



Short report

Factors associated with recent symptoms of an injection site infection or injury among people who inject drugs in three English cities



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ABSTRACT

Background: People who inject drugs (PWID) are at risk of injection site infections and injuries. The factors associated with recent symptoms of these problems are examined.

Method: PWID recruited using respondent driven sampling, underwent a computer-assisted interview and provided a dried-blood spot sample. Weight data were examined using logistic regression.

Results: The mean age of the 855 participants was 32 years, and 25% were women. During the preceding 28 days, 94% had injected heroin and 50% crack-cocaine; with 41% injecting into their arms and 47% their groin. The passing on of used needles/syringes was reported by 9.7% and receiving by 8.0%. During the preceding 28 days, 21% reported having redness, swelling and tenderness, 6.1% an abscess, and 5.2% a sore/open wound at an injection site; with a quarter (24%) reporting one or more of these. A range of factors were associated with these symptoms; all three symptoms were associated with more frequent injection and the use of multiple injection sites; two of the symptoms were also associated with having recently overdosed and the use of particular injection sites.

Conclusions: Injection site infections and injuries are common among PWID and targeted interventions are needed to reduce risk.

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Introduction

Injection site infections and injuries are among the many problems that affect people who inject drugs (PWID) (Del Giudice, 2004; Dwyer et al., 2009; Gordon & Lowy, 2005; Hope, 2010). These can be caused by a number of factors that lead either to tissue damage or the introduction of organisms that can cause infection; including poor injection hygiene, poor injection technique, and the reuse of injection equipment (Del Giudice, 2004; Dwyer et al., 2009). Injection site injuries and infections can result in a range of symptoms, including open wounds, abscesses, and areas of redness, swelling and tenderness (cellulitis) (Dwyer et al., 2009; Gordon & Lowy, 2005; Hope, 2010). The morbidity these problems cause places a substantial burden on healthcare systems (Hope, Kimber, Hickman, Vickerman, & Ncube, 2008; Kerr et al., 2005; Marks et al., 2013; Palepu et al., 2001) and can lead to death (Hope, 2010).

The prevalence of the symptoms of recent or current injection site infections and injuries among PWID can be as high as one in three (Hope, 2010). In the UK there has, over the last decade, been concern about the extent of injection site problems among PWID (Hope et al., 2008; Marks et al., 2013). A study in 2004 estimated the annual healthcare costs in the UK for injection site infections among PWID were between £15.5 and £47 million (Hope et al., 2008), but they could be much higher (Marks et al., 2013).

Previous studies of the factors associated with symptoms of injecting site infections and injuries in the UK have recruited PWID using simple opportunistic sampling approaches. Respondent driven sampling (RDS) was used here, as this structured chain referral sampling technique allows adjustment for selection biases and is currently regarded as one of the most appropriate methods for recruiting samples of PWID (Heckathorn, 1997). This study, the first to examine injecting site infections and injuries using RDS at multiple sites, collected information on a wider range of symptoms than previous UK studies which had only examined having an “abscess or open wound” in the past year (Hope et al., 2008). This paper examines the factors associated with having had each of three different symptoms of an injection site infection or injury – redness, swelling and tenderness; an abscess; or a sore/open wound – during the preceding 28 days.

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Methods

PWID were recruited in three cities, Bristol, Leeds and Birmingham using RDS. RDS methods are explained elsewhere (Heckathorn, 1997) and the methodology used in this study has been described previously (Hope et al., 2011). Briefly, the initial recruits needed to commence RDS in each city were selected (by gender and location within the city) using street outreach and key informant referrals. Eligible participants had to be aged over 15-years, have injected during the preceding four weeks, and live within the survey area. Participants underwent a computer-assisted interview with an experienced fieldworker (who could provide clarification and assistance with categorising symptoms), provided a dried blood spot (DBS) sample (tested for antibodies to the hepatitis B core antigen [anti-HBc] and hepatitis C [anti-HCV]), and were offered an acknowledgement. They were asked to act as recruiters and those who agreed were given three uniquely numbered and date-limited coupons with instructions to give these to eligible individuals whom they knew. A single fieldwork coordinator screened all participants for eligibility and attempted repeat participations. Information on the characteristics of whom they recruited and the participants' network size were used to test for evidence of selection bias and to generate sample weights (RDSAT Version 5.4.0. Ithaca, New York: Volz E, Heckathorn DD; 2005). The study had ethical approval.

Participants were asked whether, during the preceding 28 days, they had any of these symptoms at an injection site: redness, swelling and tenderness; an abscess (a swelling containing pus); or a sore/open wound. Weighted data from those who had fully completed the questionnaire were included in the analyses (undertaken in SPSS 19). Bivariate associations between the reporting of symptoms and demographic characteristics, the drugs used, injecting practices and recruitment site were examined using the χ^2 test. Those characteristics found to be associated in the bivariate analyses ($p < 0.1$) were then entered into a logistic regression model using the forward stepwise procedure, with inclusion assessed using the likelihood ratio test (stepwise probability for inclusion 0.05, exclusion 0.1).

Results

In total, 855 individuals were recruited from the three cities (291 in Birmingham, 273 in Bristol, and 291 in Leeds). In the weighted sample, the mean age of the participants was 32 years (median 31 years), and there were 217 women (25%). Mean number of years since the participants reported first injecting was 10.6 years (median 10 years). During the preceding year, 67% (574) had been arrested, 33% (284) had been imprisoned, and 50% (430) had been homeless. For almost one-third (31%, 267) the main source of income was illicit (not employment or benefits). A fifth (19%, 167) had anti-HBc, half (50%, 431) anti-HCV, and just over two-fifths (44%, 375) reported ever having an overdose.

During the preceding 28 days, 807 (94%) had injected heroin, 430 (50%) crack-cocaine, 93 (11%) amphetamines, and 59 (6.9%) cocaine powder. During that time, almost two-fifths (39%, 330) had injected on 14 days or fewer days; with 25% (212) injecting on between 14 and 27 days, and 37% (313) on 28 days. On the last full day that they injected, 260 (30%) had injected just once, 271 (32%) twice, 163 (19%) three times, and 161 (19%) four or more times. The two most common main injection sites on the body during the preceding 28 days were the arms 41% (352) and the groin 37% (314); with 20% (167) reporting use of two body sites and 6.8% (58) three or more sites. During the preceding 28 days, 43% (364) always washed their hands before injecting, 52% (448) always swabbed their injection sites prior to injecting, 71% (607)

always cleaned their mixing containers, 35% (298) re-used a filter, and 32% (276) saved filters for reuse. The passing on of used needles/syringes in the preceding 28 days was reported by 83 (9.7%) and the receipt by 69 (8.0%).

During the preceding 28 days, 21% (177) reported having redness, swelling and tenderness, 6.1% (52) an abscess, and 5.2% (44) a sore/open wound at an injection site. Having had either an abscess or a sore/open wound at an injection site in the preceding 28 days was reported by 11% (96); with 24% (208) reporting one or more of the three symptoms.

The associations between injecting practice, the drugs used, demographic factors, and environmental factors and reporting each of the three symptoms are given in Table 1. In the multivariable analysis, reporting redness, swelling and tenderness at an injection site was found to be more common among those who had been arrested in the past year, those who reported an overdose in the past year, those who injected more frequently, and those using multiple injection sites; and was less frequent among those whose main injection site was their groin, and those who always cleaned mixing containers. An abscess at an injection site was more common among those who reported an overdose in the past year, those who injected daily, those using multiple injection sites, and those who injected into their legs; it was less common among those who always swabbed injection sites. Reporting a sore/open wound at an injection site was more frequently reported among women, those who injected daily, those using multiple injection sites, and those who reported their main source of income as being illicit.

Discussion

Recent symptoms of injection site infections and injuries were common among PWID in the three cities. Overall, a quarter reported having had at least one of the three symptoms during the preceding 28 days; with one-fifth reported having had redness, swelling and tenderness, one in 16 an abscess, and one in 20 a sore/open wound.

Firstly, it is important to consider the limitations of this study. Self-reported symptoms were used in this study and, though the accuracy of these can be questioned, studies have shown good concordance with clinical diagnosis (Morrison, Elliott, & Gruer, 1997). The comparative rarity of injecting drug use, its illegality and marginalised nature all impede the recruitment of a representative sample of PWID. This study addressed this problem by using RDS to recruit participants. Sample derived weights were then applied with the aim of correcting for possible sampling biases (Heckathorn, 1997); though it is not possible to test how successful this has been. Finally, this study recruited participants in only three cities, though these were spread across England. The findings thus need to be generalised with caution.

Previous studies in the UK had only looked at the prevalence of an "abscess or open wound" in the preceding year and typically found that around one-third of PWID had reported this (Hope et al., 2008). Studies elsewhere that had examined the prevalence of current or recent symptoms reported similar levels to those found here (Hope, 2010).

To varying extents the three symptoms considered here could be caused by an infection due to poor injection hygiene or to an injury due to poor injection technique, the reuse of needles, or injecting an acidic drug solution (Del Giudice, 2004; Dwyer et al., 2009). All three of the symptoms were associated with factors related to the frequency of injection and the body sites used. These factors have also been reported to be associated with injection site infections and injuries in previous studies (Hope et al., 2008; Lloyd-Smith et al., 2005; Salmon et al., 2009). The associations with injection in to multiple body sites and frequent injection could reflect issues with

Table 1

Factors associated with a self-reported abscess, sore/open wound, or redness, swelling and tenderness at injecting site in the previous 28 days among people who inject drugs.

Characteristics	Total	Yes		<i>p</i>	Adjusted Odds Ratio, 95% CI
Abscess^a					
Overdose					
Never	479	4.2%	20		1.00
Yes, not last year	200	6.5%	13		1.39
Yes, last year	175	11%	19	0.007	2.41
Number of days injected in last 28 days					
<14 days	330	2.1%	7		1.00
14–27 days	212	6.1%	13		2.54
28 days	313	9.9%	31	<0.001	4.30
Number of areas of body injected into last 28 days					
1	630	3.8%	24		1.00
2	167	9.6%	16		1.93
3 or more	58	21%	12	<0.001	3.17
Main injection site last 28 days					
Arms	352	5.1%	18		1.00
Groin	314	3.2%	10		0.66
Legs	89	17%	15		2.81
Other	100	9.0%	9	<0.001	1.31
Swabbed injection sites last 28 days					
Not always	407	8.6%	35		1.00
Always	448	3.8%	17	0.003	0.50
Injected cocaine last 28 days					
No	796	5.5%	44		
Yes	59	14%	8	0.013	
Injected crack last 28 days					
No	425	4.2%	18		
Yes	430	7.7%	33	0.034	
Injected heroin last 28 days					
No	48	0%	0		
Yes	807	6.4%	52	0.070	
Main source of income					
Licit	588	4.8%	28		
Illicit	267	9.0%	24	0.017	
Anti-HCV test result					
Detected	431	8.4%	36		
Not detected	424	3.8%	16	0.005	
Times injected last full day					
Once	260	3.9%	10		
Twice	271	4.4%	12		
Thrice	163	8.0%	13		
4 or more times	161	11%	17	0.017	
Washed hands before injecting last 28 days					
Not always	491	7.3%	36		
Always	364	4.4%	16	0.077	
Saved filters for reuse					
No	579	5.0%	29		
Yes	276	8.3%	23	0.056	
Sore or open wound^b					
Gender					
Male	638	4.1%	26		1.00
Female	217	8.3%	18	0.015	2.17
Main source of income					
Licit	588	3.6%	21		1.00
Illicit	267	8.7%	23	0.002	2.14
Number of days injected in last 28 days					
<14 days	330	3.5%	12		1.00
14–27 days	212	3.4%	7		0.74
28 days	313	8.1%	25	0.015	1.94
Number of areas of body injected into last 28 days					
1	630	3.1%	20		1.00
2	167	10%	17		3.34
3 or more	58	12%	7	<0.001	3.82
Injected cocaine last 28 days					
No	796	4.8%	38		
Yes	59	9.8%	6	0.093	
Injected crack last 28 days					
No	425	3.8%	16		
Yes	430	6.5%	28	0.069	
Main injection site last 28 days					
Arms	352	4.9%	17		
Groin	314	3.5%	11		
Legs	89	11%	10		
Other	100	5.6%	6	0.029	

Table 1 (Continued)

Characteristics	Total	Yes		<i>p</i>	Adjusted Odds Ratio, 95% CI	
Redness swelling and tenderness ^c						
Arrested						
Not in last year	281	16%	44		1.00	
In last year	574	23%	133	0.011	1.61	1.07 – 2.43
Overdose						
Never	479	17%	83		1.00	
Yes, not last year	200	21%	43		1.20	0.76 – 1.88
Yes, last year	175	30%	52	0.003	1.84	1.19 – 2.87
Number of days injected in last 28 days						
<14 days	330	12%	40		1.00	
14–27 days	212	25%	54		2.37	1.45 – 3.88
28 days	313	26%	83	<0.001	2.58	1.60 – 4.15
Times injected last full day						
Once	260	18%	47		1.00	
Twice	271	15%	42		1.64	0.99 – 2.70
Thrice	163	21%	34		1.48	0.86 – 2.55
4 or more times	161	33%	54	<0.001	2.04	1.22 – 3.40
Number of areas of body injected into last 28 days						
1	630	14%	90		1.00	
2	167	35%	59		2.67	1.74 – 4.10
3 or more	58	49%	28	<0.001	3.55	1.89 – 6.70
Main injection site last 28 days						
Arms	352	24%	86		1.00	
Groin	314	11%	36		0.44	0.28 – 0.68
Legs	89	26%	23		0.80	0.44 – 1.46
Other	100	33%	33	<0.001	1.03	0.60 – 1.77
Clean spoon/mixing container last 28 days						
Not always	248	31%	77		1.00	
Always	607	17%	101	<0.001	0.51	0.35 – 0.74
Injected crack last 28 days						
No	425	18%	78			
Yes	430	23%	99	0.092		
Homelessness						
Never	106	12%	13			
Yes, not last year	319	20%	64			
Yes, last year	430	23%	101	0.036		
Main source of income						
Licit	588	19%	109			
Illicit	267	25%	68	0.023		
Recruitment site						
Bristol	273	28%	77			
Leeds	291	13%	39			
Birmingham	291	21%	61	<0.001		
Washed hands before injecting last 28 days						
Not always	491	24%	117			Not in final model
Always	364	16%	60	0.009		
Swab injection sites last 28 days						
Not always	407	24%	99			
Always	448	17%	78	0.013		
Re-used filter last 28 days						
No	557	18%	100			
Yes	298	26%	77	0.008		
Saved filters for reuse						
No	579	18%	102			
Yes	276	27%	75	0.001		
Passed on used needles or syringes last 28 days						
No	772	19%	147			
Yes	83	36%	30	<0.001		
Received used needles or syringes last 28 days						
No	786	20%	157			
Yes	69	29%	20	0.077		

^a No associations found with gender, age, years since first injected, injecting amphetamine last 28 days, homelessness, arrested last year, imprisonment, recruitment site, having anti-HBc, cleaning mixing containers last 28 days, re-using of filters last 28 days, passing on used needles/syringes last 28 days, or receiving used needles/syringes last 28 days.

^b No associations found with age, years since first injected, injecting amphetamine last 28 days, injecting heroin last 28 days, homelessness, arrested last year, imprisonment, recruitment site, having anti-HBc, having anti-HCV, times injected last full day, washing hands before injecting last 28 days, swabbing injection sites last 28 days, cleaning mixing containers last 28 days, re-using of filters last 28 days, saving filters for reuse, passing on used needles/syringes last 28 days, or receiving used needles/syringes last 28 days.

^c No associations found with gender, age, years since first injected, injecting amphetamine last 28 days, injected cocaine last 28 days, injecting heroin last 28 days, imprisonment, having anti-HBc, and having anti-HCV.

vascular access, for example, because of venous sclerosis caused by past injecting practice (Harris & Rhodes, 2012). This would result in intravenous injection becoming more difficult, leading to 'missed' injections, multiple attempts to inject, and the use of several body sites.

A range of other factors were also found to be associated with at least one of the symptoms considered here, and these too have been reported in previous studies, they were: demographic factors, including gender (Hope et al., 2008; Lloyd-Smith et al., 2005); environmental and social factors, such as contact with the criminal justice system (Pollini et al., 2010); the types drug being used (Hope et al., 2008; Pollini et al., 2010; Salmon et al., 2009); injection related hygiene such as cleaning injecting equipment (Dwyer et al., 2009; Hope et al., 2008; Lloyd-Smith et al., 2005), having overdosed (Salmon et al., 2009); and general health, such as having hepatitis C (Hope et al., 2008; Lloyd-Smith et al., 2005).

The variability in the factors associated with each of the three symptoms possibly reflects differences in their aetiologies. It also indicates that those who inject into their legs are particularly vulnerable to abscesses, and that women and those with illicit incomes are more at risk of sores or open wounds. Whilst these associations need further examination, they do suggest groups requiring tailored information and advice. Overall the findings indicate that preventive interventions to reduce injection site infections and injuries among PWID need to target those who use multiple injection sites, who injected more frequently, and who have recently overdosed.

Interventions need to be developed and evaluated to address injection hygiene, the management of injections sites and encourage safe injecting practice (Hope, 2010). In addition to encouraging good hygiene – for example through provision of pre-injection swabs, mixing containers, and filters – interventions should also incorporate ways to support the maintenance of good vein health (Harris & Rhodes, 2012). This could be through improving understanding of the damage caused by blunt needles and not rotating injecting sites, supported by the provision of easy access clinics that offer injection site care (Harris & Rhodes, 2012; Hope, 2010). In addition, studies indicate that PWID tend not to seek timely medical care for their injecting-related health problems, often resulting in costly emergency treatment (Hope et al., 2008), thus interventions that support prompt healthcare seeking are also needed (Hope, 2010). The UK has extensive provision of needle and syringe programmes which could provide an appropriate infrastructure for the provision of interventions that address injection site infections and injuries.

This study, the first using RDS at multiple sites to explore this topic, confirms that injection site infections and injuries are common among PWID and are particularly associated with frequent injection and the use of multiple injection sites. Interventions to reduce the level of injection site infections and injuries among PWID need to be developed and evaluated, as the healthcare burden resulting from these is likely to be substantial (Marks et al., 2013).

Authors' contributions

All authors contributed to preparing the manuscript, with VH coordinating. VH, JP & MH contributed to the design of the study,

with VH & MH leading the study implementation. Analyses were undertaken by VH.

The authors have no current or past competing or conflicting interests in relation this.

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Conflict of interest statement

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References

- Del Giudice, P. (2004). Cutaneous complications of intravenous drug abuse. *British Journal of Dermatology*, 150, 1–10.
- Dwyer, R., Topp, L., Maher, L., Power, R., Hellard, M., Walsh, N., et al. (2009). Prevalences and correlates of non-viral injecting-related injuries and diseases in a convenience sample of Australian injecting drug users. *Drug and Alcohol Dependence*, 100, 9–16.
- Gordon, R., & Lowy, F. (2005). Bacterial infections in drug users. *The New England Journal of Medicine*, 353, 1945–1954.
- Harris, M., & Rhodes, T. (2012). Venous access and care: Harnessing pragmatics in harm reduction for people who inject drugs. *Addiction*, 107(6), 1090–1096.
- Heckathorn, D. (1997). Respondent-driven sampling: A new approach to the study of hidden populations. *Social Problems*, 44, 174–199.
- Hope, V. (2010). Neglected infections, real harms: A global scoping of injection-related bacterial infections and responses. In C. Cook (Ed.), *The global state of harm reduction: Key issues for broadening the response* (pp. 89–96). London: International Harm Reduction Association.
- Hope, V., Hickman, M., Ngui, S., Jones, S., Telfer, M., Bizzarri, M., et al. (2011). Measuring the incidence, prevalence and genetic relatedness of hepatitis C infections among a community recruited sample of injecting drug users, using dried blood spots. *Journal of Viral Hepatitis*, 18, 262–270.
- Hope, V., Kimber, J., Hickman, M., Vickerman, P., & Ncube, F. (2008). Factors and cost associated with symptoms with injection site infections in England: Findings from a multi-site survey. *BMC Infectious Diseases*, 8, 120.
- Kerr, T., Wood, E., Grafstein, E., Ishida, T., Shannon, K., Lai, C., et al. (2005). High rates of primary care and emergency department use among injection drug users in Vancouver. *Journal of Public Health (Oxford)*, 27, 62–66.
- Lloyd-Smith, E., Kerr, T., Hogg, R., Li, K., Montaner, J., & Wood, E. (2005). Prevalence and correlates of abscesses among a cohort of injection drug users. *Harm Reduction Journal*, 2, 24.
- Marks, M., Pollock, E., Armstrong, M., Morris-Jones, S., Kidd, M., Gothard, P., et al. (2013). Needles and the damage done: Reasons for admission and financial costs associated with injecting drug use in a Central London Teaching Hospital. *Journal of Infection*, 66, 95–102.
- Morrison, A., Elliott, L., & Gruer, L. (1997). Injecting-related harm and treatment seeking behaviour among injecting drug users. *Addiction*, 92, 1349–1352.
- Palepu, A., Tyndall, M., Leon, H., Muller, J., O'Shaughnessy, M., Schechter, M., et al. (2001). Hospital utilization and costs in a cohort of injection drug users. *Canadian Medical Association Journal*, 165, 415–420.
- Pollini, R., Gallardo, M., Hasan, S., Minuto, J., Lozada, R., Vera, A., et al. (2010). High prevalence of abscesses and self-treatment among injection drug users in Tijuana, Mexico. *International Journal of Infectious Diseases*, 14(Suppl. 3), e117–e122.
- Salmon, A., Dwyer, R., Jauncey, M., van Beek, I., Topp, L., & Maher, L. (2009). Injecting-related injury and disease among clients of a supervised injecting facility. *Drug and Alcohol Dependence*, 101, 132–136.