



Published in final edited form as:

*J Addict Med.* 2015 ; 9(2): 87–93. doi:10.1097/ADM.0000000000000093.

## High Rates of Abscesses and Chronic Wounds in Community-Recruited Injection Drug Users and Associated Risk Factors

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### Abstract

**Objectives**—Abscesses and chronic wounds are common among injection drug users (IDUs) though chronic wounds have been understudied. We assess the risk factors associated with both acute and chronic wounds within a community-based population of IDUs frequenting the Baltimore City Needle Exchange Program (BNEP).

**Methods**—We performed a cross-sectional study of BNEP clients 18 years who completed an in-person survey regarding active or prior wounds including abscesses (duration <8 weeks) and chronic wounds (duration ≥ 8 weeks), injection practices, and skin care. Factors associated with wounds were analyzed using univariate and multivariate logistic regression.

**Results**—Of the 152 participants, 63.2% were men, 49.3% were Caucasian, 44.7% were African American, 34.9% had any type of current wound, 17.8% had an active abscess, and 19.7% had a current chronic wound. Abscesses were more common in women (odds ratio [OR], 2.56; 95% confidence interval [CI], 1.10–5.97); and those reporting skin-popping (OR, 5.38; 95% CI, 1.85–15.67). In a multivariate model, risk factors for an abscess included injecting with a family member/partner (AOR, 4.06; 95% CI, 0.99–16.58). In a multivariable analysis of current chronic wounds, cleaning skin with alcohol prior to injection was protective (AOR, 0.061; 95% CI, 0.0064–0.58).

**Conclusions**—Abscesses and chronic wounds were prevalent among a sample of IDUs in Baltimore. Abscesses were associated with injection practices, and chronic wounds appeared linked to varying skin and tool cleaning practices. There is a pressing need for wound-related education and treatment efforts among IDUs who are at greatest risk for skin-related morbidity.

### Keywords

Injection drug use; harm reduction; abscess; chronic wound; skin and soft tissue infection

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Injection-related wounds, including abscesses and chronic wounds are significant causes of morbidity for injection drug users (IDUs) (Ebright & Pieper, 2002; Palfreyman et al., 2007).

Skin and soft tissue infections (SSTIs), including cellulitis and abscesses, are the primary reason that IDUs present to emergency departments (EDs) (Palepu et al., 2001). Prior study has shown that IDUs treated for SSTIs in EDs faced a higher risk for future hospitalization and death (Binswanger et al., 2008). Injection-related wounds, which are generally perceived as low-acuity conditions, may be markers for greater addiction-related disease severity and poorer overall health status among IDUs.

Both behavioral and biological factors are thought to account for the high prevalence of wounds in this population. Repeated injection into the same anatomical site may lead to tissue and venous trauma, and bacterial inoculation may be facilitated under non-sterile situations. Vaso-constricting drugs, such as cocaine, injected either alone or in combination with heroin (i.e. speedballing) may induce vasospasm and thrombosis, leading to tissue necrosis (Ebright & Pieper, 2002; Hope et al., 2010; Murphy et al., 2001; Phillips & Stein, 2010; Spijkerman et al., 1996). Other possible risk factors for abscesses include skin-popping, defined as direct subcutaneous injection, and kicking (also known as booting or jacking), defined as injecting the drug into the vein, pulling blood into the syringe and then injecting it back into the vein (Binswanger, Kral, Bluthenthal, Rybold, & Edlin, 2000; Ebright & Pieper, 2002; Murphy et al., 2001; Phillips & Stein, 2010). Prior studies have suggested that women are at increased risk for developing abscesses (Ebright & Pieper, 2002; Fink, Lindsay, Slymen, Kral, & Bluthenthal, 2013; Hope, Marongiu, Parry, & Ncube, 2010; Lloyd-Smith et al., 2005; Lloyd-Smith et al., 2008; Spijkerman, van Ameijden, Mientjes, Coutinho, & van den Hoek, 1996) perhaps due to difficulty accessing veins, sharing of contaminated injection equipment, injection by someone else, and overlapping injection and sexual partners (Ebright & Pieper, 2002; Evans et al., 2003; Lum, Sears, & Guydish, 2005; Magnus et al., 2013; Tortu, McMahon, Hamid, & Neaigus, 2003; Wagner et al., 2010).

Vein injury occurs through scarring, non-sterile injection, and direct toxic effects of the drug and can lead to chronic venous insufficiency (CVI), which increases the risk for chronic lower extremity ulcers (Pieper & Templin, 2001; Pieper, Kirsner, Templin, & Birk, 2007). Wounds can also lead to more severe SSTIs, including gangrene and sepsis, potentially resulting in amputation or death (Callahan, Schecter, & Horn, 1998). Chronic wounds also have a social impact. The chronic pain, reduced mobility, malodor and stigma can marginalize these individuals and may make it difficult to maintain financial security and social support (Palfreyman et al., 2007; Pieper et al., 2007; Pieper, Templin, Goldberg, DiNardo, & Wells, 2013; Pieper, Templin, & Ebright, 2006). The prevalence of and risk factors for chronic ulcers in the IDU population has not been well studied or evaluated concurrently with risk factors for abscesses in this population.

The Baltimore City Health Department operates a mobile Needle Exchange Program (BNEP) in modified recreational vehicles that travel to fixed sites in the community six days per week (Gindi, Rucker, Serio-Chapman, & Sherman, 2009). We examined the prevalence and correlates for abscesses and chronic wounds in the IDU population accessing BNEP services to characterize the needs of the community and inform intervention strategies for this community and the broader IDU population.

## METHODS

### Study Design

We conducted a cross-sectional study among IDU clients of the BNEP, age 18 years, regardless of wound status. Data collection occurred between May 2012 and November 2013, and was conducted at five different exchange sites, though most participants were from Site A and Site B, which were 1.9 miles apart and demographically distinct. Site A is frequented primarily by African Americans and Site B is frequented primarily by Caucasians.

All participants provided written informed consent and completed a paper-administered survey including questions addressing demographics, injection behaviors, pre-injection skin care, wound history, wound care, and general medical history. Surveys required approximately 20 minutes, and upon completion, participants were given a \$10 gift card for local businesses. Chronic wounds were defined as open areas on the skin that had been present and non-healing for 8 weeks. Abscesses were defined as swollen, red, painful lumps under the skin that may or may not be open and that have lasted <8 weeks. Study team members visually verified the presence of current abscesses and wounds at the time of the survey. This study was approved by the Johns Hopkins Medicine Institutional Review Board.

### Data Analysis

Statistical analysis was performed using Stata 12 (StataCorp, College Station, TX). All survey variables were categorical except for age, which was a continuous variable. Survey variables were analyzed using  $\chi^2$ , univariate, multivariable and multinomial logistic regression. *P* values 0.05 were considered statistically significant. Covariates with *P* values 0.15 on univariate testing were included in multivariable models. Odds ratios predicting risk of outcome of abscess or chronic wound with 95% confidence intervals were assessed.

## RESULTS

### Demographics and Injection Behaviors

The 152 participants included 96 men (63.2%), 75 Caucasians (49.3%), and 68 African Americans (44.7%) (Table 1). The median age was 45 years with an interquartile range (IQR) of 35–52. These statistics were representative of the overall BNEP client population.

The majority, 121 reported daily heroin use (79.6%) and nearly a third (n=49, 32.2%), reported daily use of speedball (mixture of heroin and cocaine) within the last thirty days. The majority of participants had lengthy addiction histories, having injected for over 15 years (n=92, 60.5%).

Although report of sharing needles was uncommon (n=125, 82.2%, never share), sharing of other injection tools was frequent. For example, 62 reported sharing spoons or cookers (40.8%), 55 shared water (36.2%), and 39/149 shared filters (26.7%). The most frequent method to clean the injection site before injection was topical alcohol (n=83, 54.6%). In the past 30 days, the median number of times clients used their own needles was three with an

IQR of 1–4 (range, 1–50). Of the 111 clients (73.0%) who reported reusing their needles, all reported cleaning their needles prior to reuse with at least one agent: 56 used water only (50.5%), and 55 used bleach or a combination of bleach/water (49.5%).

### Prevalence of Abscesses and Chronic Wounds

The prevalence of any active wound at the time of the interview, including abscesses and chronic wounds, was 34.9%, as seen in Table 2. Current chronic wounds were reported by 19.7% of participants (n=30). Current abscesses were reported by 17.8% of participants (n=27). Current wounds were self-reported and then visually verified by study staff at the time of the survey. Of clients without a current chronic wound (n=122), 19.7% reported having had a chronic wound in the past. Of the clients without a current abscess (n=125), more than half reported having at least one abscess anytime in the past. The burden of wound-related skin disease was calculated to include individuals either having a wound at the time of evaluation or anytime in the past. Without double counting individuals who had both current and past wounds, the wound-related skin disease burden in our population was 75.0% (n/N=114/152).

### Factors Associated with a Current Abscess

As shown in Table 3, factors associated with a current abscess on univariate analysis included being female (Odds ratio (OR), 2.56; 95% Confidence interval (CI), 1.10–5.97), skin-popping (OR, 5.38; 95% CI, 1.85–15.67), injecting with a family member or partner compared to injecting alone (OR, 3.78; 95% CI, 1.38–10.31), and kicking occasionally (OR, 3.09; 95% CI, 1.02–9.37). In the multivariable model, injecting with a family member or a partner (Adjusted odds ratio (AOR), 4.06; 95% CI, 0.99–16.58) and kicking occasionally (AOR, 4.88; 95% CI, 1.09–21.90) remained associated with having a current abscess.

### Factors Associated with a Current Chronic Wound

Presenting with a current chronic wound was associated on univariate analysis with identifying as Native American compared to African American (OR, 10.6; 95% CI, 1.03–109.45), injecting into the leg (OR, 3.12; 95% CI, 1.34–7.30) and cleaning needles with bleach or bleach/water combination before reuse, compared to cleaning needles with water only (OR, 4.44; 95% CI, 1.36–14.51), as shown in Table 4. Additionally, using filters appeared to be protective against having a current chronic wound (OR, 0.15; 95% CI, 0.024–0.94).

The multivariable model for factors associated with current chronic wounds indicated that cleaning the skin with either water (AOR, 0.018; 95% CI 0.00054–0.60) or alcohol (AOR, 0.061; 95% CI, 0.0064–0.58) before injection reduced the odds of having a chronic wound (Table 4). Factors associated with chronic wounds in the multivariable model included identifying as Native American (AOR, 128.1; 95% CI, 1.86–8800.41), having an injection history 15 years (AOR, 76.2; 95% CI, 1.55–3753.56), and cleaning needles with bleach or bleach/water combination compared to water only at time of reuse (AOR 17.9; 95% CI, 2.14–149.95).

### Factors Associated With a History of Abscess

Participants without active abscesses were asked about their history with prior abscesses. Among these individuals, a history of at least one abscess was associated on univariate analysis with Caucasians compared to African Americans (OR, 2.91; 95% CI, 1.37–6.18), and with injecting into the neck (OR, 6.62; 95% CI, 1.44–30.55). Compared to those who primarily visited BNEP Site A, those frequenting Site B were more likely to have an abscess history (OR, 2.51; 95% CI, 1.12–5.63). On univariate analysis, protective factors included cleaning skin with soap occasionally compared to never cleaning with soap before injection (OR, 0.26; 95% CI, 0.099–0.67).

### Factors Associated With a History of Chronic Wound

For the participants who did not have a chronic wound at evaluation, a history of prior chronic wounds was associated with sharing filters (OR, 3.95; 95% CI, 1.53–10.16) and skin-popping (OR, 4.04; 95% CI, 1.12–14.59) at the univariate level. Skin-popping remained significant in the multivariable model (AOR, 7.04; 95% CI, 1.15–43.11).

### Factors Associated With Female Gender and Current Abscess

We further evaluated injection practices by gender to understand the above-noted association between women and abscesses. After noting the potential influence of race and gender on current abscess risk, we compared African American men to Caucasian women. In this comparison, Caucasian women were at increased risk of having a current abscess (OR 3.52, 95% CI 1.16–10.64) and had similar risk for a history of abscesses (OR 3.54, 95% CI 1.27–9.86).

Across all women enrolled, reusing needles 5–7 times was associated with an 18.0-fold greater odds of having an abscess at evaluation compared to never reusing needles (95% CI 1.37–235.69). Compared to women who had injected for 15 years, less experienced female IDUs (injecting 9–14 years), had a 6.67 greater odds of presenting with a current abscess (95% CI 1.18–37.78). Finally, women who reported skin-popping had greater risk for a current abscess (OR 8.22, 95% CI 1.72–39.35) compared to women who denied skin-popping.

Although other socio-behavioral factors may explain women's greater risk for abscesses, the covariates we measured were not significant by  $\chi^2$  analysis. For example, compared to women without abscesses (n=41, 73.2%), women with abscesses (n=15, 26.8%) more often reported unstable housing (n=6, 40.0% versus n=6, 14.6%;  $P=0.119$ ), using cigarette filters (n=9, 60.0% versus n/N=14/37, 37.8%;  $P=0.090$ ), sharing spoons/cookers (n=9, 60.0% versus n=16, 39.0%;  $P=0.162$ ), and sharing filters (n=6, 40.0% versus n=8, 19.5%;  $P=0.129$ ). In addition, women with abscesses less often cleaned their skin with alcohol before injection (n=6, 40.0% versus n=26, 63.4%;  $P=0.185$ ). Between these two groups of women, there were no significant differences in drug used or frequency thereof.

## DISCUSSION

IDU participants in the BNEP harm reduction program have a high prevalence of current wounds (34.9%). This is consistent with prior reports and supports the need for focused interventions in the IDU population (Binswanger et al., 2000; Phillips & Stein, 2010).

Abscesses were associated with female gender (Fink et al., 2013; Hope et al., 2010; Lloyd-Smith et al., 2005; Spijkerman et al., 1996), kicking (Murphy et al., 2001), and skin-popping (Binswanger et al., 2000; Ebright & Pieper, 2002; Fink et al., 2013; Murphy et al., 2001; Phillips & Stein, 2010). We found that they were also associated with injecting in the company of a partner or family member. This finding suggests that there may be an ecology of common transmissible bacterial pathogens associated with skin infection, such as *Staphylococcus aureus*, among the immediate social network of IDUs (Quagliarello et al., 2002). The consistent finding of greater abscess risk in women may be physiological or related to social factors such as greater perceived security while injecting around family members or partners (Tortu et al., 2003; Wagner et al., 2010).

Abscesses were more frequent among women, especially Caucasian women. Among women of all races, those women with abscesses may have been less experienced with injection or safer injection practices overall. In addition to these factors, there may be additional unmeasured social and/or behavioral factors, including different injection habits, among Caucasian female IDUs in particular that may convey risk. Conversely, African American male IDUs may learn other, potentially skin-protective and safer injection habits not captured in this survey-based study. African Americans may have also had increased exposure to harm reduction messages over a longer period of time than Caucasians. The racial disparity in abscess prevalence observed here is consistent with prior study suggesting that Caucasians practice riskier injection behaviors compared to their African American peers (Bourgois et al., 2006; Williams et al., 2013).

Contrary to other studies, speedballing was not correlated with a current abscess or abscess history. We suspect that this is partly due to the racial differences in drug preference and abscess risk among our study participants, as African Americans more commonly reported daily use of speedball (data not shown), yet abscesses were marginally more common in Caucasians.

Chronic wounds in IDUs often persist due to the accumulation of venous trauma, which may partly explain why these wounds were associated with an injection history > 15 years. Cleaning the skin with alcohol or even with water only before injection appeared protective against current chronic wounds. It is unclear why this hygiene measure was not significant in statistical models of the other wound outcomes. In contrast to cleaning the skin, cleaning needles with bleach upon reuse, versus using water, was associated with individuals who had a current chronic wound. This association might suggest that individuals with chronic wounds have different habits of local peri-injection skin care, possibly as a result of living with a chronic wound. Older individuals may have also internalized harm reduction messages over a longer period of time, perhaps influencing their behavior towards a type of needle cleaning advocated by harm reduction providers. Despite being more careful to clean

needles before reuse, our analysis suggests that older individuals are less likely to clean their skin before injection. The reasons for these differences in pre-injection behavior among individuals with chronic wounds are unclear and suggest further study is necessary.

Our study had limitations. The survey was primarily conducted in the morning and early afternoons, potentially excluding more nocturnal clients. Participants were active members of the BNEP, and therefore they may report different injection and skin care practices than IDUs not accessing community-based harm reduction services and education. Our survey-based design also provided interesting associations that require further study. Finally, the survey relied upon self-reported data. Despite these potential limitations, we report for the first time risk factors for both acute and chronic wounds in a mobile metropolitan needle exchange program in Baltimore City. To our knowledge, acute and chronic wounds and their associated risk factors have not been evaluated jointly in comparable IDU populations.

## CONCLUSIONS

Abscesses and chronic wounds are highly prevalent in the IDU community. Chronic wounds in IDUs in particular have been understudied. This study offers insight into behavioral, environmental and biological risk factors associated with these wound types, which can help guide intervention efforts. Future public health interventions to address abscesses and chronic wounds among IDUs should be targeted at especially vulnerable populations, including women and individuals reusing and cleaning needles. Additionally, there may be racial differences in access to wound care that require further study. Harm reduction education could stress the deleterious effect of skin-popping and kicking and raise awareness of injection-related, irreversible venous disease. Furthermore, specialized wound care services could improve the quality of life of IDUs given the high prevalence of wounds within this population. A sustainable, ongoing mobile wound program for IDUs may also limit healthcare costs by reducing unnecessary ER visits and hospitalizations through prompt treatment and prevention of secondary infections.

## Acknowledgments

### Source of Support:

This work was supported by The Johns Hopkins Undergraduate Woodrow Wilson Research Fellowship Program (MES), The Johns Hopkins University Center for AIDS Research, Baltimore HIV/AIDS Scholars Program 1P30A1094189 (MES), and The National Institutes of Health K23AI083100 (KEJ).

The authors would like to acknowledge the Baltimore City Health Department Office of Community Risk Reduction Services, the Needle Exchange Program staff, clients, and study participants, the Johns Hopkins Bayview Medical Center Division of Infectious Diseases, and the Johns Hopkins Wound Healing Center. We would also like to thank Dr. Susan Sherman for her thoughtful input. This work was supported by The Johns Hopkins University Woodrow Wilson Undergraduate Research Fellowship Program (MES); The Johns Hopkins University Center for AIDS Research, Baltimore HIV/AIDS Scholars Program 1P30A1094189 (MES); and The National Institutes of Health K23AI083100 (KEJ).

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TABLE 1

Description of Population for all Participants and by Current Wound Status

Description	All participants (N=152)	Current Abscess (N=27)	Current Chronic Wounds (N=30)
	No. (%)	No. (%)	No. (%)
<b>Demographics</b>			
Age*	45; (35–52)	44; (35–50)	45.5; (42–57)
Gender			
Male	96 (63.2)	12 (44.4)	17 (56.7)
Female	56 (36.8)	15 (55.6)	13 (43.3)
Race			
Caucasian	75 (49.3)	17 (63.0)	12 (40.0)
African American	68 (44.7)	8 (29.6)	15 (50.0)
Native American	4 (2.6)	2 (7.4)	3 (10.0)
Other or Multiple†	5 (3.3)	0 (0.0)	0 (0.0)
Housing‡			
Stable housing	113 (74.3)	21 (77.8)	25 (83.3)
Unstable housing	39 (25.7)	6 (22.2)	5 (16.7)
<b>Injection Practices</b>			
Years injecting drugs			
2	15 (9.9)	3 (11.1)	1 (3.3)
3–8	25 (16.4)	6 (22.2)	2 (6.7)
9–14	20 (13.2)	6 (22.2)	3 (10.0)
15	92 (60.5)	12 (44.4)	24 (80.0)
Heroin			
Never	7 (4.6)	1 (3.7)	4 (13.3)
Sometimes	24 (15.8)	1 (3.7)	4 (13.3)
Every day	121 (79.6)	25 (92.6)	22 (73.3)
Cocaine			
Never	53 (34.9)	9 (33.3)	11 (36.7)
Sometimes	45 (29.6)	5 (18.5)	7 (23.3)
Every day	54 (35.5)	13 (48.1)	12 (40.0)
Speedball			
Never	49 (32.2)	8 (29.6)	9 (30.0)
Sometimes	54 (35.5)	8 (29.6)	9 (30.0)
Every day	49 (32.2)	11 (40.7)	12 (40.0)
Skin-popping (N=151)	17 (11.3)	8 (29.6)	6 (20.0)
Use of Filters	147 (96.7)	26 (96.3)	27 (90.0)
With whom do you inject?			
Alone	77 (50.7)	9 (33.3)	16 (53.3)
Friends	39 (25.7)	6 (22.2)	9 (30.0)
Family member or partner	33 (21.7)	11 (40.7)	4 (13.3)

	<b>All participants (N=152)</b>	<b>Current Abscess (N=27)</b>	<b>Current Chronic Wounds (N=30)</b>
<b>Description</b>	<b>No. (%)</b>	<b>No. (%)</b>	<b>No. (%)</b>
Other	3 (2.0)	1 (3.7)	1 (3.3)
Most frequent method of cleaning injection site before injecting			
Do not clean	35 (23.0)	7 (25.9)	10 (33.3)
Water	12 (7.9)	2 (7.4)	1 (3.3)
Soap/water	14 (9.2)	4 (14.8)	1 (3.3)
Alcohol	83 (54.6)	13 (48.1)	16 (53.3)
Other <sup>§</sup>	8 (5.3)	1 (3.7)	1 (3.3)

\* Median; (Interquartile range).

<sup>†</sup> Hispanic, Asian, multiple.

<sup>‡</sup> Unstable includes living in shelter, on the streets, in an abandoned unit, no set place, or multiple. Stable housing includes living in an owned/rented house, subsidized housing, with a friend, other (e.g. transitional house).

<sup>§</sup> Including bleach, saliva, baby wipe, multiple agents.

Abscess\* and Chronic Wound† Prevalence and Characteristics for all Participants and Separated by Gender and Race Categories

TABLE 2

Description	Gender			Race				
	All Participants (N = 152)		Female (N = 56)	Male (N = 96)	African American (N = 68)		Native American (N = 4)	Other (N = 5)
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Current chronic wound	30 (19.7)	15 (26.8)	12 (12.5)	17 (22.7)	8 (11.8)	3 (75.0)	0 (0.0)	
Current abscess	27 (17.8)	13 (23.2)	17 (17.7)	12 (16.0)	15 (22.1)	2 (50.0)	0 (0.0)	
Chronic wound history ‡,§	24 (19.7)	28 (68.3)	42 (50.0)	40 (69.0)	26 (43.3)	0 (0.0)	1 (20.0)	
Abscess history ‡,*	70 (56.0)	7 (16.3)	17 (21.5)	14 (22.2)	9 (17.0)	1 (50.0)	3 (60.0)	
Overall prevalence of wounds**	53 (34.9)	25 (44.6)	28 (29.2)	26 (34.7)	23 (33.8)	4 (100.0)	0 (0.0)	
Current chronic wound location	(N = 30)	(N = 13)	(N = 17)	(N = 12)	(N = 15)	(N = 3)	***	
Arm	4 (13.3)	2 (15.4)	2 (11.8)	1 (8.3)	2 (13.3)	1 (33.3)		
Leg	19 (63.3)	8 (61.5)	11 (64.7)	7 (58.3)	10 (66.7)	2 (66.7)		
Buttocks	1 (3.3)	1 (7.7)	0 (0.0)	1 (8.3)	0 (0.0)	0 (0.0)		
Other	6 (20.0)	2 (15.4)	4 (23.5)	3 (25.0)	3 (20.0)	0 (0.0)		
Current abscess location	(N = 27)	(N = 15)	(N = 12)	(N = 17)	(N = 8)	(N = 2)	***	
Arm	13 (48.1)	7 (46.7)	6 (50.0)	10 (58.8)	2 (25.0)	1 (50.0)		
Leg	7 (25.9)	4 (26.7)	3 (25.0)	4 (23.5)	2 (25.0)	1 (50.0)		
Hand	3 (11.1)	2 (13.3)	1 (8.3)	0 (0.0)	3 (37.5)	0 (0.0)		
Foot	3 (11.1)	2 (13.3)	1 (8.3)	2 (11.8)	1 (12.5)	0 (0.0)		
Groin	1 (3.7)	0 (0.0)	1 (8.3)	1 (5.9)	0 (0.0)	0 (0.0)		

\* Defined as swollen lump under the skin lasting < 8 weeks, which is often red, warm, and painful. It may or may not have pus or be an open wound.

† Defined as open areas on the skin lasting ≥ 8 weeks.

‡ Clients who did not have a current wound were asked about their history with abscesses or chronic wounds. History included at least one prior wound that had healed before study evaluation. Number of participants answering history questions differs from general population N.

§ Chronic wound history – All: N=122; Females: N=43; Males: N=79; Caucasian: N=63; African American: N=53; Native American: N=1; Other: N=5.

• Abscess History – All: N=125; Females: N=41; Males: N=84; Caucasian: N=58; African American: N=60; Native American: N=2; Other: N=5.

\*\*\* Current wounds only, including abscesses and chronic wounds.

\*\*\*  
Not applicable, N=0 for "Other" races.

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Univariate and Multivariate Analysis of Factors Associated With a Current Abscess Among Clients of the Baltimore City Needle Exchange Program

TABLE 3

	Univariate			Multivariate (N=133) <sup>†</sup>		
	OR	95% CI	P	OR	95% CI	P
Gender						
Male	Reference			Reference		
Female	2.56	1.10–5.97	0.029*	2.35	0.72–7.64	0.156
Race <sup>‡</sup>						
African American	Reference			Reference		
Caucasian	2.20	0.88–5.49	0.091	2.21	0.64–7.58	0.207
Native American	7.50	0.92–60.90	0.059	7.35	0.48–113.36	0.153
Skin Popping						
No	Reference			Reference		
Yes	5.38	1.85–15.67	0.002*	3.31	0.63–17.29	0.156
Sharing needles						
Never	Reference			Reference		
Occasionally	0.21	0.027–1.65	0.138	0.24	0.024–2.33	0.216
Most of the time	1.40	0.14–14.08	0.774	0.74	0.014–39.52	0.881
Every time	4.21	0.25–69.71	0.316	...	...	...
Kicking						
Never	Reference			Reference		
Occasionally	3.09	1.02–9.37	0.046*	4.88	1.09–21.90	0.039*
Most of the time	...	...	...	...	...	...
Every time	0.86	0.30–2.43	0.772	1.15	0.29–4.61	0.840
With whom do you inject?						
Alone	Reference			Reference		
Friends	1.37	0.45–4.18	0.576	1.66	0.42–6.47	0.467
Family member or partner	3.78	1.38–10.31	0.009*	4.06	0.99–16.58	0.051*
Clean skin with soap before injection						
Never	Reference			Reference		

	Univariate			Multivariate (N=133) <sup>†</sup>		
	OR	95% CI	P	OR	95% CI	P
Occasionally	1.71	0.63–4.67	0.295	1.79	0.41–7.90	0.443
Most of the time	3.91	0.99–15.52	0.052	6.50	0.72–59.00	0.096
Every time	0.84	0.096–7.31	0.873	0.16	0.0053–4.58	0.281
Clean hands before injection						
Never	Reference			Reference		
Occasionally	2.13	0.72–6.33	0.174	2.30	0.54–9.86	0.262
Most of the time	0.65	0.13–3.41	0.613	0.38	0.039–3.62	0.398
Every time	2.47	0.82–7.41	0.107	2.04	0.39–10.57	0.395

Abbreviations: OR, odds ratio; CI, confidence interval.

<sup>†</sup>This multivariate model includes variables from the univariate analysis that had at least one category with  $P < 0.150$ .

<sup>‡</sup>Race categories of “Other” (Hispanic, Asian and multiple) had too few observations for both univariate and multivariate logistic regression.

<sup>§</sup>Insufficient observations for univariate or multivariate logistic regression.

\*  $P < 0.05$  by logistic regression.

**TABLE 4**  
Univariate and Multivariate Analysis of Factors Associated With a Current Chronic Wound Among Clients of the Baltimore City Needle Exchange Program

	Univariate			Multivariate (N=104) <sup>†</sup>		
	OR	95% CI	P	OR	95% CI	P
Age (years) <sup>‡</sup>	1.04	1.00–1.08	0.029*	0.88	0.78–0.99	0.032*
Race <sup>§</sup>						
African American	Reference			Reference		
Caucasian	0.67	0.29–1.56	0.357	0.38	0.053–2.74	0.337
Native American	10.6	1.03–109.45	0.047*	128.1	1.86–8800.41	0.025*
Time injecting drugs (years)						
2	Reference			Reference		
3–8	1.22	0.10–14.69	0.877	2.19	0.058–82.49	0.671
9–14	2.47	0.23–26.46	0.455	3.03	0.051–180.90	0.595
15	4.94	0.62–39.61	0.132	76.2	1.55–3753.56	0.029*
Skin Popping						
No	Reference			Reference		
Yes	2.63	0.88–7.84	0.082	3.12	0.41–23.82	0.273
Inject into leg						
No	Reference			Reference		
Yes	3.12	1.34–7.30	0.009*	3.17	0.56–18.10	0.194
Filter use						
No	Reference			Reference		
Yes	0.15	0.024–0.94	0.043*	0.11	0.0014–8.07	0.312
Cleaning skin before injection						
Do not clean	Reference			Reference		
Water	0.23	0.026–2.00	0.182	0.018	0.00054–0.60	0.025*
Soap/Water	0.19	0.022–1.67	0.135	0.14	0.0058–3.18	0.215
Alcohol	0.60	0.24–1.49	0.269	0.061	0.0064–0.58	0.015*
Bleach	**	...	...	**	...	...



	Univariate			Multivariate (N=104) <sup>‡</sup>		
	OR	95% CI	P	OR	95% CI	P
Saliva	2.50	0.14–43.97	0.531	0.22	0.0051–9.47	0.431
Multiple	0.83	0.077–9.00	0.881	0.14	0.0043–4.63	0.272
Cleaning needle with bleach upon reuse						
Water	Reference			Reference		
Bleach	4.44	1.36–14.51	0.014*	17.9	2.14–149.95	0.008*

Abbreviations: OR, odds ratio; CI, confidence interval.

<sup>‡</sup>This multivariate model includes variables from the univariate analysis that had at least one category with  $P < 0.150$ .

<sup>‡</sup>Continuous variable.

<sup>§</sup>Race categories of “Other” (Hispanic, Asian and multiple) had too few observations for both univariate and multivariate logistic regression.

\*\*\* Insufficient observations for univariate or multivariate logistic regression.

\*  $P < 0.05$  by logistic regression.