (Barnaby et al., 2010; Evenson et al., 2009; Fast et al., 2009; Johnston et al., 2011; Kirst et al, 2009; Kulik, et al, 2011; Paquette et al., 2010; PHAC, 2007). The Shout Clinic's Harm Reduction Report on street youth in Toronto reported that 71% of the respondents had smoked crack cocaine in the 6 months prior to the study (n=100); 25% of these youth also reported 3-4 times per week use (Barnaby et al., 2010). A particularly troubling finding from this report was that 61% of the respondents who smoked crack cocaine used a pipe that was already used by someone else.

A report on crack cocaine smoking among street youth in Montreal revealed that polysubstance use was positively associated with crack cocaine inhalation initiation (Paquette et al., 2010). PHAC has reported consistently "high rates" of polysubstance use amongst street youth (by non-injection means, excluding alcohol and tobacco), and that 30.9% of homeless youth engaging in sex in exchange for cigarettes, drugs or alcohol (2007). Smoking crack cocaine has also been implicated in engaging in survival sex among street youth (Walls & Bell, 2011). Risky drug practices of youth can contribute to the healthcare burden through infection by HIV and overdoses. Johnston and colleagues (2011) surveyed 589 drug using youth in Vancouver, and concluded that HIV knowledge was very low among the youth, and that more work was needed to address education of youth engaging in high-risk behaviours. A study of street youth in Vancouver discussed the implications of involvement in drug networks, homelessness, and exploitation that exposes them to numerous harms (Fast et al., 2009). Finally, a review of healthcare needs of homeless youth in Canada noted that life on the streets could contribute to early mortality for youth through substance use, suicide, and accidents (Kulik et al., 2011). An important consideration for any program that intends to provide harm reduction and outreach to youth is the willingness to provide services that can decrease their vulnerability.

Finally, populations that are socioeconomically marginalized present the greatest area of need. Aboriginal persons, women, youth, transgendered individuals, those with mental illness, HIV-positive individuals, and the homeless are all groups that need special consideration in the distribution of safer smoking supplies. While the list of groups discussed here is not exhaustive, it is hoped that the reader can appreciate the multitude of ways in which marginalization can interact with smoking crack cocaine.

Safer smoking equipment distribution evidence summary

The evidence that informs this chapter and its recommendations came from a variety of studies. Laboratory evidence and clinical reports were used to explain how risky practices associated with smoking crack increase the chances of acquiring HIV, HCV or other pathogens. Observational studies (e.g. cross-sectional and prospective cohort studies) were the primary sources of evidence used to document risky smoking behaviours and provide estimates of the prevalence of HIV, HCV and other diseases among people who smoke crack cocaine. Studies using qualitative methods provided greater insight into the role of behaviours and experiences of people who smoke crack cocaine.

Systematic and meta-analytic reviews of scientific literature provided greater insight into interactions between crack cocaine and infectious disease. Data from program evaluations conducted in varied jurisdictions across Canada and published as grey literature were used to describe program distribution practices, demographic characteristics of program clients and the impacts of safer crack use kit distribution.

The majority of evidence used in this chapter was derived from observational studies. While RCTs are generally considered to provide the highest quality evidence for interventions, it is not always feasible or ethical to conduct this type of research within populations or with harm reduction

programs. This is recognised by a number of public health experts and authorities, for example:

> *[T]he difficulty of conducting a strictly randomized controlled trial to evaluate a public health intervention such as a NSP should not be underestimated. Potential sources of bias and confounding are impossible to control because of insurmountable ethical and logistical impediments. (WHO, 2004, p. 5)*

> *[I]n some cases it is impossible for researchers to conduct RCTs since to do so would be unethical. Further, given the complexity of causal chains in public health, the external validity of RCT findings often has to be enhanced by observational studies. (NICE, 2009, p. 17)*

Evidence related to crack cocaine, safer smoking and the prevention of HIV and other blood-borne pathogens is limited, but growing. This chapter therefore is the most up to date synthesis of the current literature.

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9 Disposal and handling of used drug use equipment

RECOMMENDED BEST PRACTICE POLICIES to facilitate disposal of all used injection equipment (i.e., needles/syringes, cookers, filters, swabs, tourniquets) and non-injection equipment (i.e., stems, mouthpieces, screens, other smoking and inhalation devices) in accordance with local, provincial/territorial, and federal regulations regarding disposal of biomedical waste and to prevent needlestick and/or sharps-related injuries to staff members, clients and others:

- **Regular review and assessment of compliance with local, provincial/territorial and federal regulations regarding collection, storage, transportation, security and disposal of biomedical waste**
- **Educate clients and staff members on how to properly handle, secure and dispose of used injection and non-injection equipment**
- **Encourage clients to return and/or properly dispose of used injection and non-injection equipment**
- **Provide clients with tamper resistant sharps containers in a variety of sizes**
- **Provide multiple, convenient locations for safe disposal of used equipment in rural and urban settings. Do not penalize or refuse to provide new equipment to clients who fail to return used drug equipment.**
- **Visually estimate the amount of returned equipment; staff should not touch used equipment and neither staff nor clients should manually count used equipment**
- **Encourage staff and clients to be vaccinated against hepatitis B (HBV)**
- **Provide access to safety devices for staff and procedures for first aid and post-exposure prophylaxis (PEP)**

Needle and syringe programs (NSPs) and other harm reduction programs play a key role in the collection and disposal of used drug use equipment (Kaplan & Heimer, 1994; Leonard, 2010). Removing used equipment from circulation helps to reduce the risk of transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), HBV, and other blood-borne pathogens associated with accidental needlestick/sharps injury and equipment sharing (Heimer & Abdala, 2000; Ksobiech 2004). Through education and training with service providers and clients, harm reduction programs can reduce unsafe disposal practices such as: putting used equipment into the garbage; giving equipment to someone else to discard; discarding equipment in streets, parks, alleys, sewers, and other public spaces; and otherwise failing to dispose of equipment in an appropriate sharps container (Leonard, 2010).

Pathogens and used drug equipment

Viruses such as HIV, HCV and HBV have varying degrees of survival in the environment. Active HIV-1 particles have been found in syringes up to 42 days at 4 degrees Celcius and have been detected 21 days after use when stored at room temperature (Abdala et al., 2000). A more recent study detected viable HCV in syringes for up to 63 days (Paintsil et al., 2010). Heimer and colleagues (1996) detected HBV in syringes up to 8 months after storage at room temperature. The survival of these pathogens in injection equipment presents a potential risk for infection for all individuals who handle or reuse them.

HCV has been detected on crack cocaine smoking equipment (Fischer et al., 2008). Infectious HCV particles can be present after being dried on inanimate surfaces after 7 days (Doerrboecker et al., 2011). Ciesek and colleagues (2010) reported that HCV was stable and infectious at room temperature for many days when present on different surfaces and concluded that this presented a substantial risk for transmission for person to person infection and infection in healthcare environments. In this study, HCV particles were detected 28 days after inoculation of plastic surfaces, metal surfaces and rubber gloves (Ciesek et al., 2010). Mycobacterium tubercu-

losis can withstand extreme temperatures by forming spores and can also survive up to 4 months on inanimate surfaces (Kramer et al., 2006). HBV can also survive for more than a week on surfaces (Kramer et al., 2006). The survival of these pathogens on open surfaces underscores the need for proper disposal practices to reduce risk of transmission for crack cocaine smoking equipment.

Needlestick, other injuries, and risk of infection

Needlestick injuries are accidental punctures of the skin. Such injuries are a concern for all program staff members, clients, and others who come into contact with used needles and other sharps because of risk for HIV, HCV, HBV, and other blood-borne pathogens. At the time of preparing this document, there were no estimates available of needlestick or other sharps-related injuries among staff members at NSPs, harm reduction programs, and/or public health settings.

In healthcare settings, it is estimated that among nurses the annual rate of needlestick injuries is 4.8 per 100 full-time equivalents (i.e., total hours worked divided by average annual hours worked in full-time jobs; Canadian Centre for Occupational Health and Safety, 2005). CCOHS (2005) estimates that approximately one-third of nursing and laboratory staff experience a needlestick injury every year. Estimates of needlestick related infections in occupational settings vary by pathogen: 1%-40% for HBV (among those who are unvaccinated); 1.8% for HCV; and 0.3% for HIV (CCOHS, 2005). From a study of sharps injuries in healthcare settings, Blenkharn and Odd (2008) reported an overall low rate of injury (1 injury per 29000) with no seroconversions due to sharps injuries among a group of medical waste disposal workers. However, they reported inconsistent use of puncture-resistant gloves among workers which resulted in injuries to hands from improperly closed or overfilled sharps containers; and sharps were placed into soft-walled bags which also resulted in injury (Blenkharn & Odd, 2008). Practices such as recapping needles or placing syringes in containers that are not puncture resistant can increase the chances of a needlestick injury (WHO, 2010).

Among those at risk of community-acquired needlestick injury are people who use parks or other public spaces, those who may pick up a discarded needle, and sanitation workers who may be injured by needles discarded in the garbage, sewers, or in toilets (Macalino et al., 1998). Injury from used syringes in community settings (e.g., outdoor spaces) is generally considered to have a low risk of infection (Canadian Pediatric Society, 2008; Elder & Paterson, 2006; Papenberg et al., 2008). Despite the low risk of infection, the risk of physical injury or acquiring an infection is not eliminated due to lack of knowledge regarding the previous users' serostatus and exposure of the device to the elements. Furthermore, needlestick injuries can be very emotionally distressing regardless of the low risk (Blenkharn & Odd, 2008; Canadian Pediatric Society, 2008).

Handling crack cocaine smoking equipment (stems or self-fashioned pipes) has the potential to lead to a sharps injury if the pipes are broken or sharp edges are apparent. An estimate of the proportion of people who smoke crack cocaine and/or harm reduction staff who experience a sharps injury from a smoking device was not available at the time of writing this document. When available, results often present an aggregate of two or more types of injuries (e.g., sores, cuts, injuries, and burns) and do not specify the cause (e.g., wound from a sharp edge versus wound from a heat source). Leonard (2010) reported that between 21% and 23% of people who smoke crack cocaine in Ottawa reported an injury (i.e., sore, cut, crack, burn, or other) to the mouth as a result of smoking crack cocaine in the 6 months prior to the interview. Data from a Vancouver study showed that 52% of people who smoke crack cocaine had lesions from smoking and another 59% reported a pipe exploding while they were smoking crack cocaine (Malchy et al., 2008). Data from a large study in the United States reported that among those participants who smoked crack cocaine and had an oral sore, just under half (68 of 141; 48.2%) attributed the sore to crack cocaine smoking (Faruque et al., 1996). Other reports have noted that damaged crack cocaine pipes can lead to injuries; however, this risk is not quantified (Porter & Bonilla, 1993).

As well, pipe screens may also cause injuries to hands. Clients who participated in the evaluation of the Toronto Public Health safer crack kit evaluation noted that the sharp edges of the screens caused cuts to their hands (Toronto Public Health, 2012). Therefore, handling of used screens may require special consideration from programs to ensure safety of workers and service users.

Safer handling, disposal and "routine practices" for used equipment

Evaluation has shown that NSP disposal activities benefit communities by removing the majority of potentially infectious syringes from the community (Tookes et al., 2012; Wenger et al., 2011). In a meta-analysis of data from 26 international studies, the overall return rate for NSPs was 90%,

ranging from 15% to 112% (Ksobiech, 2004). Four studies included in this review reported return rates of 100% or more (Ksobiech, 2004). Interpretation of return rates among NSPs must take into consideration returns of needle/syringes from other programs and returns of syringes to other programs. For example, Grund et al. (1992) reported that 13% of needles distributed were disposed of at other programs. Evidence shows that strict exchange policies, such as "one-for-one", are not necessary or desirable to achieve high return rates (Grund et al., 1992; Small et al., 2010; Strike et al., 2005). Utilization of NSPs is associated with safer disposal of used syringes (Bluthenthal, et al., 2007; Coffin et al., 2007; Doherty, 2000; Doherty et al., 1997; Khoshnood et al., 2000; Sherman et al., 2004).

Most literature and policy recommendations encountered in the preparation of this document addressed the disposal of used injection equipment. There is little literature about the safe handling and disposal of non-injection drug use equipment such as safer crack cocaine smoking equipment (glass stems, mouthpieces, screens, etc.). However, the most thorough approach to biohazard waste management encountered is referred to as "routine practices" which assumes that all blood, body fluids, secretions, excretions, mucous membranes, non-intact skin or soiled items are potentially infectious (CCOHS, 2011). "Routine practices" also include administrative procedures and standards for immunization, training, and first aid to ensure safe management of contaminated materials (CCOHS, 2011). This approach is appropriate for used drug equipment since it addresses many of the key components required for proper handling and disposal and because pathogens such as HIV, HCV, HBV, Tuberculosis mycobacterium and others can survive in/on used injection and inhalation drug equipment. This equipment includes syringes, filters, cookers, alcohol swabs, tourniquets, stems, mouthpieces and screens. (see Table 9.1 for examples of routine practices)

Table 9.1 Examples of routine practices for used needles and syringes, cookers, filters, tourniquets, alcohol swabs, glass stems, mouthpieces, stems, brass screens other smoking/inhalation devices

Disposal of sharps

Sharps are any device that can break the skin and include needles, scalpels, glass, and exposed ends of wires (WHO, 2010). While some drug equipment is "soft" (e.g., swabs) and cannot puncture the skin, this equipment should also be handled with caution since it may be contaminated with blood.

Sharps containers – examples of routine practices

Sharps must be disposed of in containers with some of the following characteristics:

- Be rigid to avoid puncturing of walls by sharps
- Not have removable lids and be tamper resistant
- Labelled as containing hazardous materials
- Be able to withstand the weight of the waste without breaking, tearing or cracking
- Sharps containers may be offered alongside safer injecting equipment to encourage proper disposal practices
- Programs may dispose of full sharps containers for clients
- Sharps containers should not be filled more than 2/3 since this increases the chances of container malfunction, and therefore risk of injury
- If sharps containers are not available, clients should be encouraged to place used equipment into rigid plastic containers with tight fitting lids such as bleach bottles, fabric softener bottles, etc. Containers should be well-labelled, not recycled, and only be 2/3 full when brought in for disposal.

Handling of used equipment for clients and workers – examples of routine practices

- All used supplies should be considered to be contaminated and therefore must be handled and disposed of in accordance with local, provincial/territorial, and federal regulations regarding disposal of biomedical waste.
- Sharps containers should be tamper resistant and secured to prevent used supplies/equipment from being removed.
- Sharps containers should be placed in a convenient location that is nearby to ensure prompt disposal of used equipment from the area.
- Needles should never be recapped. Recapping can increase the chances of a needlestick injury and expose the person to infection.
- Needlestick injuries from a used needle that has been exposed to the environment (e.g., on the street, in the park, lying on a table or the floor) pose a risk of infection because the needles are no longer sterile.
- Needles should not be placed or carried in bags, pockets, or sleeves of clothing because they are not puncture resistant and pose a risk for injury.
- Never handle someone else's used equipment. If assisting someone else with disposal (i.e., bringing used equipment to an NSP), ensure that they place their used equipment into a sharps container first.
- Bending, breaking or forcing needles into already full sharps containers increases risk of injury. This may occur with glass stems as well.
- If used equipment needs to be counted, do not touch it. Estimate the amount returned.
- Collecting any supplies off the ground increases risk of injury. Anyone who is collecting discarded equipment should use tongs and/or wear puncture-resistant gloves and carry a sharps container for immediate disposal.
- Hand hygiene – washing hands with soap and water and/or an alcohol-based hand rub is encouraged after all handling of sharps, containers, used equipment, and after removal of gloves.

Collection and storage of used equipment for fixed site programs – examples of routine practices

- Programs may want to explore collection and storage options for sharps versus soft (e.g., alcohol swabs) equipment versus non-infectious waste (e.g., packaging) to reduce disposal costs. All options must comply with local, provincial/territorial, and national guidelines.
- If returned equipment is separated for storage and disposal, staff should not manually separate equipment. Clients should not manually separate equipment that is not their own.
- All disposal containers (sharps or bags) should be monitored and stored securely.

Sources: BCHRSS, 2011; CCOHS, 2011; CPSO, 2012; Edmonton Community Drug Strategy, 2006; Health Canada, 2004; New York State Department of Health, 2011; Northwest Territories Health and Social Services, 2011; OSHA, 2011; ONA, 2004, 2010; PIDAC, 2010; WorkSafe BC, 2006, 2008,2009; WHO, 1999, 2004, 2006, 2010

Please note that the lists provided above and also below are not intended to be exhaustive. To ensure that practices are safe, up-to-date and in accordance with all relevant guidelines, it is recommended that programs regularly review the local, provincial and national guidelines regarding the handling and disposal of contaminated equipment. Listed at the end of the chapter are resources to provide the reader with more in depth guidance about management of used drug equipment.

Hepatitis B vaccination

Currently no vaccinations exist against HIV or HCV; however, a vaccination against HBV is widely available through primary care clinics and many public health units across Canada. Vaccination is recommended for people where exposure to body fluids or contaminated devices can occur, including health care workers, people who inject drugs, men who have sex with men, incarcerated people, people with a history of sexually transmitted infection, and people who have unprotected sex (Health Canada, 2008; WHO, 2010). HBV vaccinations can significantly reduce the chances of infection (WHO, 2008) and offer protection against infection for more than 90% of healthy individuals (Shepard et al., 2006).

First aid and post exposure prophylaxis (PEP)

All harm reduction programs and satellite/partner organizations that collect and dispose of sharps should implement emergency first aid policies in case of accidental injury due to sharps, in accordance with provincial/territorial guidelines. In Canada, access to PEP is mandated through occupational health and safety. Depending on the jurisdiction, people exposed to infectious body fluids or tissues may access treatment in occupational settings, through public, emergency rooms and/or clinics. Below (Table 9.2) are excerpts from the WHO's (2010) recommendations upon exposure to blood.

Table 9.2 WHO recommendations regarding steps to take in cases of occupational exposure to blood

- Apply first aid care, as appropriate.
- Notify a supervisor. The worker should report immediately to the medical services and seek advice on the need for PEP for HIV and HBV.
- Carry out an immediate medical evaluation, including a risk assessment and follow-up care (e.g., counseling and PEP) as appropriate.
- Complete an exposure form documenting the circumstance and report the exposure in the needlestick injury surveillance system.

Source: WHO best practices for injections and related procedures toolkit, 2010.

Example of a PEP policy

PEP is recommended if exposure meets ALL the following criteria (p.36):

- Exposure within 72 hours
- Exposed individual not known to be HIV-infected
- Source of exposure is HIV-infected or of unknown status
- Exposure was to one or more of the following: blood, body tissues, visibly blood-stained fluid, concentrated virus, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid or amniotic fluid
- Exposure was through one or more of the following: skin penetration with spontaneous bleeding or deep puncture, splash of significant amount of fluid to mucous membrane, prolonged contact of an at-risk substance with non-intact skin
- If skin penetration occurred, exposure was from a recently used hollow-bore needle

Source: WHO best practices for injections and related procedures toolkit, 2010.

Disposal options

A variety of options exist to increase access to safe disposal methods: NSPs, other harm reduction programs, drop boxes, syringe vending machines, residential pick-up, alley and street patrols, community clean up initiatives and supervised injection facilities (City of Ottawa, 2012; de Montigny et al., 2009; Gold & Schumann, 2007; Hayashi et al., 2010; Strike et al., 2002, 2005). To increase both access to safe disposal across the city and for 24 hours a day, the Montréal Department of Public Health installed needle/syringe drop boxes in outdoor locations and in neighbourhoods with active injection drug use scenes. Convenience – a general predictor of whether people who inject drugs will use services (Coffin et al., 2007) – was a key design feature of this program. Evaluation showed a 98% reduction in discarded needles within 200m of the drop boxes (de Montigny et al., 2010).

Evaluation of programs in New York State after expansion of access to needles and syringes in 2001 showed increased disposal through the community collection drop boxes, hospitals, nursing homes and community pharmacies (Klein et al., 2008). Success of some community drop-box sites pointed to the need for continued monitoring to know how often they need to be emptied (Klein et al., 2008). Importantly, no adverse events such as needles/syringes found near the drop boxes or needlestick injuries were reported. Klein et al. (2008) noted that these efforts were consistent with the goal proposed by the Environmental Protection Agency to eliminate disposal of used needles/syringes in the trash. There are also conflicting reports about improper disposal around unsupervised disposal methods such as community disposal bins and syringe vending machines. Klein et al. (2008) report that no syringes were discarded adjacent to community disposal bins, while McDonald (2009) reported that during 19% of visits, discarded syringes or plastic syringe kit containers were found adjacent to the syringe vending machine and adjacent disposal bins. Parkin and Coomber (2011) noted that location and design influence utilization of drop boxes; people who inject drugs are more likely to use drop boxes that are located in geographically relevant but also discrete locations.

Syringe vending machines are used to increase access to needle and syringes and disposal services at times and locations not served by NSPs. Some vending machines dispense new equipment in exchange for old equipment thus ensuring disposal. However, to increase access to sterile equipment, other machines do not require an exchange of used materials for new equipment and provide adjacent disposal bins for used equipment. Evaluation data have shown that the installation of syringe vending machines does not result in an increase of discarded needles/syringes in the community and also that clients will use disposal bins attached or adjacent to syringe vending machines (Islam & Conigrave, 2007; Islam et al., 2008; McDonald, 2009).

Since 1998, the City of Ottawa has operated the Needle Hunters Program to locate and dispose of needles, crack cocaine pipes, and other drug use equipment found in the community. In 2011, the Needle Hunters recovered 6349 needles and 1271 crack cocaine pipes (City of Ottawa, 2012). Other than the City of Ottawa Needle Hunter Program, there are few other reports and studies about disposal of crack cocaine smoking equipment. From Ottawa, Leonard (2010) reported modest declines and some increases in improper disposal of crack cocaine smoking equipment following introduction of a safer inhalation program in Ottawa. Before introduction of the program, over 54% of people who smoke crack cocaine reported that they disposed of glass stems in the garbage. The next most frequent disposal methods included: placing stems in a container and into the garbage (29.5%), community disposal drop boxes (25.1%), biohazard containers (18.8%), and returning used stems to an agency that distributes stems (16.4%; Leonard, 2010). When asked for reasons for disposing of stems on the street, parks, alleys or sewers, the most common reasons offered included: did not need it [stem] anymore (50%), did not want to carry it around (46.7%), worried about being caught by police with stems (43.4%), and there was no community disposal drop box around (40.0%; Leonard, 2010). Other reasons included: being too high, did not know where to dispose of stems, did not know there was a risk to others, too much hassle to go to an NSP, forgot and left stem behind, and did not think about it (Leonard, 2010). Data from Toronto showed a similar pattern; the two most common methods to dispose of crack cocaine smoking equipment were thrown in garbage (56%) and disposal in street/parks/alleys/sewers (18%; Hopkins et al., 2012).

Disposal behaviours among clients

Both individual and structural factors influence the ability of people who use drugs to properly dispose of used needles and syringes. At the individual level, issues such as lack of knowledge of correct practices or locations can impede proper disposal (Jackson et al., 2002). People who are homeless may also not be able to properly store and dispose of used equipment (Strike et al., 2002). On a structural level, NSP operating hours may be inaccessible for some people

who inject drugs, and clients may not be able to return their needles to the NSP during operating hours. Identification (ID) codes are used by some NSPs to track service utilization and clients' needle exchange rates. The lack of anonymity associated with ID codes – whether real or perceived – may discourage clients from using an NSP and properly disposing of used equipment (Loue et al., 1995).

When asked, 62% of people who inject drugs in a San Francisco study reported disposing of used needles at the NSP in the past 6 months, but 67% reported at least one incident of improper disposal (i.e., street, sidewalk, park, parking lot, trash receptacle, toilet, sewer or manhole; Wenger et al., 2011). Wenger et al. (2011) also estimated that 13% of syringes were improperly disposed of by study participants. In this study, improper needle disposal was associated with injecting in a public place, crack cocaine injection, and obtaining needles from an unauthorized source. Bluthenthal et al. (2007) found that having an income of less than $1000 USD, being injected by others, and concerns about arrest for possession of drug use equipment were associated with lower odds of safe syringe disposal. A novel study by Tookes et al. (2012) compared improper disposal patterns between San Francisco, a city with an NSP, and Miami, a city without an NSP. They found that people who inject drugs in Miami were 8 times more likely to improperly dispose of syringes than those in San Francisco who had access to an NSP. They estimated that 95% of all syringes used by people who inject drugs in Miami were improperly discarded compared with 13% in San Francisco (Tookes et al., 2012).

Evidence shows that intensified policing and 'crackdown' programs can impede access to both new equipment and disposal services. Fear of being identified and/or detained by the police discourages program attendance and also results in discarding of needles/syringes shortly after use to avoid increased scrutiny if detained by the police (Csete & Cohen 2003; Riley & Oscapella, 1996; Small et al., 2006; Springer et al., 1999; Strike et al., 2002). While police are noted above as a barrier to safe disposal, DeBeck et al. (2008) reported that the police may refer clients who improperly dispose of injecting equipment to programs such as a safer injection facility where they can properly discard of their used equipment.

Strategies to encourage proper disposal

To increase proper disposal, a number of strategies have been suggested including: adopting needle/syringe distribution policies instead of strict exchange policies (Small et al., 2010; Strike et al., 2002); providing multiple options and locations for return and disposal of equipment (Hankins 1998; Macalino et al., 1998; Small et al., 2010); lengthening the hours of operation of NSPs and other harm reduction programs (Wenger et al., 2011); conducting visits to retrieve biohazard bins and syringes from homes, social housing and communal drug use spaces (Hankins 1998; Small et al., 2010); installing public disposal boxes (de Montigny et al., 2010; Klein et al., 2008; Obadia et al., 1999; Riley et al., 1998); promoting pharmacy disposal (Golub et al., 2005); conducting community clean-ups to collect needles (Small et al., 2010); and providing safer spaces such as supervised injection facilities for people to use drugs (Wood et al., 2004).

Further readings on sharps handling and disposal

British Columbia Harm Reduction Strategies and Services (BCHRSS). Personal Sharps Containers: Questions and Answers; 2011. http://www.bccdc.ca/NR/rdonlyres/E0C-CCF65-F9A0-4FCD-B51B-27748F2FDD97/0/ContainersQA_Nov2011_.pdf

Canadian Centre for Occupational Health and Safety website for further information about Routine Practices: http://www.ccohs.ca/oshanswers/prevention/universa.html

Canadian Centre for Occupational Health and Safety website for further information about HIV precautions for needles and sharps: http://www.ccohs.ca/oshanswers/diseases/aids/health_care2.html

College of Physicians of Ontario (CPSO). A Practical Guide for Safe and Effective Office-Based Practices; 2012. http://www.cpso.on.ca/uploadedFiles/policies/guidelines/office/SafePractices.pdf

Edmonton Community Drug Strategy. Safe Needle Disposal Kit; 2006. http://www.cvrd.bc.ca/DocumentView.aspx?-DID=1597

Health Canada. The Laboratory Biosafety Guidelines 3rd Edition; 2004. http://www.phac-aspc.gc.ca/publicat/lbg-ldm-bl-04/pdf/lbg_2004_e.pdf

New York State Department of Health. How to Safely Dispose of Household Sharps; 2011. http://www.health.ny.gov/publications/0909.pdf

Northwest Territories Health and Social Services. Infection Prevention & Control: Fact Sheet #1

Routine Practices; 2011. http://www.hlthss.gov.nt.ca/pdf/brochures_and_fact_sheets/diseases_and_conditions/2011/english/routine_practices_infection_prevention_control.pdf

Occupational Safety and Health Administration (OSHA). Laboratory Safety Guidance; 2011. http://www.osha.gov/Publications/laboratory/OSHA3404laboratory-safety-guidance.pdf

Ontario Nurses Association (ONA). Needlestick/Sharps Safety and Prevention: Checklist for Sharps injury prevention; Updated 2010. http://www.ona.org/documents/File/healthandsafety/sharps/NeedlestickSharpsSafetyPrevention_Checklist.pdf

Ontario Nurses Association (ONA). Needlestick/Sharps Safety and Prevention: Handbook; Updated 2010. http://www.ona.org/documents/File/healthandsafety/sharps/NeedlestickSharpsSafetyPrevention_Handbook.pdf

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Ontario Nurses Association (ONA). Sharps Container Assessment; 2004

http://www.ona.org/documents/File/healthandsafety/sharps/SharpsContainerAssessmentSheet.pdf

Provincial Infectious Diseases Advisory Committee (PIDAC). Best Practices For Cleaning, Disinfection and Sterilization of Medical Equipment/Devices In All Health Care Settings; 2010. http://www.oahpp.ca/resources/documents/pidac/2010-02%20BP%20Cleaning%20Disinfection%20Sterilization.pdf

WorkSafeBC. Controlling Exposure: Protecting Workers from Infectious Disease; 2009. http://www.worksafebc.com/publications/high_resolution_publications/assets/pdf/bk129.pdf

WorkSafeBC. Home and Community Health Worker Handbook; 2006. http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/community_health_workers.pdf

WorkSafeBC. Laboratory Health and Safety Handbook; 2008. http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/laboratory_handbook.pdf

World Health Organization. Safe Management of Wastes from Health-Care Activities; 1999. http://www.healthcare-waste.org/fileadmin/user_upload/resources/Safe-HCWM-WHO-1999.pdf

World Health Organization. Management of Waste from injection activities: Guidelines for District Managers; 2006. http://www.who.int/water_sanitation_health/medicalwaste/mwinjections.pdf

World Health Organization. Laboratory biosafety manual. 3rd Edition; 2004. http://www.who.int/entity/csr/resources/publications/biosafety/Biosafety7.pdf

World Health Organization (WHO) WHO best practices for injections and related procedures toolkit; 2010. Accessed from: http://whqlibdoc.who.int/publications/2010/9789241599252_eng.pdf

Disposal and handling of used drug use equipment evidence summary

The recommendations in this chapter have been informed by a number of sources and studies. Laboratory evidence has been used to discuss infection risks related to used drug use equipment. Observational studies, program evaluations, geographic surveys, and reviews were the main sources of evidence documenting distribution and disposal practices of NSPs. Studies using qualitative methods provided greater insight into the role of behaviours and experiences related to disposal of drug use equipment. Finally, position statements and best practice guidelines were used to provide the reader insight into practices for safer handling and disposal of used drug use equipment.

The majority of evidence in this chapter was derived from observational studies. Even though randomised control trials (RCTs) are considered to provide the highest quality data, they may not be feasible for ethical and practical reasons for research on public health initiatives. This is recognised by a number of public health experts and authorities, for example:

> [T]he difficulty of conducting a strictly randomized controlled trial to evaluate a public health intervention such as a NSP should not be underestimated. Potential sources of bias and confounding are impossible to control because of insurmountable ethical and logistical impediments. (WHO, 2004, p. 5)

> [I]n some cases it is impossible for researchers to conduct RCTs since to do so would be unethical. Further, given the complexity of causal chains in public health, the external validity of RCT findings often has to be enhanced by observational studies. (NICE, 2009, p. 17)

Evidence related to disposal for harm reduction programs is limited, but growing. Therefore this chapter is an up-to-date synthesis of the literature.

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10 Safer drug use education

RECOMMENDED BEST PRACTICE POLICIES to facilitate knowledge and application of drug consumption practices that reduce or eliminate the risk of transmission of human immunodeficiency virus (HIV), hepatitis C (HCV), hepatitis B (HBV), and other pathogens; drug overdose; soft tissue injuries; and other drug consumption related harms.

- **Provide educational interventions targeted toward reduction of injection-related risk behaviours (e.g., needle and other injection equipment reuse and sharing) associated with HIV and HCV transmission, drug overdose, soft tissue injuries, and other drug consumption related harms**
- **Provide educational interventions targeted toward reduction of crack cocaine smoking risk behaviours (e.g., pipe reuse and sharing) to reduce smoking-related harms, such as injuries to the mouth and lips, associated with HIV and HCV transmission**
- **Provide safer drug use education in a variety of formats including one-on-one education, workshops and group education, skills-building sessions, information pamphlets, instructional videos, demonstrations, and other formats as necessary**
- **Provide peer-delivered, brief interventions, and longer interventions to reach a broad range and diversity of clients**
- **Develop and evaluate programs to train peers to deliver safer drug use education.**
- **Involve clients in the design and evaluation of educational materials and interventions to ensure message acceptability, relevance, and comprehension. Tailor education for the populations and contexts served by the program.**
- **Integrate evaluation of educational interventions into programming to ensure desired impact and to build evidence**

This chapter is divided into four subsections. The first addresses guiding principles for educational interventions. The second reviews evidence from safer injection interventions. The third reviews evidence from safer smoking interventions and the fourth summarises the type of evidence available.

Guiding principles for designing educational interventions in harm reduction settings

Health educational interventions for adults can be delivered using varied models. The following principles have been synthesised from these frameworks for use in public health settings (Bryan et al., 2009).

1) The rationale for the learning or knowledge may need to be explained to the target audience.

For example, prior to discouraging an individual's reuse of an alcohol swab used by another person, it may be useful to explain how bacteria and viruses can be transferred between people in this way and why it is important for health to avoid transmission.

2) Existing problems can motivate people to learn.

For example, service users may say that they are concerned about abscesses resulting from injecting drugs. This would be a good opportunity to design and deliver education on how abscesses form, treatment, and prevention through safer injecting practice.

3) Previous experiences must be recognised and incorporated into education.

For example, service users may be hesitant to remove mouthpieces from stems while sharing pipes due to fear of burning their fingers. Incorporating these concerns into education and offering different options for prevention of these burns may then curb sharing.

4) Modes of content delivery need to reflect the person's background.

For example, different cultures, levels of literacy, and preferences for learning modality may affect uptake of education-

al messages in service delivery settings. Programs may need to use a variety of methods (e.g., workshops, one-on-one coaching, demonstrations, pamphlets, posters) to ensure that the educational interventions are inclusive of various client backgrounds.

5) The audience needs to be involved in the design and delivery process.

For example, conducting a needs assessment prior to the design of an intervention and obtaining feedback from service users about the utility of an educational intervention can be an effective way to ensure that the education is relevant, meaningful, and functional for the service user. Furthermore, collaborating with service users in the design of programs can be an effective means to build capacity and recognise service users' expertise.

Effective communication related to safer drug use may require more emphasis on the beneficial effects of behaviour change and stress benefits in the short term (Aggleton et al., 2005). A meta-analysis that tested the outcomes of different HIV-risk reduction strategies in 354 interventions with 99 control groups reported that interventions that explored attitudes, provided educational information, and provided behavioural skills and training were the most effective; while those that used fear-based approaches were less effective (Albarracín et al., 2005).

Safer injection education

The scientific literature contains a wide variety of studies and evaluations on HIV and HCV educational interventions for people who inject drugs. Often educational interventions consist of combinations of the following: information on HIV and/or HCV routes of transmission; HIV and/or HCV counselling and testing; information on injection-related risk behaviours and hierarchies of risk (especially needle and injection equipment sharing); information on safer injection techniques; information on safer sex practices; self-efficacy and skills-building; and peer training (e.g., how to offer supplies, advocacy). Safer injection education typically focuses on prevention of HIV, HCV, and other blood-borne pathogens; few educational interventions mentioned in the literature focus on prevention of skin, vein, and soft tissue damage. Educational interventions in the studies we reviewed made use of a variety of content delivery formats including: peer education training sessions; one-on-one counselling (with different styles, often motivational interviewing techniques); group sessions and/or discussion; written materials (e.g., pamphlets, harm reduction and other services contact information); videos; hands-on demonstrations and practice; and role-playing. Across varied evaluation study designs, educational interventions have shown to have modest effects on risk behaviours.

Provision of education need not be time-consuming or costly. An important finding from a Cochrane review (Meader et al., 2010) and from some of the studies cited below is that brief interventions are sometimes as effective as longer, more formal psychosocial interventions. Well-designed evaluation studies often compare a group that receives an educational intervention to a control group that receives no intervention or treatment as usual (typically consisting of HIV and HCV testing and basic counselling). Numerous studies have found that while new educational interventions had an impact on injection-related risk behaviours, standard or control interventions also had an impact on such behaviours. These findings underscore the need for service providers to engage, even briefly, with clients to discuss or deliver HIV and HCV education. In terms of format, education delivered through peer training may offer benefits – it encourages peers to reduce their risk behaviours and models how to pass on safer practices to others (e.g., Craine et al., 2006; Garfein et al., 2007; Weeks et al., 2009). Peers may also reach people who inject drugs in the community who may not attend harm reduction programs. In addition, involving peers can mean involving people who use drugs in the design and delivery of educational interventions which may help make such interventions more meaningful and useable for them.

In addition to formally evaluated educational interventions, there is a large grey literature that contains many types of educational materials that address a broad range of safer drug use topics. In particular, CATIE provides, free of charge, a wide array of harm reduction materials that have been reviewed for accuracy (see http://orders.catie.ca/index.php?cPath=9). However, although the quality and effectiveness of educational materials are difficult to assess, they may respond to emerging risks and/or scientifically un(der)studied risks. Given the wide variety of individual differences that programs observe with their clients every day, a "one-size-fits-all" set of guidelines on safer injecting techniques is not possible. Programs therefore face the challenges of a) determining educational services based on high-quality evidence versus addressing immediate, real-world risks where evidence may be lacking, and b) finding or developing their own safer injecting advice that best meets the needs of their diverse client base. For more detail on these issues, please refer to the last section of this chapter.

Education topics, modes of delivery, and effectiveness

There are studies that have evaluated HIV and HCV prevention interventions using a variety of methodologies. While randomized controlled trials (RCTs) are typically considered to provide the best-quality evidence (e.g., NICE, 2009), they are not commonly conducted in harm reduction research and evaluation since these designs may present unique challenges. This section will review the available evidence from RCT designs available in the literature.

The general lesson from RCTs and reviews of RCTs is that provision of HIV and HCV educational interventions to people who inject drugs leads to modest reductions in injection-related risk behaviours such as sharing and reusing needles. For example, Booth et al. (2011) reported on results from an RCT involving 632 people who inject drugs and were enrolled in eight residential detox centres in the US. Their study compared three different conditions: 1) a two-session counselling and education condition based on a manual that included HIV counselling and optional testing, rehearsal of cleaning injection equipment and condom use, basic healthcare advice, and written materials; 2) a single, approximately 45-minute session "therapeutic alliance intervention" that focused on the alliance between client and outpatient counsellor and was designed to encourage treatment entry after detoxification; and 3) treatment as usual involving referrals for HIV testing and counselling and treatment. During the second session for the counselling and education condition, participants received their test results and post-test counselling; content was varied depending on the HIV test results (e.g., discussion of partner notification and medical referral in seropositive cases). Reductions in injection risk behaviours were reported for all conditions.

In another RCT that collected data at six, eight, and twelve months from people who inject drugs in Baltimore, Tobin et al. (2011) compared an intervention focused on injection and sexual risk reduction within personal risk networks to control sessions. The intervention consisted of five group-based sessions, one individual session, and one dyad session that aimed to increase knowledge and skills on injection-related, drug-splitting, and sexual risks, and communication skills; the control involved five group-based informational sessions that addressed topics related to injection drug use (e.g., HIV testing, overdose). The intervention taught participants some safer drug-splitting techniques (e.g., needleless syringe used for splitting). At last follow up, significantly lower odds of injection-related risk behaviours were observed with the intervention condition compared to the control group.

Purcell et al. (2007b) evaluated an RCT that involved 966 HIV-positive people who inject drugs recruited from four US cities. This intervention consisted of a ten-session peer-mentoring intervention that included individual and group sessions on HIV primary care and adherence, sexual risk behaviours, and drug-related risk behaviours. Participants also engaged in one "peer volunteer activity" that involved observing and practicing peer skills at a local service agency. Risk hierarchies (which introduced sexual and injection risk behaviours in pyramids ordered from no risk to greatest risk) were presented to participants on posters and handouts. Individual risk plans were developed based on how participants identified their risk behaviours using the hierarchies, and motivation and skills for behaviour change were discussed and reinforced. An eight-session video discussion intervention served as the control. The primary injection risk outcomes were lending used syringes and sharing cottons cookers and rinse water with anyone of HIV-negative or unknown serostatus. Purcell et al. (2007b) found that injection risk behaviours decreased in both the intervention and control groups over time, and the difference in the decrease between the groups was not significant.

The DUIT study was an RCT that involved a peer education intervention (Garfein et al., 2007; Purcell et al., 2007a) consisting of six two-hour sessions that covered topics including HIV and HCV transmission, safer injection, and safer sexual practices. Formats included videos depicting people engaging in peer education and risk reduction practices, group discussion, skills-building, role-playing, and practice activities, and offering community resources and information. This intervention was compared against a video discussion intervention which comprised the same number of hours where participants watched videos on various health and social issues and engaged in post-video discussions. All injection-related outcome measures (e.g., injecting with used syringe, sharing injection equipment including cookers, filters, and rinse water) significantly decreased at follow-up compared to baseline, though decreases were also found in the group that received the video discussion intervention (Garfein et al., 2007). Reductions in sharing syringes and equipment such as cookers, cottons, and rinse water were also observed following a peer education intervention among people who inject drugs in Philadelphia and Chiang Mai, Thailand (Latkin et al., 2009). In this study, the intervention included six small group peer training sessions and two follow-up sessions at six and twelve months; injection and sexual risk "myths and facts" were presented and videos, demonstrations, posters and handouts, role-playing, pair work, and discussion were used. The intervention manual and demon-

strations included advice on cleaning needles with bleach and water. Reductions in injection-related risk behaviours were observed in both locations and both arms of the study, including a 24% reduction in using a used syringe (Latkin et al., 2009).

Systematic reviews of RCTs often involve reviewing the evidence from studies that employ a variety of intervention types. This variety can make these types of reviews difficult to conduct, but available reviews have provided valuable and fairly consistent messages. Copenhaver et al. (2006) performed a meta-analysis (a statistical method that combines the findings of different studies) of 37 RCTs that examined 49 HIV prevention intervention strategies in 10,190 participants. To be included in the review, a study had to include: an evaluation of a behavioural HIV prevention intervention; at least 50% of people who inject drugs in the sample; and drug-related outcomes (although these outcomes, among others, were more focused on reducing injection and non-injection drug use). Copenhaver et al. (2006) found that group interventions were more common (51%) than individual interventions (44%), while the remaining studies (5%) used a combination of group and individual interventions. Ninety percent of the interventions included HIV/AIDS education and 70% included drug-related and sexual risk reduction. Self-management skills (such as coping with drug cravings; 57%), drug treatment (35%), provision of bleach (35%) and condoms (35%) were also components of interventions. Modest effect sizes were observed on risk behaviour outcomes, but the authors noted that behaviour risk reduction interventions often produce small increments of change and that even modest behavioural changes in populations at higher risk can improve public health.

A Cochrane review examined "the efficacy of multi-session psychosocial interventions in comparison with standard education and minimal intervention controls for the reduction of injection and sexual risk behaviour" (Meader et al., 2010, p. 1). This review examined 35 randomized or quasi-randomized controlled trials with data on 11,867 participants (people who use opiates, cocaine, or a combination of the two, including people in and not in drug treatment). Multi-session psychosocial interventions were defined as designed for individuals or groups and having at least three sessions (resulting range was three to sixteen sessions) that involved education about HIV and skills training aimed at communication, assertiveness, sexual and injection risk behaviours. Standard educational interventions were similar to the multi-session interventions in content, but consisted of one to two sessions. Minimal intervention referred to receiving minimal (e.g., provision of information booklets) or no intervention. Meader et al. (2010) found that both multi-session psychosocial interventions and standard interventions reduced sexual and injection risk behaviours. However, there were small differences between the interventions in terms of reductions in risk behaviours which indicated that multi-session interventions were not more effective than standard services. The authors concluded that brief, standard educational interventions are likely more cost-effective and should be implemented alongside other effective interventions such as outreach programs, needle and syringe programs (NSPs), and methadone maintenance treatment). Multi-session interventions are effective too and deserving of further evaluation research where resources permit. The authors also observed from subgroup analyses that people engaged in formal drug treatment may respond well to longer interventions, though they did not define the type(s) of drug treatment included. Meader et al. (2010) did not specify the length or amount of time that would qualify an intervention as "brief". In a review of varied harm reduction interventions, Ritter and Cameron (2006) noted that, "The length of a brief intervention can range from a single 15-minute intervention to a four-session intervention" (p. 616).

Sacks-Davis et al. (2012) systematically reviewed six RCTs of peer training and counselling interventions for reducing HCV among people who inject drugs and their findings were fairly consistent with those of Meader et al.'s (2010) review of psychosocial HIV prevention interventions. Self-reported injecting risk behaviour was commonly assessed in the studies reviewed by Sacks-Davis et al. (2012) and the larger studies reported significant reductions in injection-related risk behaviours among the intervention conditions compared to controls. Two smaller trials reviewed did not find an intervention effect on injection-related risk behaviours, but did find significant reduction in risk over time in intervention and control conditions. A third smaller trial found reduced frequency of injecting over time in both intervention and control conditions, though this trial did not measure changes in injecting-related risk behaviour. Again, based on studies that have found effects from control conditions, we may consider the value in engaging in brief risk reduction discussions and basic HIV and HCV education with clients.

In terms of understanding which elements or process(es) make educational interventions effective, more research is needed. Copenhaver and Lee (2006) conducted a structural equation modelling study on theory-based interrelated causal pathways that lead to HIV risk reduction behaviours

using the Information-Motivation-Behavioural (IMB) skills model of behaviour change. As these authors discuss, this model assumes that there are three prerequisites for risk reduction behaviour: having information that is relevant to HIV prevention; motivation to reduce risk, including personal and social motivation; and behavioural skills comprised of objective skills and perceived self-efficacy. These authors found that personal motivation was positively associated with self-efficacy in drug-related HIV risk reduction which, in turn, was linked with safer injecting outcomes. They also reported that increasing knowledge and social motivation can increase personal motivation. Part of social motivation involves peer norms which may be shaped by using peers in education delivery, as a number of the studies reviewed above had done.

The above evidence comes from evaluations of some broader-focused HIV and HCV prevention interventions; evidence is less available for interventions that focus on safer injection education in the context of preventing other injection-related harms like skin, vein and soft tissue damage. In the only RCT we found on skin and needle hygiene, Phillips et al. (2012) pilot tested a 2-session intervention called "Skin" (also based on an information-motivation-behavioural framework) that tried to reduce bacterial as well as viral infections among people who inject drugs. Forty-eight people in Denver, Colorado, who inject heroin completed baseline assessments, after which they were randomly assigned to either the Skin intervention or an assessment-only condition. All participants received HIV testing and review of test results, brief counselling, and follow-up interviews at 1 and 6 months. The two Skin intervention sessions used a therapist manual and clients were provided with workbooks. During the first session, information and preventive strategies were presented on bacterial infections (e.g., skin abscesses, endocarditis) and viral infections (HIV, HCV). The interventionist assessed each participant's readiness for behaviour change, helped participants identify barriers to improving skin- and needle-related practices, and set personal goals. Step-by-step instructions were given on cleaning needles with bleach and skin cleaning, and participants were asked to demonstrate the skills. Participants were given other materials including a "hygiene kit" (bleach and water kits, cleanser for the skin, swabs, etc.) and referral information for other services including NSPs and drug treatment. Those in the Skin intervention also received a "booster session" one month after the initial session that involved review of risk reduction practices and, if needed, setting new goals. Phillips et al. (2012) found that participants in the intervention condition had significantly greater improvements in their skin-cleaning demonstration between baseline and follow-up. Various other types of studies have reported that people who inject drugs will take up improved skin-cleaning practices (Colon et al., 2009) and new types of hygiene supplies, such as post-injection pads to stanch blood flow (Grau et al., 2009), following intervention delivery. Mercure et al. (2008) noted that people who inject drugs desire more education on skin and soft tissue infections. We know, however, that more education on safer injection technique and other infections is being delivered in community settings (e.g., nurse-delivered education inside Vancouver's supervised injection facility; Wood et al., 2008) than has so far been evaluated in the literature.

It is unfortunately not always clear from the empirical literature exactly how education was delivered because details (e.g., wording and images used on pamphlets and posters) were not typically included. From discussions with a small number of clients of the supervised injection facility in Sydney, Australia, Treloar et al. (2008) reported that clients appreciate simple, attention-getting messages in educational resources. To be accessible to many clients, safer injection education materials and messages should be presented in clear and plain language and have pictures or diagrams wherever possible. Providing written material can help to ensure that people who inject drugs can look over the material if they are unsure or do not remember instructions and/or show or give the material to others. However, while written material can help reinforce instructions, not all NSP clients are able to read. For this reason, it is important for harm reduction workers to explain written material and demonstrate safer practices as needed. Video and online demonstrations can be made available to increase access to educational messages. Harm reduction workers at NSP sites and on mobile units and peer workers who distribute supplies to people who inject drugs in various community settings can be trained to deliver safer injection education, including how to give demonstrations. With data from 50 interviews with people who inject drugs who use a supervised injection facility, Fast et al. (2008) found that many acknowledged the benefits of actually being shown safer injection techniques. Many people may be more responsive to and/or require visual demonstrations over being told how to inject or being given written instructions.

Safer smoking education

While the literature shows many risks associated with smoking drugs like crack cocaine, corresponding studies of educational interventions that address these risks are lacking.

There are a few studies that have evaluated educational interventions for people who smoke crack cocaine; however, many of them are of limited utility as they also included people who inject drugs and the educational interventions focused on sexual and/or injection related risk. Furthermore, many of the educational interventions we identified were combined with other interventions such as counselling and psychosocial skills building, and studies lacked sufficient detail about the content of the intervention and/or its mode of delivery to determine what, if any, content pertained to crack cocaine smoking-related risks (e.g., burns to lips and mouth).

In Canada, the targets and content of harm reduction programming have increasingly begun to address the harms associated with smoking crack cocaine (Backé et al., 2011; Benjamin, 2011; Boyd et al., 2008; Canadian HIV/AIDS Legal Network, 2008; Haydon & Fischer, 2005; Hopkins et al., 2012; Ivsins et al., 2011; Johnson et al., 2008; Leonard et al., 2006; O'Byrne & Holmes, 2008). While programming has expanded, the scientific literature has been slow to catch up with this innovation. Therefore, there are few published evaluations of harm reduction educational programs for people who smoke crack cocaine.

The Safer Crack Use Coalition (SCUC) of Toronto began in 2000 as an alliance devoted to advocating for and addressing the needs of people who smoke crack cocaine in Toronto (Goodman, 2005). While this organization was the first in Canada devoted to people who smoke crack cocaine, to date there have been no published evaluations of their activities. The SCORE (Safer Crack Use, Outreach, Research and Education) Project from Vancouver has published a number of reports detailing education efforts for people who smoke crack cocaine (Boyd et al., 2008; Bungay et al., 2009, 2010; Johnson et al., 2008). The project included kit-building circles where women were invited to build safer crack use kits and discuss the contents of the kits and methods to distribute the kits (Bungay et al., 2009). While only women participated in the kit-making circles, the kits were distributed to both women and men in Vancouver (Bungay et al., 2009). In this project, the process of distributing the kits also included demonstrations by staff on how to insert brass screens into stems and attach mouthpieces (Johnson, et al., 2008). Information was also provided to service users about the rationale for using brass screens instead of metal wool (i.e., Brillo; Johnson et al., 2008). A qualitative evaluation of the project revealed that the kit-making circles provided many benefits for participants, including: a legal source of income, short respite from street life and sex work, mutual sharing of information and concerns about services, and a safe place to relax. Bungay et al. (2009) noted that these circles encouraged knowledge transfer that was useful to the women's lives, and recognised that the women could provide harm reduction education to one another. Tip cards included in the kits were credited by some of the participants in the project with changing their drug use habits, promoting regular use of mouthpieces and learning about health issues associated with crack cocaine smoking (Johnson et al., 2008).

In the Toronto Public Health Safer Crack Use program, outreach workers provide education on a variety of issues including strategies for maintaining safety in advance of drug consumption, such as getting clean equipment and finding safe locations to smoke crack cocaine (Hopkins et al., 2012). Included in the distributed safer crack kits are educational pamphlets with messages about "safer use and disease prevention practices" (p.28). The evaluation of this program included focus group discussions where participants stated that their knowledge about the potential risks of HCV and HIV infections through sharing pipes/stems increased as a result of the Safer Crack Use Program (Hopkins et al., 2012). However, the same evaluation also reported that many of the inserts contained in kits were usually discarded; that information was generally considered redundant and some clients "never read pamphlets" (Hopkins et al., 2012, p.28). Toronto Public Health has identified the need for all clients to receive education on how to properly use safer crack kits, and to review the educational needs of clients "relevant to their knowledge and practice of reducing risk behaviours" (Hopkins et al., 2012, p.41).

In a non-randomized study of the Risk Avoidance Partnership Project (RAP) in Hartford, Connecticut, peer outreach workers distributed "prevention materials and information" and modeled "health promotion advocacy and prevention practices among their peers" that included people who smoke crack cocaine and people who inject drugs (Weeks et al., 2009, p.273). It is unclear from the study exactly what information was contained within the prevention materials and how peer workers modeled health promotion advocacy or prevention practices. There is reference to a program-specific manual or "flip book" for peers to guide their interactions and 6 slogans that peers used in their interventions (these slogans and the contents of the field manual were not available for our review). The study evaluated the peer-delivered intervention, and specifically asked participants about behaviour changes that had occurred as a "result of talking to someone from RAP" (Weeks et al., 2009, p. 259). The researchers reported that they could "not observe,

track or document all of the interventions peer workers delivered to members of their drug-using networks" (Weeks et al, 2009, p.259); however, the peer-delivered HIV prevention program for people who inject drugs and people who smoke crack cocaine significantly increased use of rubber mouthpieces (from 23.0% at baseline, to 71.1% after 6 months, p 0.009; Weeks et al., 2009). This intervention was also successful at decreasing sexual risks such as trading sex for money or drugs (Weeks et al., 2009).

Cottler et al. (1998) conducted an RCT with 1,434 non-injecting people who smoke crack cocaine and examined a standard National Institutes of Drug Abuse (NIDA) intervention versus an enhanced intervention to reduce HIV/AIDS risk across five U.S. sites. Each site developed a unique intervention. For example, the enhanced intervention utilised in St. Louis, Missouri, was delivered by peers and included four two-hour sessions on stress management, drug awareness, HIV/AIDS (which was led by Public Health Department staff) and how to reduce sexual risk behaviours. HIV knowledge review sessions were included at the beginning of each session and were followed by peer-led education sessions. This site also provided meals, transportation and babysitting to increase participation. The overall study sample consisted of people who had never injected or reported not injecting in the 12 months at baseline; participants were followed up at 3 months. The sample was recruited at five different sites: Kentucky (Lexington and Louisville) - The Prevention Education on AIDS in Kentucky Project (PEAK); Missouri (St. Louis) – the EachOneTeachOne Project; North Carolina (Durham/Wake Counties); Washington D.C. – Project NIA (Neighbourhoods in Action); and Texas (San Antonio) – Community Outreach Prevention of AIDS (COPA). Each site had two intervention groups, of which one received the standard intervention. The enhanced interventions were unique to each site. This study analysed three behaviours that were deemed to be risky: frequency of crack cocaine use, number of sexual partners, and condom use. Level of risk associated with crack cocaine use was evaluated by the frequency of crack cocaine use in the past 30 days. Approximately 75% of participants from both groups reported decreases in the number of sexual partners. Cottler et al. (1998) noted that individuals who received the enhanced intervention also significantly maintained low levels or reduced crack cocaine use when compared to the standard intervention group (85% versus 77%, $p<0.001$).

The evidence base for educational interventions for people who smoke crack cocaine is small but growing. There is a clear need for more evaluations detailing the specifics of education provision for people who smoke crack cocaine. Currently, evaluation of different modes of educational delivery and content is limited; therefore, specific recommendations cannot be made.

Potential limitations of evidence base (design, availability, samples)

For a variety of reasons, it is challenging to evaluate harm reduction educational initiatives. Many different harm reduction programs have developed and piloted unique educational interventions to help their clients better understand and learn how to reduce injection-related risk. Due to the variety of possible educational interventions and the need to tailor interventions to local drug-use settings, it is hard to determine what a standard educational intervention should include. Randomly assigning people who inject drugs to different harm reduction interventions and/or control groups – important study-quality criteria in most health-related research – may not always be feasible or ethical (especially where HIV-prevention information is involved). Non-random selection can result in some people who use drugs having a greater or lesser chance of being included in a study and this can bias or skew the sample, therefore potentially reducing the quality of the scientific evidence. Caution is needed when extrapolating evidence from studies that involved people engaged in drug treatment programs. These participants may have different characteristics from people who inject drugs who are not in treatment – especially marginalised, street-based users who are not accessing programs. We also know that people who use drugs have a high rate of attrition (e.g., dropout) from treatment interventions (Amato et al., 2011; Anglin et al., 1997; Gossop et al., 1999; Knapp et al., 2008). In addition to the differences between types of participants, there may be differences between drug treatment settings and harm reduction programs in terms of resources, staff, and other features that influence education delivery and uptake.

When looking at the results of an educational intervention, it is important to consider outcome criteria and timeframes. For example, if an educational intervention involved teaching people how to avoid HIV transmission by never using or lending used injection equipment, an appropriate measure of effectiveness may include self-reported sharing of injection equipment pre- and post-intervention. Ideally, outcomes should be measured over time with the same participants to determine if these individuals adopted safer practices in the short, medium, and longer terms. Some outcomes and timeframes may be more appropriate than others for cer-

tain harm reduction settings. While reducing the frequency of drug use can serve as an indicator of success, this outcome may not be a desirable or realistic goal for many clients of harm reduction programs. Risk-reducing behaviours in the short term are important and should be measured. Achieving long-term change may depend on delivering educational interventions or reminders more than once or on a recurring basis. Achieving long-term change may also depend on addressing other individual, social, and structural issues that perpetuate risk behaviours (e.g., Rhodes, 2002, 2009). Broader social and legal contexts, including NSP accessibility, matter too. Some educational interventions that have been studied involved showing people how to clean needles and injection equipment with bleach (Booth et al., 2011; Latkin et al., 2009; Phillips et al., 2012). Based on our review of the evidence related to needles, we do not endorse cleaning with bleach as a best practice measure. We acknowledge that in some places access to adequate supplies of needles may be restricted, resulting in programs offering educational services that may not be best practice but that try to offer options under such local constraints.

While many studies employ self-reported data to measure outcomes, self-reported data has limitations (e.g., socially desirable responding, difficulty recalling behaviours) and should be complemented with additional, objective measures (e.g., lab tests of used injection equipment, HIV and HCV testing) that can help verify reduction of risk behaviours wherever possible. Nonetheless, self-reported data on drug use are generally reliable and provide valuable information (Darke, 1998). Further, researchers may often be logistically and/or financially limited when it comes to gathering data in other or multiple ways.

Other educational material and challenges for programs

There is a vast grey literature that includes online reports, policies, program descriptions, tip sheets, drug use "recipe cards", and many other materials that address a broad range of safer drug use education topics. Some of these educational materials were developed by people who use drugs and may reflect many years of personal experience. Typically, evaluation data are not available and insufficient information is provided on which to assess the quality of this type of educational material. Thus, it is difficult to assess the quality and effectiveness of many educational interventions currently offered in communities. However, educational material found in the grey literature may reflect important responses to emerging risks and/or risks that have been ignored by scientific evaluation. A key challenge for programs will be to determine a balance between programming based on the highest-quality evidence versus addressing immediate, real-world risks for which evidence is lacking.

Furthermore, harm reduction programs across Canada respond to regional and local variation in the populations they serve, as well as individuals with unique personal needs. That is, clients display a wide range of individual differences including age, gender, experience with injecting and/or smoking drugs, health complications (including serostatus, extent of vein damage), mental health considerations, housing status, and many others. Given these individual differences, a "one-size-fits-all" set of safer drug use education guidelines is not possible. Although programs may desire such guidelines for teaching the finer details of safer drug use technique (e.g., how to find a vein), programs may need to find or develop their own safer drug use education from the wide array of grey literature material that best suits the complex and unique characteristics of their clients.

Safer drug use education evidence summary

In contrast to the chapters on harm reduction equipment distribution, the evidence that informs this chapter and its recommendations came mostly from evaluation studies and reviews of evaluation studies. Randomized controlled trials (RCTs) and systematic reviews of RCTs have contributed broad overviews of educational interventions and their efficacy at reducing risk behaviours that can lead to HIV and HCV transmission and other health-related harms. RCTs are generally considered to provide the highest quality evidence for evaluating health interventions, though it has been noted in this document that it is not always feasible or ethical to conduct RCTs with harm reduction programs and the populations they serve. Mixed evaluation (primarily outcome oriented) studies involving varied methodologies have added further information about educational interventions that could be worth piloting elsewhere. Additional qualitative work on safer drug use educational interventions could deepen our understanding of client learning processes, as well as acceptability and accessibility of interventions for clients. There is also a wide range of educational materials in the grey literature, but as noted these materials were not reviewed as they are constantly evolving to suit emerging practice needs and we are unable to assess their quality in most instances.

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11 Opioid overdose prevention: education and naloxone distribution

RECOMMENDED BEST PRACTICE POLICIES to facilitate knowledge and application of opioid overdose prevention strategies, and how to appropriately respond in the event of an overdose (including the use of naloxone if available)

- **Educate clients about opioid overdose prevention techniques**
- **Educate clients about the signs and symptoms of opioid overdose**
- **Provide first aid and CPR training to clients**
- **Educate clients about how to respond to an opioid overdose including calling 911**
- **Assess feasibility and acceptability of a naloxone distribution program**
- **Partner with multiple community stakeholders to prevent mortality from opioid overdose**
- **Where naloxone is available, ensure eligible and at risk clients are trained on appropriate use of naloxone and offer kits and training in a variety of locations. Evaluate opioid overdose prevention and response interventions to ensure desired impact and to build evidence**

Description of overdose prevention and response training with naloxone

Programs that teach people who use opioids how to avoid overdose events, and how to respond appropriately to an experienced or witnessed overdose are emerging worldwide. Naloxone is a fast acting, safe, and effective opioid reversal agent that is used routinely in hospital and pre-hospital settings. According to the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, naloxone is recommended for a patient "with known or suspected opioid overdose with respiratory depression who is not in cardiac arrest" (Vanden Hoek et al., 2010). This drug is also available as a Schedule F prescription medication in Canada, although it is not stocked in outpatient pharmacies on a routine basis.

Programs that train clients to respond to overdose events and distribute naloxone are based on the premise that overdoses are often witnessed by others who could respond with life-saving measures prior to the arrival of emergency medical services (EMS). This intervention has the potential to decrease mortality and morbidity (e.g., anoxic brain injury) from overdose.

These programs typically offer a training session on preventing overdoses, recognizing overdose emergencies, recommended bystander first response techniques, and administering naloxone. Naloxone is dispensed under the authority of a prescribing physician Individuals with a naloxone supply are encouraged to respond to overdoses using the skills learned in the training session, and to call 911. They are asked to report overdose incidents to the program and obtain a refill of naloxone as needed. Some programs also train friends, family, agency workers or others who may witness an overdose to recognize and respond in an emergency, without necessarily providing a naloxone prescription directly to these individuals.

Epidemiology of Overdose

Overdose is the most common cause of death among heroin and opioid users worldwide, and it is increasing (Degenhardt et al., 2011). Since 1991, Ontario has seen a dramatic increase in prescription opioid use and opioid-related deaths have doubled in the province (Dhalla et al., 2009; Gomes et al., 2011a; Gomes et al. 2011b). Toronto's data mirrors a global trend of escalating drug-related mortality since 1990 (National Institute on Drug Abuse, 2009; Centers for Disease Control and Prevention, 2010).

Available Canadian data show geographical and temporal changes in drug-related deaths, including a study of

drug-related overdose deaths among coroners' data in British Columbia and Ontario from 1992 to 2004 (Fischer et al., 2006). This study found that the rate of deaths per 100,000 people in Toronto were similar to the overall Ontario rates, and were relatively stable over time (Fischer et al., 2006). The death rates in Toronto were lower than those in Vancouver. Vancouver's rates were much higher than the provincial total but the ratio was decreasing over time (the OD ratio between Vancouver and BC overall has been reduced from 4:1 to 2:1) (Fischer et al., 2006).

See Figure 1 below from Fischer et al 2006 (Fischer et al., 2006):

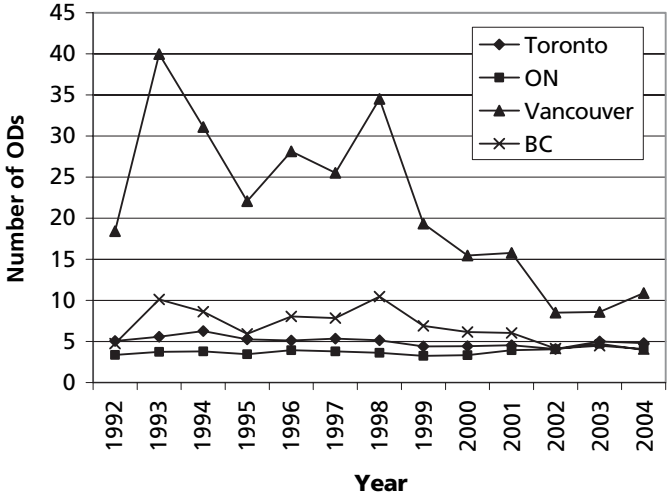

Figure 1. Number of drug-related overdose deaths (ODs) per 100,000 in the City of Toronto, the Province of Ontario (ON), the City of Vancouver, and the Province of British Columbia (BC), 1992-2004

1. OD figures are based on data from provincial coroners' offices; population numbers are based on data from Statistics Canada.
2. Numbers for ODs in Toronto and Vancouver are included in Ontario and British Columbia figures, respectively.
3. OD numbers for Toronto and Ontario in 2003 and 2004 are preliminary.

In British Columbia, hospitalizations related to illicit drugs increased between 2002 and 2009, from 6.3 in 2002 to 8.4 per 100,000 in 2009 (Vallance et al., 2012). Rates of overdose deaths were stable between 2004 and 2010, and were estimated at 4.79 deaths per 100,000 in 2010. Emergency room visits related to illicit drugs represented approximately 2.5 of every 1000 visits. Surveys estimated that approximately 50 to 60% of non-fatal overdoses were associated with multiple substances (Vallance et al., 2012).

Further, another study found 60% of drug deaths identified by the coroner in British Columbia involved opioids (excluding methadone) (Buxton et al., 2009).

Risk Factors for Overdose

In the literature, several risk factors for opioid overdose are identified, including:

- Known or suspected prescription opioid dependence or heroin use (Degenhardt et al., 2011)
- History of emergency care for opioid overdose (Stoove et al., 2009)
- Opioid use with known or suspected use of alcohol or benzodiazepines, or other drugs known to increase overdose risk (Chan et al., 2006; Drug Abuse Warning Network, 2004)
- Upon release from prison, among those with history of opioid dependence (Binswanger et al., 2007)
- Upon discharge from a treatment program for opioid dependence (Davoli et al., 2007)
- Enrollment in opioid dependence treatment with methadone during specific times such as induction or discharge (Caplehorn, 1998; Woody et al., 2007)
- High doses of prescribed opioids (Gomes et al., 2011a)

Availability of community-based naloxone in Canada and abroad

As a harm reduction strategy, the first take-home naloxone distribution programs worldwide began in the late 1990s to prevent overdose deaths among opioid users (Dettmer et al., 2001). Over 180 overdose prevention and response programs involving naloxone dispensing have been reported in the United States, with over 53,032 participants and 10,171 uses of naloxone reported between 1996 and 2010 (Centers for Disease Control and Prevention, 2010). Additionally, the American Medical Association (AMA) adopted a resolution supporting naloxone programs at its 2012 Annual General Meeting, whereby the AMA "urges that community-based programs offering naloxone and other opioid overdose prevention services continue to be implemented in order to further develop best practices in this area" and "encourages the education of health care workers and opioid users about the use of naloxone in preventing opioid overdose fatalities" (http://www.ama-assn.org/assets/meeting/2012a/a12-resolutions.pdf).

A few emerging naloxone programs exist in Canada, and several others operate throughout Europe, the United Kingdom, and Australia. Most naloxone programs exist in harm reduction settings, but others operate in re-entry programs (after incarceration), pain management clinics, treatment programs, local drug services, outreach efforts (e.g., single room occupancy hotels, private homes, street corners), homeless shelters, and physician offices (Dettmer et al., 2001; Albert et al., 2011; Bennett et al., 2011; Bennett et al., 2012; Doe-Simkins et al., 2009; Dong et al., 2012; Enteen et al., 2010; Galea et al., 2006; Green et al., 2008; Gaston et al., 2009; Lankenau et al., 2012; Maxwell et al., 2006; McAuley et al., 2010; Piper et al., 2008; Ross, 2010; Seal et al., 2005; Sherman et al., 2009; Strang et al., 2008; Tobin et al., 2009; Wagner et al., 2010; Yokell et al.; 2011).

To our knowledge, the Canadian experience with distributing take-home naloxone currently includes the following:

Provincial

Province	Program	Operator	Start Date	Details:
British Columbia	Toward The Heart	British Columbia Centre for Disease Control, Harm Reduction Program	August 31, 2012	http://towardtheheart.com/
Ontario	Opioid Overdose Prevention Program	Ontario Harm Reduction Distribution Program	March 2012	http://www.ohrdp.ca/

Local

Municipality	Program	Operator	Start Date	Details:
Edmonton	Community Based Naloxone Overdose Prevention Program	Streetworks	October 2005	http://www.streetworks.ca/
Toronto	Prevent Overdose In Toronto (POINT)	Toronto Public Health – The Works	August 31, 2011	http://www.toronto.ca/health/sexual-health/sh_the_works.htm
Ottawa	Peer Overdose Prevention Program (POPP)	Ottawa Public Health	August 31, 2012	Contact Ottawa Public Health or Sandy Hill Community Health Centre
Thunder Bay	Overdose Prevention Program	Northwestern Health Unit	March 2013	Contact NWHU

In Canada, Naloxone is a Prescription Only Medicine (POM) under Schedule F of the Food and Drug Regulations for Canada's Food and Drug Act. In community-based naloxone programs, it is prescribed by doctors to named patients who are deemed to be at risk of opioid overdose.

Currently in Canada, programs that are interested in implementing a take-home naloxone program must ensure that they have a physician who will either 1) assess and prescribe naloxone to people who are deemed to be at risk of opioid overdose; or 2) delegate the authority to other properly trained staff. A variety of models can be used, including through physicians at public health units, methadone maintenance programs, community health centres, family health teams or prison physicians. The physician must ensure that if the action of prescribing and dispensing is delegated, that staff are properly trained. Take-home naloxone programs will then educate eligible individuals about overdose prevention strategies and how to administer naloxone in an opioid overdose situation.

Some jurisdictions in the United States, such as Washington State, have passed Good Samaritan laws that "provide immunity from prosecution for drug possession charges to overdose victims and bystanders who seek aid in an overdose event" (Banta-Green et al., 2011). An evaluation following the passing of this law in Washington State found that arrests rarely occurred before and after its implementation, but that drug users commonly feared arrest. After the law passed, drug users surveyed stated they would be more likely to call 911 (Banta-Green et al., 2011).

Community-Based Naloxone: Evidence of Effectiveness

As this intervention is still increasing in its implementation, the literature on its effectiveness is still emerging and somewhat limited to date. This section first discusses previous review articles focused on the effectiveness of community-based naloxone, and a mathematical model of mortality and cost-effectiveness. Next, we present our own systematic review on the effectiveness of this intervention, which updates previous syntheses of the literature and improves on the methods of previous reviews. We aimed to thoroughly discuss what is currently known about the intervention's effectiveness and highlight areas for future research.

Previous reviews of community-based naloxone effectiveness

An early systematic review (Oldham et al., 2003) published in 2003 (literature to 2002) found 11 articles in peer-reviewed journals on the topic of naloxone for heroin overdose. The majority of these articles did not report on experience with the use of take-home naloxone among opioid users. Only one published case series from the UK (Dettmer et al., 2001) and two other early reports from the United States were available at the time (see Huang, 2002 and Bigg, 2002 within Oldham, 2003). A 1995 discussion paper commented on naloxone over-the-counter availability in Italy (Lenton et al., 2000). The review authors suggest further research into the effectiveness of this intervention is imperative.

A 2008 review based on three articles (Barrie, 2008) concluded there was a lack of evidence on naloxone for personal use, and that "careful evaluation of local circumstances is necessary when considering this option" (Barrie, 2008). Another, more comprehensive review based on 12 studies reported that evidence for community-based naloxone was based on poor quality studies that typically did not use a comparison group to allow estimation of effectiveness (Evans et al., 2010; Snooks et al., 2011).

Modeling of community-based naloxone cost-effectiveness

A recent study used mathematical modeling to estimate the effectiveness (mortality and cost-effectiveness) of naloxone distribution programs (Coffin et al., 2013). Parameters used for both models were found using a literature search and sources from conference abstract books, online searches, and prior knowledge. An economic analysis was used to determine the cost effectiveness of naloxone distribution programs. The traditional standard for cost-effectiveness is an incremental cost of less than $50,000 per quality-adjusted life-year (QALY). The authors took a conservative approach in the analysis and included cost to society related to illicit drug use in their analysis.

This model estimated that naloxone distribution would prevent 6% of overdose deaths, with approximately 1 death prevented for every 277 naloxone kits distributed. The authors also estimated that naloxone distribution was cost-effective (Coffin et al., 2013). This is the first comprehensive cost analysis of naloxone distribution programs. The model accounted for the wide range of naloxone programs available, and conducted sensitivity and probability analysis to validate the findings. Some parameters had high degrees of uncertainty; however, the authors suggest their results can aid in efforts to predict the effect of naloxone distribution.

Systematic review of community based naloxone programs

For this chapter, we completed a systematic review, using rigorous methods to identify and summarize the most up to date evidence. Using standard search, extraction and assessment methods, we identified 22 studies from 1996 to September 2012 that met criteria for full text-review. We also included two new studies published after our initial search, and an unpublished program evaluation. In total, we summarize the evidence from 25 articles.

Existing studies report findings from programs located in the United States (18 reports of programs in 9 regions), in the United Kingdom/Europe (6 reports of 7 programs), and 1 in Canada. Study designs included case studies, evaluations, cohorts, cross-sectional studies, retrospective data analysis, and qualitative studies. The longest time a program was operational was 6 years, and it served 1,942 clients (Enteen et al., 2010). Nine studies followed clients prospectively for up to 12 months (n=19 to 250); however, follow-up was poor with 4 studies retaining no more than 50% of participants at the end of the follow-up period. Most other studies used passive reporting of client outcomes only, whereby the programs relied on clients to return and report to them, rather than actively trying to contact clients. Two studies involved a comparison group, which consisted of people who use opioids but were not trained in a naloxone program (Bennett et al., 2012; Green et al., 2008).

One study conducted an analysis of annual opioid related rates of overdose fatalities and acute care hospital visits using available records, comparing communities and years where naloxone programs were implemented with those where it was not (Walley et al., 2013).

In the studies, training sessions ranged from 10 minutes to 8 hours (four two-hour sessions). Few details were provided regarding whether the training programs were offered in individual or group formats, or both. Most programs reported teaching some form of basic life-support in addition to naloxone use. Most taught rescue breathing (typically programs in the United States), while others reported rescue breathing plus CPR or the option to learn CPR along with rescue breathing, CPR/First Aid, or basic life support.

In most programs, the naloxone prescriber was a physician. However, it was prescribed under a Patient Group Direction (PGD) in some programs in the United Kingdom, a means of providing prescription-only medication to a group of people without individual prescriptions. Naloxone was dispensed in ampoules, prefilled intramuscular syringes and 10mL vials. One study reported dispensing naloxone in a prefilled intranasal format (Doe-Simkins et al., 2009). Physicians, other medical providers, program or research staff, or pharmacists dispensed the naloxone. Doses ranged from 0.4ug to 4mg (possible reporting errors) but most used 0.4mg intramuscular, and one used 2 mg intranasal (Doe-Simkins et al., 2009).

Outcome data from these studies show that between 8 and 100% of program participants had witnessed an overdose after the naloxone training program. Across six studies, up to 21% of participants reported experiencing an overdose themselves since training (Enteen et al., 2010). One study found a difference between the study and comparison groups, whereby no overdoses were experienced in the trained group, and 11/50 participants in the comparison group experienced overdoses (Bennett et al., 2012). Four studies did not report the number of witnessed overdoses after the training program.

Across the studies, after receiving training, a wide range from 2 to 399 participants reported using naloxone in an opioid overdose, depending on the size of the program, which corresponded to naloxone use ranging from once for ever 1.5 to 24 people trained. For reported witnessed overdoses, naloxone was used for 43 to 100% of opioid overdose cases; this wide range in estimated use may be attributable to how data were collected and reported. Some studies reported naloxone was used more often in private locations rather than in public. There were 27%-100% of participants who retained their naloxone either with them or where they normally used drugs.

Among trained participants in the studies, reported inappropriate uses of naloxone included administering naloxone intravenously, in the abdomen, or without the intranasal atomizer. Other inappropriate responses among trained individuals to observed overdoses included applying ice or water, or eliciting pain (slapping, etc.). Reports of using other drugs to assist with an overdose decreased after receiving naloxone training.

Only one new study directly investigated effectiveness of community-based intranasal naloxone to prevent naloxone deaths (Walley et al., 2013). This study found opioid related death rates were reduced in communities that implemented naloxone distribution compared to those without. Two other studies anecdotally reported a drop in deaths in the region after implementation of the program (one was part of a comprehensive community overdose initiative) (Albert et al., 2011; Maxwell et al., 2005).

Eight studies reported that knowledge, confidence, and willingness to intervene in an overdose improved after training (Bennett et al., 2012; Green et al., 2008; Gaston et al., 2009; McAuley et al., 2010; Seal et al., 2005; Strang et al., 2008; Tobin et al., 2009; Wagner et al., 2010). Trained individuals were better able to recognize an overdose when compared to untrained individuals (Green et al., 2008), and participants retained knowledge and confidence over time (Gaston et al., 2009; Strang et al., 2008).

After the training, between 10 and 100% of participants in the studies called for emergency medical services when witnessing an overdose incident. Studies comparing the frequency of calling 911 (or willingness to call) before and after naloxone training show mixed results: four studies found a decrease, while two reported an increase. Clients' fear of police was commonly reported among barriers to calling for assistance.

The proportion of study participants who reported performing rescue breathing or CPR ranged from 22% to 100% of overdose events (Gaston et al., 2009; McAuley et al., 2010). An increase in the use or willingness to use rescue breathing/CPR in witnessed overdoses after training was reported by two studies, but still used by fewer than 30% of respondents (Galea et al., 2006; Tobin et al., 2009). Bennett and colleagues found those trained to use naloxone were less likely to use rescue breathing/CPR than a comparison group (Bennett et al., 2012).

Reports of adverse events associated with naloxone administration included withdrawal symptoms (3 to 34%, 3 studies) (Dettmer et al., 2001; Doe-Simkins et al., 2009; Enteen et al., 2010), seizure (0 to 1%, 3 studies) (Dettmer et al., 2001; Enteen et al., 2010; Maxwell et al., 2006), vomiting (0 to 13%, 4 studies) (Dettmer et al., 2001; Enteen et al., 2010; Maxwell et al., 2006; Wagner et al., 2010), victim was angry or dissatisfied (0 to 40%, 4 studies) (Dettmer et al., 2001; Doe-Simkins et al., 2009; Strang et al., 2008; Wagner et al., 2010), negative interaction with EMS or police (3 to 20%, 5 studies) (Enteen et al., 2010; Galea et al., 2006; Piper et al., 2008; Seal et al., 2005; Wagner et al., 2010), arrests (0 to 9%, 5 studies) (Doe-Simkins et al., 2009; Enteen et al., 2010; Seal et al., 2005; Tobin et al., 2009; Wagner et al., 2010), and death (0 to 11%, 15 studies) (Dettmer et al., 2001; Bennett et al., 2011; Doe-Simkins et al., 2009; Dong et al., 2012; Enteen et al., 2010; Galea et al., 2006; Gaston et al., 2009; Lankenau et al., 2012; Maxwell et al., 2006; McAuley et al., 2010; Piper et al., 2008; Ross, 2010; Sherman et al., 2009; Strang et al., 2008; Wagner et al., 2010). One study reported that when a death occurred, EMS was called over 30 minutes after naloxone was used (Ross, 2010). Some participants reported difficulty connecting the intranasal atomizer (Doe-Simkins et al., 2009). Several programs reported difficulty obtaining a naloxone supply (Centers for Disease Control and Prevention, 2010).

Four studies found evidence of decreased drug use after training (Dong et al., 2012; Seal et al., 2005; Tobin et al., 2009; Wagner et al., 2010). Dettmer and colleagues noted "more risky consumption as a result of the availability of naloxone was not reported" (Dettmer et al., 2001). Across the studies, there were no reports of increased risky drug use behaviours.

Among participants needing a naloxone refill, reasons other than replacing a dose administered during an overdose, included: dose was lost, stolen or confiscated. In the study by Tobin and colleagues, where 10mL re-usable vials were dispensed, 3 participants obtained a refill because their vial was contaminated (Tobin et al., 2009).

As well as quantitative studies, others reported qualitative data about clients' experience with the naloxone training programs (Sherman et al., 2009; Sherman et al., 2008; Worthington et al., 2006). After the training, some participants reported still being afraid to use naloxone. Fear and worry about being too intoxicated to use it reduced their confidence in their ability to use naloxone as trained. However, other participants in these studies reported naloxone gave them a feeling of security that they could help a friend, and some stated they were more comfortable with being able to use naloxone after using it once. Although trained not to do so, many participants reported using inappropriate actions such as applying water or ice, or hitting the person in response to an overdose. Participants expressed a fear of inducing withdrawal if they gave naloxone to someone, especially if they themselves had received naloxone from emergency medical personnel in the past. Although the training programs recommended that no other drugs be used to respond to an overdose, some participants still expressed a desire to give more opioids after using naloxone. Participants in these studies also reported a fear of police attending 911 calls and a fear of arrest. However, Sherman and colleagues (Sherman et al., 2009) noted that approximately half of participants reported having a positive interaction with emergency responders and some expressed a desire for training on how to communicate with police (Worthington et al., 2006). Although few participants reported having conversations about overdose outside of

the training programs, several said that they taught others how to use naloxone. Some participants also said that they used the training information to create "house rules" about using opioids to help reduce overdoses. Many participants referred others for training, and felt pride in learning overdose response.

Limitations of the community-based naloxone evidence base

Our review agrees with previous reviews that the evidence on the effectiveness of community-based naloxone training programs remains limited. Most studies have small sample sizes, do not actively collect follow-up data after the training programs, and do not include a comparison group. Specific assessment of training effectiveness, morbidity and mortality outcomes is limited. Comparison across the studies is challenging because there is great variation in the metrics used to evaluate the interventions. Furthermore, studies dispensed naloxone in different formats, complicating efforts to understand if a particular format may have different and more beneficial outcomes than another. However, one randomized trial that compared time to response among pre-hospital overdose patients to intranasal or intramuscular naloxone found no difference between groups (Kerr et al., 2009). Further study is needed to determine the most appropriate and beneficial dose, route, and format for dispensing naloxone. Nevertheless, existing data do suggest that clients would likely benefit from access to easier-to-use devices for administering naloxone.

Most of the studies reported in the literature were conducted within a harm reduction setting; however, the transferability of the results to other settings (e.g., prisons, emergency departments, addictions medicine, and primary care) is unclear. Although the implementation issues may vary, it would likely be important to evaluate relevant training programs in additional settings to determine the potential to reduce opioid-related morbidity and mortality.

There is evidence that training improves self-reported knowledge, confidence, and willingness to intervene in an overdose. However, these studies did not use validated tools, and did not verify that these improved measures are related to improvement in actual performance during an overdose. The available studies largely did not measure the diffusion of awareness about opioid overdose prevention, which may support a broader overdose prevention strategy in reducing morbidity and mortality from overdose.

Across the studies, there was variation in emergency response maneuvers taught. Most studies reported the training programs focused on teaching rescue breathing rather than chest compressions. However, the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care do not specifically address bystander response to opioid overdose with or without naloxone.

The current basic life support (BLS) guidelines recommend that lay rescuers assume a cardiac arrest if an unresponsive person is not breathing normally, and begin chest compressions. If adequately trained, it is also recommended that a lay responder administer both chest compressions and rescue breaths in the case of drug overdose (Berg et al., 2010). Programs that do not teach chest compression may not equip clients to respond appropriately to unresponsive victims during overdose emergencies (or otherwise).

AHA guidelines do recommend naloxone administration along with ventilation only for patients not in cardiac arrest, in a setting attended by a health care provider where bag mask or advanced airway is available (Vanden Hoek et al., 2010). However, this recommendation assumes the provider is a healthcare professional who can reliably assess patients for a pulse within 10 second and provide reliable means of ventilation with naloxone administration. The role of naloxone in a community-based setting needs to be clarified for lay bystanders.

The administration of training to use naloxone varies in length and resources needed to deliver the training. In the general literature on basic life support, brief videos were found to result in superior performance compared to traditional classroom teaching (Todd et al, 1998; Braslow et al., 1997). Additionally, outcomes of training should be evaluated with valid and reliable measures, similar to other research on basic life support (Brennan et al., 1996). Innovation and research related to teaching methods can help improve access to overdose response training programs and knowledge of their effectiveness in the future.

Overall, further studies are needed to address the practice of administering a community-based naloxone program, as well as the effectiveness of this intervention on actions at the event of an overdose, drug use behaviour, morbidity, mortality and cost. It is encouraging that the first randomized controlled trial on the distribution of naloxone to drug users is now underway - the N-ALIVE trial (King's College London, http://www.kcl.ac.uk/iop/depts/addictions/research/

drugs/N-ALIVE.aspx). This study will enroll individuals upon release from prison and will measure deaths related to heroin use – the pilot study will recruit 5,600 participants, and the larger trial will enroll 56,000. It is imperative that funding be allocated to support research and evaluation alongside new and existing naloxone programs. Increased investment in more rigorous studies will help to determine the effectiveness of community-based naloxone programs, and support the establishment or continuation of effective overdose prevention interventions.

Opioid overdose response with naloxone evidence summary

The evidence that informs this chapter and its recommendations came mostly from evaluation, cross-sectional, and cohort studies. Additionally, some qualitative studies, review articles, and one study involving mathematical modelling and cost-effectiveness were used. There are no results yet available from randomised controlled trials (RCTs) on the effectiveness of this intervention. Although the existing evidence is promising, larger, more rigorous studies about opioid overdose prevention and response interventions, including naloxone distribution, are needed. Additional qualitative work on bystander overdose resuscitation interventions could improve our understanding of client acceptability and accessibility of interventions. There is also a wide range of community-based naloxone materials in the grey literature, but these materials were not reviewed as they are variable based on local program decision and we are unable to assess their effectiveness in most instances.

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Appendix A – Methods: Overview of Research Evidence Review and Synthesis

Reviews and syntheses of scientific evidence about public health interventions are complex because these interventions are comprised of multiple components (e.g., information, education, building and mastery of skills) and the types and quality of available scientific evidence are varied (Centre for Reviews and Dissemination, 2008; Jackson & Waters, 2005; Pawson et al., 2005). For most of the chapters in this document, we used a narrative synthesis method. Narrative synthesis is well suited to the complexity and multi-component character of harm reduction programs that deliver a range of services to people who use drugs and are at risk for HIV, HCV, and other harms. This synthesis approach combines systematic collection, quality assessment, and synthesis of multiple types of studies and research evidence – experiments, observational studies, and qualitative studies – using rigorous and reproducible methods. We followed a system similar to the seven steps of narrative synthesis set out by Popay et al., 2006:

1. Identifying the review focus, then searching for and mapping the available evidence (i.e., describing the types of interventions, study designs, and volume of literature)
2. Developing a "theory" or explanation of how the intervention/activity works to produce the desired effect
3. Specifying a scientific evidence review question including population, interventions, and outcomes
4. Identifying studies to include in the review
5. Extracting evidence and appraising its quality
6. Synthesising the evidence across studies
7. Reporting the results of the review

We designed our research project to have a series of overlapping and iterative activities including evidence identification, extraction, review and synthesis, and development of best practice recommendations. Over the course of the project, we held regular teleconference meetings to achieve team consensus on all activities and outcomes.

Review of existing best practice documents

Existing best practice recommendation documents from British Columbia (BCCDC, 2008; Kerr & Wood, 2007), Ontario (Strike et al., 2006), Scotland (Scott, 2008), the United States (NYC Department of Health and Mental Hygiene, 2009), England (National Institute for Health and Clinical Excellence, 2009b), and emerging economies (Burrows, 2006) were reviewed by our team to identify strengths, content that needed to be updated, and content that needed to be expanded in light of changes in practice and/or new scientific evidence. The goal of these early team meetings was to respond to the following:

- What are the strengths in each document and what should be retained and/or integrated into the new best practice recommendations?
- What evidence, recommendations, or other area(s) need to be updated?
- In light of changes in drug use patterns, practices, and/or new scientific evidence, what needs to be added to the best practice recommendations?
- Define how a given component of a harm reduction program contributes to reduced transmission of HIV and other sexually transmitted and blood-borne infections or enhances the social determinants of health (i.e., write the theory/explanation statement).
- Identify any changes to patterns of drug use and related risks that may have created new needs not currently addressed by the existing best practice documents and determine if completely new content sections are needed.

Development of a table of contents and work plan

After reviewing each content area from the existing best practice documents, our team used a consensus decision-making approach to develop a table of contents that listed all core areas of practice to be included in the new best practice recommendations. We then developed a formal research proposal and work plan to complete the necessary reviews, literature syntheses, and integrate the evidence into the best practice recommendations.

Identification and extraction of research evidence related to each core area of practice

Searches of Medline, Embase, PsycINFO, Sociological Abstracts, CINAHL, and Scopus were performed for each content area. The databases were searched from 2006 onwards. This year corresponds to the oldest set of best practice recommendations in Canada (i.e., Ontario best practice recommendations for needle and syringe programs).

Eligibility criteria for documents to be considered for the review included: (a) subject relevant to the content area; (b) published in English or French; and (c) reported results that are relevant to the context of the Canadian public health system. The reference lists of eligible articles were reviewed by hand to identify any other articles that may have met the inclusion criteria. For articles that did not meet inclusion criteria for a given content area, we reassessed their appropriateness for other content areas. If deemed potentially appropriate, these articles were retained for the review(s) in the other content areas. All remaining articles were discarded. We also supplemented this material with unpublished program evaluations from Canada and other grey literature.

Assessment of the quality of selected studies and evidence synthesis

In keeping with our goal to provide guidance best fitted to the Canadian context (while recognising variation across provinces and territories), we adapted an approach to evidence appraisal based on NICE (2009a) methods that matched the scope of this project. After extracting the articles that were relevant, we assessed the quality of the studies and the level of evidence (e.g., randomized controlled trials, cross-sectional studies) outlined in the NICE methods. Based on the types of studies included and any patterns observed (e.g., evidence of injection risk behaviours typically comes from prospective cohort and cross-sectional studies), a summary of the quality of the evidence was prepared for each main chapter. Summary boxes were intentionally brief and written in plain language.

Synthesis and development of evidence statement(s) for each core area

For each content area, the extracted evidence and quality assessment summary boxes were reviewed and compared to the "theory" or explanation of how the intervention/activity works (e.g., collection and disposal of used drug consumption equipment reduces opportunities for reuse and/or injury and consequently reduces the risk of transmission of HIV and HCV). Using a plain-language format, summary evidence statements were written for each core area.

Development of best practice recommendations for each content area

At team meetings, the evidence summaries and quality assessment summary boxes were reviewed and assessed; we used a consensus decision-making process to "approve" the content of each chapter. Prior to the teleconferences, team members were sent working drafts of chapters. Team members were asked to comment on the evidence summaries and determine if further work would be necessary or if the summaries were sufficient for the group to draft best practice recommendations for the content area under discussion. Each recommendation was written using a plain-language format.

Naloxone chapter

For the naloxone chapter, the available evidence base allowed us to use standard systematic review procedures that are described in the chapter.

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Appendix B – Other Injection-related Equipment Supporting Evidence

Numerous studies examine injection-related equipment, but do not examine behaviours related to or the role of each piece of equipment separately. For example, in some studies participants were asked if they ever shared a "cooker, filter, or water." As a result, it is difficult to determine from these studies if particular pieces of equipment are more likely than others to be shared and therefore contribute greater or lesser potential risk of HIV or HCV transmission. Nevertheless, studies that have employed composite measures of injection-related equipment behavior have revealed some patterns consistent with those found by studies examining individual pieces of equipment separately. This appendix serves to support the chapters about each specific piece of equipment.

Sharing other injection-related equipment

Unpublished data collected between 2010 and 2012 – as part of the most recent Ontario I-Track Study examining risk behaviours among people who inject drugs – documented that 38.2% of the 953 participants had borrowed any type of equipment (average of data from Toronto, Kingston, Sudbury, Thunder Bay, and London, Ontario). Earlier pilot data from the I-Track study found that 43% of 794 participants had injected with previously used drug injection equipment such as cotton, filters, cookers, and water. This proportion ranged from 32 to 54% across the cities where participants were recruited (Health Canada, 2004).

Among 551 people who inject drugs recruited from nine NSPs in Ontario, Millson et al. (2003) documented that the majority of participants (62%) had shared cookers, cotton, or water in the six months prior to their interview, with the proportions of people engaging in this behaviour ranging from 55 to 80% ($p<0.001$). Leonard et al. (2005) documented similarly high rates among 418 men and 85 women who inject drugs in Ottawa participating in the POINT Project between October 2002 and January 2003. The majority of both men (59%) and women (68%) had injected with previously used equipment at some point in their drug-injecting history and, of these, 41% of the men and 50% of the women had done so in the six months before their baseline interview (Leonard et al., 2005).

Sharing of drug injection equipment appears to be a very common practice elsewhere in the world (Power et al., 1994; Thorpe et al., 2001; Wang et al., 1998). Hunter et al. (1995) studied the injection-related risk behaviours of 2,062 people who inject drugs in Greater London, United Kingdom, from 1990 to 1993. Over 50% of the respondents reported sharing filters and/or spoons in the six months prior to their interview (Hunter et al., 1995). In a study involving five US cities, data from 1,438 people who inject drugs and do not practice receptive syringe sharing indicated that 54% reported non-syringe equipment sharing, a composite variable that combined responses about sharing cookers, filtration cottons, and water (Thiede et al., 2007). Thirty-nine percent of participants who reported equipment sharing shared primarily with a sexual partner, 46% shared with an injection partner or friend, and less than 2% reported sharing with dealers or strangers (Thiede et al., 2007).

Sharing other injection-related equipment versus needles

Studies have shown that people who inject drugs share injection equipment more often than they share needles (Bennett et al., 2000; Gossop et al., 1997; Green et al., 2001; Hunter et al., 1995; Huo et al., 2005; Koester et al., 1996; Power et al., 1994; Thorpe et al., 2001; Vlahov et al., 1997; Wang et al., 1998). Several studies have documented that even when people use only their own needle, they may have shared other injection equipment such as spoons, water, containers, and filters (Gossop et al., 1997; Hagan et al., 2001; McCoy et al., 1998; Power et al., 1994). For example, in the study by Hunter et al. (1995), more than 33% of people who inject drugs who reported that they had not shared needles in the six months prior to the interview had shared filters and spoons during that time period. In a study involving 12,323 people who inject drugs recruited from 19 sites in the United States, injection with previously used cookers/cotton/water was almost twice as frequent as injection with a previously used needle/syringe (McCoy et al., 1998).

Correlates of risk behaviours

Studies comparing injection practices have found that women are significantly more likely than men to use injection equipment that has already been used by someone else (Bennett et al., 2000; Evans et al., 2003). In the POINT Project conducted by Leonard et al. (2005) in Ottawa, women were more likely than men to have shared someone else's cooker or spoon and significantly more likely than men to have shared someone else's filter or cotton (p<0.001) and someone else's washes (p<0.001). These findings suggest that women may be at greater risk of acquiring HIV and HCV through these injection practices. This documented greater risk for women needs to be identified and incorporated into prevention programs and risk reduction messages.

Younger age has also been found to be significantly associated with sharing injection preparation equipment. Studies have found that younger people who inject drugs with shorter injecting careers were more likely to report sharing of injection equipment than older and more experienced people (De et al., 2007; Hunter et al., 1995). This documented greater risk for younger people needs to be incorporated into prevention programs and risk reduction messages.

People who inject drugs with a history of mental health problems also appear to be more likely to inject using previously used equipment or to share injection equipment. Among a cohort of 2,198 people who inject drugs aged 18 to 30 from five U.S. cities, Morse et al. (2001) found that those with a history of mental health hospitalization were more likely to report sharing syringes (OR=1.6; 95%CI: 1.3-1.9), cookers (OR=1.5; 95%CI: 1.2-1.8), cotton (OR=1.4; 95%CI: 1.1-1.7), and rinse water (OR=1.5; 95%CI: 1.2-1.8). Similarly, people who inject drugs with suicidal ideation were more likely to report sharing syringes (OR=1.8; 95%CI: 1.5-2.2), cookers (OR=1.6; 95%CI: 1.3, 1.9), cotton (OR=1.6; 95%CI: 1.4-2.0), and rinse water (OR=1.7; 95%CI: 1.4-2.1; Morse et al., 2001).

Severely drug dependent people who inject drugs have been found to share previously used drug injection equipment more frequently than others; increased sharing may be related to urgency to use to reduce withdrawal symptoms. Gossop et al. (1993) conducted a study examining heroin dependence and sharing injecting equipment among a group of 408 people who use heroin in London, United Kingdom. Equipment sharers were significantly more likely to be polydrug injectors (p<0.01), older (average 30 vs. 26 years, p<0.001) and to have been injecting heroin for longer (12 vs. 8 years, p<0.001) compared to non-sharers (Gossop et al., 1993).

Injecting-related relationships, injection settings, and beliefs may also impact injection-related equipment sharing. Thiede et al. (2007), in the study mentioned above, found that sharing non-syringe equipment (including cookers, filters, and water) was independently associated ($p < 0.05$) with having five or more injection partners in the past 3 months, mostly injecting with sexual partners or regular injection partners, injecting in shooting galleries, having peers who shared, lower self-efficacy regarding avoiding sharing, and not believing that HIV and HCV could be transmitted via equipment sharing. Overall, there are a number of factors related to other injection equipment sharing that NSPs should consider, especially when designing safer injection education initiatives.

Sharing injection-related equipment and HIV and HCV transmission

Preparing injections with previously used equipment other than needles has been found to be associated with existing levels of infection with HIV and HCV, and as a predictor of HCV seroconversion among women and men who inject drugs. For example, among 834 people who inject drugs in East Harlem, New York City, it was found that those who tested HIV-positive were significantly more likely to have injected with previously used cookers, cotton and/or rinse water than those who tested HIV-negative (p<0.002; Beardsley et al., 1999).

Hagan et al. (2001) measured HCV seroconversion among a cohort of 317 people who inject drugs in Seattle who tested negative for HCV antibody at study recruitment. Among those who did not share syringes, sharing drug cookers and cotton filters elevated the risk of HCV seroconversion sixfold (adjusted relative risk=5.9;95%CI: 1.1-31.7) and 54% of HCV infections among this group were attributable to cooker/cotton sharing (Hagan et al., 2001). Hahn et al. (2002) conducted a cohort study in which 195 HCV-negative people who inject drugs were recruited and their risk factors for HCV seroconversion examined. In the 21-month time period, it was found that the risk of HCV infection increased significantly for those who shared non-sterile drug equipment (hazard ratio=2.5; 95%CI: 1.3-5.1; Hahn et al., 2002). Similarly, Thorpe et al. (2000) measured the incidence of HCV infection among a cohort of 18 to 30 year-old people who inject drugs in Chicago between 1997 and 1999. The adjusted relative hazard (ARH) of HCV seroconversion was highest for those who shared cookers (ARH=3.5; 95%CI: 1.4-8.5), followed by those who shared rinse water (ARH=2.2; 95%CI: 1.1-4.6), unbleached syringes (ARH=2.0; 95%CI: 1.0-

4.0), and cotton (ARH=1.96; 95%CI: 1.0-3.8; Thorpe et al., 2000). However, in a more recent review of ten studies (cohort and case-control studies) estimates of risk of HCV infection associated with injection-related equipment had wide confidence intervals and the authors stated that few studies have been able to assess the individual contributions of containers, filters, and water (De et al., 2008).

Other injection-related equipment distribution

Some evidence has suggested that NSP attendance has an impact on injection-related equipment sharing behaviours. For example, Ouellet et al. (2004) compared regular NSP attendees with non-attendees. All HIV and HCV risk-related injection practices examined were significantly less likely among regular NSP attendees compared with non-attendees. Regular NSP attendees compared with non-attendees had a 61% reduced odds of sharing cookers (adjusted odds ratio (AOR)=0.4; 95%CI: 0.3-0.6), a 52% reduced odds of sharing cotton (AOR=0.5; 95%CI: 0.3-0.7), and a 59% reduced odds of sharing water (AOR=0.4; 95%CI: 0.1-0.3; Ouellet et al., 2004). Individual studies like this should be considered in light of findings from a systematic review of thirteen studies that indicated there is limited evidence that demonstrates the provision of injecting-related equipment reduces incident HCV infection (Gillies et al., 2010). Having reviewed 12 observational and one non-randomized uncontrolled intervention, Gillies et al. (2010) concluded that the evidence was limited based on the amount and quality of research.

When asked, NSPs clients express a desire for programs to offer the full complement of other injection related supplies. A study from Scotland examined data from 370 questionnaires completed by people who inject drugs and found that "paraphernalia (citric acid, water and filters)" was identified by participants as the highest priority for service provision (Matheson et al., 2008). Ongoing consultation with people who inject drugs can be an important way to stay current with what types of equipment clients need and what their preferences are (e.g., brand of cookers, size of filters).

The biggest barrier to distribution of the supplies is cost. Many NSPs and AIDS Service Organizations (ASOs) have limited budgets and are unable to purchase these items. For example, the Canadian AIDS Society (2004) carried out a Harm Reduction Kit Survey among its member groups. Many organizations responded that they were not in a position to purchase and distribute items that they knew were essential to reduce the harms associated with injection drug use. A study that surveyed core and satellite NSP managers across Ontario found that more programs were distributing injection-related equipment after the release of best practice recommendations and the implementation of the Ontario Harm Reduction Distribution Program (OHRDP; Strike et al., 2011). According to participants, major reasons for the reported changes in equipment distribution practices included the OHRDP, the best practices document, and decisions by NSP managers. Since 2006, OHRDP has provided injection-related equipment free of charge to Ontario NSPs (Strike et al., 2011). In British Columbia, provincial harm reduction supply distribution became centralized in 2008 (BCCDC, 2012). Having programs like these in place helps remove some of the cost barriers faced by NSPs.

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