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High dead-space syringe use among people who inject drugs in Tijuana, Mexico

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Abstract

Background—High dead-space syringes (HDSS) are believed to confer an elevated risk of acquiring HIV and other blood-borne infections.

Objectives—We identified prevalence and correlates of HDSS use among injection drug users (IDU) in Tijuana, Mexico, where syringe purchase and possession is legal without a prescription.

Methods—Beginning in 2011, IDU who reported being 18 years or older, who injected drugs within the last month were recruited into a prospective study. At baseline and semi-annually, 557 IDU underwent HIV-testing and interviewer-administered surveys. Logistic regression was used to identify correlates of using HDSS.

Results—Of 557 IDU, 40% had ever used HDSS, mostly because no other syringe type was available (72%), or because they were easier to get (20%). Controlling for sex and age at first injection, use of HDSS was associated with cocaine as the first drug injected (Adjusted Odds Ratio [AOR]:2.68; Confidence Interval 95% [CI]:1.15-6.22), having been stopped or arrested by police (AOR:1.84; 95% CI:1.11-3.07), being deported from the US (AOR:1.64; 95% CI:1.06-2.53), and believing it is illegal to carry syringes (AOR:1.78; 95% CI:1.01-3.15).

Conclusion—Use of HDSS is surprisingly common among IDU in Tijuana. Efforts are needed to expand coverage of low-dead space syringes through existing syringe exchange programs. Education is required to increase awareness of the harms associated with HDSS, and to inform IDU that syringe possession is legal across Mexico.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

1. BACKGROUND

It has been estimated that 10,000 injection drug users (IDU) live in Tijuana, Mexico, a large Mexico-U.S. border city that is situated on a major drug trafficking route.¹ This prevalence of injection drug use is over ten times the national mean.^{2,3} In 2008, HIV prevalence among male and female IDU in Tijuana was estimated at 4% and 10%, respectively,⁴ and hepatitis C virus (HCV) prevalence was estimated at 95.5%.⁵

From 1980 until the mid-2000s, there was only one active syringe exchange program (SEP) in Mexico, which was run by a local non-governmental organization (NGO) in Ciudad Juarez, Chihuahua. In 2004 another NGO opened a SEP in Tijuana, Baja California. By 2007 Mexico's federal government supported SEP in seven states. In 2009 the Global Fund provided funding for HIV programs and by 2010, there were SEP also in two more states.⁶ However, this funding has ended, making it more difficult for NGOs to provide syringes to IDU.

In Tijuana, besides the direct drug-related characteristics of both substance use and trafficking previously mentioned, there are demographic, social and political factors that contribute to an environment that heightens the risk of blood-borne infections for IDU. In 2010 there were 1,559,683 registered people living in Tijuana, the fifth largest city in the country and the largest in the state of Baja California.⁷ Baja California is the state with the highest mobility in Mexico; 41.2% of the population was born in a different state⁸. The Tijuana-San Diego region is the busiest land border crossing in the world, with as many as 130,000 individuals crossing between the cities daily.⁹ Among Mexican cities, Tijuana also received the greatest number of deportees from the US, registering 366 repatriations per day in 2010.¹⁰ Among IDU in Tijuana, a history of deportation has been shown to be associated with more frequent drug injection, less interaction with medical or treatment services¹¹ and a greater risk of HIV infection.⁴

Another factor that may increase the risk of blood-borne infections among IDU is the type of syringe that individuals use.¹² Syringes can be broadly categorized as high dead-space syringes (HDSS) or low dead-space syringes (LDSS). HDSS have detachable needles and retain more than 1000 times more blood than LDSS.¹³ The quantity of virus in an exposure has been suggested to influence the risk of HIV transmission.¹⁴ That is, considering that HDSS retain more blood than LDSS, they may be increasing the risk of blood borne infection among people that engage in receptive syringe sharing through blood transfer. One study estimated that an HIV epidemic among a IDU population could be sustained in cases wherein 10% of the IDU population uses HDSS.¹³ It is worth noting that in Mexico, the purchase of both types of syringes is legal and that SEP provide LDSS. However, there has not been a public health campaign that promotes the use of LDSS instead of HDSS. The aim of this paper is to identify the prevalence and correlates of HDSS use among IDU in Tijuana.

2. METHODS

2.1 Sample and procedures

Beginning in 2011, 785 IDU in Tijuana were enrolled in a prospective cohort study (*Proyecto El Cuete*, Phase IV) that included interviewer-administered surveys and HIV testing at baseline and every six months. As previously reported,¹⁵ recruitment was conducted through targeted sampling, which consisted of street-based outreach in ten neighborhoods across Tijuana.

The inclusion criteria included being 18 years or older, injecting drugs within the last month, being able to speak English or Spanish, currently living in Tijuana with no plans to move outside Tijuana over the next 24 months, and not currently participating in an intervention study. The Human Research Protections Program of the University of California, San Diego and the Ethics Board at El Colegio de la Frontera Norte approved the study protocols.

For this analysis, the sample was comprised by 557 IDU that had completed the baseline and second visit and who answered questions about use of HDSS.

2.2 Measures

The interviewer-administered surveys solicited data on sociodemographic, behavioral and contextual factors, including lifetime and 6-month drug use, and behaviors related to drug use such as needle and drug paraphernalia sharing, the type of syringe used, and other health conditions. To assess the type of syringe used, participants were asked: "Have you ever used a syringe with a removable needle?" Those who reported previous removable needle use were also asked: "Why did you use a syringe with a removable needle the last time you used one?" The possible responses were: "to prefer syringes with removable needles", "it was the easiest to get", "it was all that was available" and "other". If the answer was "other", they were asked an open-ended question to specify the reasons.

2.3 Statistical analyses

Frequencies and medians were compared between those who ever used HDSS to those that did not. Univariate and multivariate logistic regressions were conducted to identify lifetime and past 6-months factors associated with HDSS use. To identify variables independently associated with HDSS use, we entered variables significant at the $p < 0.05$ level in the univariate analysis into a multivariate logistic regression model in a manual forward stepwise fashion. The likelihood ratio test was used to compare nested models, using a significance level of $p < 0.05$. For the final model, we tested for multicollinearity through a correlation matrix and a Wald test.

3. RESULTS

Of the total sample of IDU ($n = 557$), 58.9% were male, the median duration of injection drug use was 16 years (interquartile range [IQR]: 10-23 years), median age was 37 years (IQR: 31-45), and 24.7% moved to Tijuana because they were deported from the US.

A total of 40% reported using HDSS at least once in their lifetime. The main reported reason for HDSS use was because no other syringe type was available (72%) and because HDSS were easier to get (20%). Lack of access because of the late hour or because they could not afford to buy a new syringe was reported by 2.7% of those who used HDSS. Using an HDSS to avoid injecting with a syringe used by someone else was reported by 0.5% IDU, 1.4% said the LDSS bend and get clogged, 0.5% reported to have been “desperate” because they were just released from prison, 0.5% used HDSS to be able to share drugs with someone else, and 0.5% wanted to stop withdrawal symptoms. In relation to frequency of injection, 79.2% in the HDSS group and 71.1% in the no-HDSS group injected more than once a day in the past month. This difference was not significant.

Both groups were predominantly male with 54.8% males in the no-HDSS group and 64.3% in the HDSS group (Table 1), however, the proportion was significantly different between groups. The median age of those reporting HDSS use was 39 years old, compared with 36 years old for those using non-HDSS. The median years of injection drug use were 18 in the HDSS group and 16 years in the no-HDSS group. Monthly income higher than \$2,500 Mexican pesos (equivalent to approximately \$200 US dollars) was reported by 52.4% of those in the no-HDSS group and 47.5% in the HDSS group. Positive HIV status was reported by 2.1% in the no-HDSS group and 4.5% in the HDSS group; knowing anyone with HIV or knowing anyone that died with HIV was reported by 10.6% in the no-HDSS group and by 4.5% in the HDSS group. Median age, years of injection drug use, monthly income, and HIV status were not significantly different.

In both groups, most of the IDU used heroin the first time they injected drugs (77.7% in the no-HDSS and 78.7% in the HDSS group; difference not significant). Cocaine was the second most common drug of initiation for 3.9% in the no-HDSS group and 8.1% in the HDSS group. Those who have used HDSS started injecting heroin at a median age of 19, a year prior to those in the no-HDSS group.

The age at first cocaine injection was 20 years for both groups, 20.5 and 21 for first speedball (cocaine combined with heroin) injection, and 24 and 25.5 for methamphetamine and the combination of methamphetamine with heroin. The median lifetime overdoses was one for both groups. Asking for help injecting was reported by 26.5% in the no-HDSS group and 22.6% in the HDSS group. None of these differences were significant.

Most of the IDU interviewed reported a history of being stopped and arrested by the police (72% in the no-HDSS group and 76.9% in the HDSS). Although it is legal to carry syringes in Tijuana, only 16.4% in the no-HDSS group and 10% in the HDSS group were aware of that. History of deportation from the US was reported by 36.6% in the no-HDSS group and 50.7% in the HDSS group.

With respect to risky drug-related behaviors in the past 6 months, 27.4% in the no-HDSS group and 22.6% in the HDSS group had injected with a used syringe at least half of the time. Distributive and receptive syringe sharing at least half the time were reported by more than one-third of participants in both groups, as was sharing the same dose with someone else. That is, almost all of those who engaged in syringe sharing have done so in a receptive

behavior. In both groups, almost 50% of participants shared other injection paraphernalia such as cookers, cottons or rinse water at least half of the times they injected in the past 6 months. Buying syringes that were preloaded with already prepared drug for at least half of injections was reported by only 5.4% in the no-HDSS group and 6.3% in the HDSS group. Overall 17.3% in the no-HDSS group and 19.5% in the HDSS group reported that it was “hard” to get new syringes; 40.2% and 47.1% respectively reported obtaining syringes from a “safe” source of syringe such as pharmacy or SEP. Close to 10% in both groups reported at least one overdose in the past 6 months. Reporting difficulty avoiding receptive needle sharing and other sharing injection equipment ranged between 28.3% and 52.1% in the no-HDSS and between 27.6% and 60.6% in the HDSS group. Almost 28% in each group reported being homeless at least once in the past 6 months. None of the past 6-month behaviors differed significantly across groups.

In the univariate analyses, being male, having ever been stopped or arrested by the police, using cocaine as first drug injected, believing that in Tijuana it is illegal to carry syringes, a longer injection drug use trajectory (per 10 year increase), being deported to Tijuana, earlier onset of first heroin injection (per 10 year increase), and earlier year of first injection (per 10 year increase) were all significantly associated with an increased odds of HDSS use.

There was collinearity between years injecting, age at first heroin injection and absolute year of first injection. That is, most of PWID used heroin at first injection. For this, we tested each of these variables in different multivariate models. The best fitting model included age at first heroin injection. Controlling for sex and age at first heroin injection (Adjusted Odds Ratio [AOR]:9.7 per 10 year increase; 95% Confidence Interval [CI]:9.4-10.0), use of HDSS was independently associated with cocaine as first drug injected (AOR:2.68; 95%CI: 1.15-6.22), having ever been stopped or arrested by police (AOR:1.84; 95% CI:1.11-3.07), being deported from the US to Tijuana (AOR=1.64; 95%CI:1.06-2.53), and believing it is illegal to carry syringes (AOR=1.78; 95%CI:1.01-3.15) (Table 2).

4. CONCLUSION

In this study of IDU in Tijuana, use of HDSS was common, which is concerning because use of these syringes is likely to increase the risk of transmission of HIV and viral hepatitis^{12,16}. Surprisingly, few drug-related behaviors were independently associated with use of HDSS; rather, social and structural factors predominated as correlates of HDSS use.

IDU who reported ever being arrested by police were nearly twice as likely to report HDSS use, compared to those who had never been arrested. This is a critical finding considering that approximately 74% of IDU in this sample report having been arrested. Our findings are consistent with previous evidence of the relationship between policing practices (such as arrests) and high-risk injection behaviors such as needle sharing in Tijuana and elsewhere.^{17,18} Our findings are also consistent with previous studies of IDU in Tijuana, which have shown that certain policing practices such as syringe confiscation are associated with increased sharing of drugs and drug paraphernalia.¹⁹ As such, given the potential that policing practices may increase risk of blood-borne disease transmission via increased use of HDSS among IDU, education programs may be needed to ensure policing practices to

reduce such behaviors among IDU.¹⁹ Such an approach is likely to reduce the risk of blood-borne disease transmission through accidental syringe punctures that police and other first responders may experience in interactions with IDU populations. A closer collaboration between public health programs and policing strategies may also reduce the likelihood of engaging in risk behaviors.²⁰

Those who were deported from the US were 1.6 times more likely to report HDSS use. The vulnerable condition and increased risk of Mexican IDU repatriated to Tijuana in relation to HIV and other health and behavioral conditions has previously been reported.^{4,21} The fact that people who have been deported from the US are more likely to use HDSS than those with no deportation history builds on the evidence of the need for public health interventions that target the migrant population, and especially the deportee population in Tijuana.²² Previous research among deportees in Tijuana suggests that ongoing targeting by law enforcement is likely to increase their risk of engaging in used syringe sharing and to binge on drugs following release from prison.²³ For instance, IDU deported are 1.6 times more likely to ever been incarcerated than those with no prior deportations,²⁴ and are more exposed to arrest because they lack identification documents, even though according to the law it is not mandatory to carry identification.²⁵ Interestingly, IDU who believed that syringe possession was illegal in Tijuana were more likely to report HDSS use. In a qualitative study, IDU in Tijuana reported difficulties when trying to buy syringes at pharmacies.²⁶ The most common problem was that many pharmacies refuse to sell syringes or charge higher prices when they suspect the client may be a IDU.²⁷ Although in the present study we did not find access to LDSS or pricing to be significantly related to HDSS use, it is likely that the previously reported difficulties in accessing syringes have influenced the perception of legality of syringe purchasing and possession. This conclusion is supported by prior findings of criminalization of syringe possession, which found that this is a risk factor for blood-borne infection among IDU.²⁸ IDU in Tijuana are a vulnerable population that are constantly experiencing targeting by law enforcement, and are therefore highly vulnerable. As such, this population is likely to benefit from interventions that can provide information on strategies to minimize behaviors such as use of HDSS that may heighten the risk of blood borne disease transmission, as well as information on the legality of carrying sterile syringes in Tijuana. In addition to Tijuana's IDU population, health-care providers also require more information concerning the risks of HDSS use. For instance, the manual for HIV/AIDS prevention among IDU published by the Mexican Ministry of Health recommends the use of LDSS.²⁹ However, it does not explain how their use may reduce the risk of HIV, focusing only on the reduction of tissue damage.

Tijuana is one of the few cities with harm reduction programs in Mexico.^{30,31} As a response to the increasing need for a health approach to minimizing the harms of injection drug use, two non-governmental organizations in Tijuana provide new syringes through SEP,³¹ while these organizations only provided 1.2 million LDSS,³² our results suggest that the supply is not sufficient to achieve adequate coverage of the total IDU population. Even more critical is the lack of funding for SEP given the end of activities of Global Fund in Mexico.³² To achieve adequate coverage, a SEP would need to consider the frequency and patterns of injection among IDU and the fact that to avoid withdrawal symptoms IDU are likely to use whatever type of syringe is most readily accessible. Increasing the numbers of LDSS

distributed, extending operating hours, and implementing educational programs may all improve the service provided by SEP.

This study has several limitations. First, the cross-sectional design does not allow causal inferences. Second, there is no information regarding hepatitis C status and there is no statistical power to analyze the relationship between HIV status and HDSS use. Third, because of lack of statistical power it was not possible to analyze past-month HDSS use and hence, it may be that our findings do not represent present injection practices, which may imply that HDSS were used in other conditions such as prior to deportation.

Overall, our findings suggest the need for a more extensive harm reduction program that expands the coverage of SEP, as well as education programs highlighting the increased risks associated with HDSS as well as the legal status of syringe possession in Mexico. IDU who use HDSS exhibit indicators of greater vulnerability compared with those using LDSS. Additional efforts to increase access to LDSS and to educate IDU and service providers regarding the increased risk associated with HDSS are therefore needed. Considering the geographic location of the study site, any effort to improve the health conditions of IDU in Tijuana may have an impact on international migrant health.

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Table 1

Descriptive statistics of high dead space syringe use (HDSS). El Cuete IV 2011, Tijuana (n= 557).

	No HDSS use n= 336		HDSS use n= 221	
	n	%/ Median (IQR)	n	%/ Median (IQR)
Lifetime variables				
Male	184	54.8	142	64.3
Age (median)	336	36 (31-43)	221	39 (32-45)
Years injecting (median)	336	16 (8-22)	221	18 (11-25)
Monthly income >\$2,500 (Mexican pesos) *	176	52.4	105	47.5
Married (not married as reference)	161	60.7	104	39.25
Years living in Tijuana (median)	335	21 (10-33)	219	21 (10-34)
Completed secondary or more	131	40	90	40.7
HIV status	7	2.1	10	4.5
Knows anyone with HIV or anyone that died with HIV	36	10.7	10	4.5
First drug injected				
Heroin	261	77.7	174	78.7
Cocaine	13	3.9	18	8.1
Age at first injecting drug use (median)				
Heroin	331	20 (17-25)	217	19 (16-24)
Cocaine	141	20 (18-25)	121	20 (16-25)
Speedball	173	21 (18-26)	138	20.5 (17-26)
Crystal/Methamphetamine	173	24 (20-30)	128	25 (20-30)
Heroin and methamphetamine	224	25.5 (20-31)	166	25 (21-33)
Lifetime overdoses (median)	336	1 (0-2)	221	1 (0-3)
Hit doctor	89	26.5	50	22.6
Ever stopped and arrested by police	242	72.0	170	76.9
Perception of legal status of carrying new syringes in				
Tijuana	55	16.4	22	10.0
Deported to Tijuana	123	36.6	112	50.7
6-month variables				
Injected with a used syringe **	244	27.4	171	22.6
Distributive needle sharing **	134	39.9	77	34.8
Receptive needle sharing **	124	36.9	75	33.9
Divided drugs with someone else by using a syringe **	118	35.1	84	38.0
Used a cooker, cotton, or water with someone or after someone else used it **	167	49.7	111	50.2
Bought drugs that came already prepared in a syringe **	18	5.4	14	6.3
Found it hard was to get new, unused syringes for injecting drugs	58	17.3	43	19.5
Safe source of syringe	135	40.2	104	47.1
Overdose	30	8.9	21	9.5

	No HDSS use n= 336		HDSS use n= 221	
	n	%/ Median (IQR)	n	%/ Median (IQR)
Cannot avoid receptive needle sharing with someone he/she knows	95	28.3	61	27.6
Cannot avoid receptive needle sharing with someone sick	175	52.1	134	60.6
Cannot avoid receptive sharing of cooker, cotton, or rinse water	133	39.6	96	43.4
Cannot avoid receptive needle sharing from a sex partner	128	38.1	98	44.3
Cannot avoid receptive sharing of sex partner's cooker, cotton, or rinse water	132	39.3	103	46.6
Homelessness	93	27.7	61	27.6
Past-month				
Injected more than once a day	241	71.7	175	79.2

* Approximately \$200 US dollars at the time of the interview;

** at least half the time; significant difference at $p < 0.05$ bolded; IQR: Interquartile range.

Table 2

Univariate and multivariate analysis of HDSS use. El Cuete IV 2011, Tijuana (n= 557).

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)*
Ever stopped and arrested by police	1.74 (1.11-2.71)	1.84 (1.11-3.07)
Cocaine first drug injected	2.20 (1.06-4.59)	2.68 (1.15-6.22)
Age at first heroin injection (per 10 year increase)	9.7 (9.5-9.9)	9.7 (9.4-10.0)
Perception of legal status of carrying new syringes in Tijuana	1.73 (1.01-2.94)	1.78 (1.01-3.15)
Deported to Tijuana	1.56 (1.06-2.29)	1.64 (1.06-2.53)

Controlling for sex; 95% CI: 95% Confidence Intervals; Reference group non-HDSS use; significant at p<0.05 bolded.