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## The extent of injection site infection in injecting drug users: findings from a national surveillance study

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### SUMMARY

Injection site infections in injecting drug users (IDUs) are associated with serious morbidity and healthcare costs. Factors associated with symptoms of these were examined through annual (2006–2008) unlinked-anonymous survey of IDUs in England, Wales and Northern Ireland. Overall 36% (1863/5209) self-reported having a symptom with no trend over time (35% 2006, 37% 2007, 34% 2008). Symptoms were less common in the North East of England; increased with years injecting; and were higher in women, those recently homeless, those recently using a needle exchange, and those injecting both opiates and stimulants. Of those injecting during the previous 4 weeks ( $n = 3733$ ) symptoms were associated with: injecting daily; injecting  $\geq 10$  times a day; injecting into hands, groin, or legs; sharing filters; and reusing water to flush syringes. Symptoms of injection site infections are common in IDUs. Better-targeted preventive interventions are needed, and continued surveillance should assist with assessing the impact of new initiatives.

**Key words:** Injecting drug-users (IDUs), skin infections, surveillance.

### INTRODUCTION

Injection sites are susceptible to a wide range of bacterial infections; as result of poor hygiene injecting drug users (IDUs) are particularly vulnerable to such infections. These bacterial infections can result in illnesses ranging from localized infections of the skin and soft tissues, such as abscesses and cellulitis, to systemic and toxin-producing infections, such as endocarditis and botulism [1, 2]. These infections can be serious, requiring costly in-patient intervention and can also lead to death [1, 2]. The prevalence of recent

or current skin and soft tissue infections in IDUs has been reported to be one in ten in Vancouver and Sydney [3, 4]; however, other studies from North America and in Europe indicate prevalence can be as high as one in three [5–8]. In North America these infections are the most common diagnoses in IDUs presenting to emergency departments [9, 10].

Injection site infections have been associated with poor hygiene and unsafe injection practices including: inadequate cleaning of the hands or the injection sites [11–13]; needle and syringe re-use [8, 11]; frequent injection [8, 14–16]; subcutaneous injection [6, 11]; the injection sites used [8, 13, 16]; the drugs injected [8, 11, 14, 15]; and drawing blood back into the syringe repeatedly [9]. Higher levels of these infections have also been reported to be associated with environmental factors, including poor housing and homelessness

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[3, 4, 13], and with gender [3, 4, 8, 14] and source of income [4].

Since the start of the decade there has been increasing concern in the UK about the extent of bacterial infections in IDUs [17–19]. There has been a marked rise in hospital admissions by drug users with skin and soft tissue infections, e.g. admissions due to cutaneous abscesses of trunk or groin increased from 92 to 613 (566%) between fiscal years 1997/1998 and 2003/2004 [19]. Annual reports of severe group A streptococcal infections in IDUs have increased more than tenfold from less than ten in the mid-1990s to 143 in 2004 [17], although reports have since declined [17]. There have been outbreaks of *Clostridium novyi*, tetanus and wound botulism in IDUs [20–22] in recent years. Community-acquired methicillin-resistant *Staphylococcus aureus* infection has also been reported in IDUs [23]. A community recruited study of IDUs in 2004 found that over a third (36%) of IDUs in the seven sites sampled in England reported either an abscess or open wound at an injection site in the past year, and this study estimated a healthcare burden cost of between £15.5 and £47 million per annum [8]. These infections are thus likely to place a considerable burden on health services in the UK, as has been observed elsewhere [5, 6, 16, 24], and this may be increasing [17, 19].

In response to these concerns and the limited available data on the extent of, or the factors associated with, injection site infections in IDUs, the UK's national annual unlinked anonymous sero-behavioural survey of IDUs added in 2006 the collection of self-reported data on symptoms likely to be due to bacterial infection. Using data from this system for the period 2006–2008, this paper explores the prevalence and factors associated with self-reported symptoms of injection site infections in IDUs.

## METHODS

IDUs have been recruited since 1990 into an annual voluntary unlinked-anonymous survey across England, Wales and Northern Ireland, methodological details of which have been previously published [25]. Briefly, drug agencies (both statutory and non-statutory providers of advice, needle exchange, opiate substitution therapy, or addiction treatment) invite clients who have ever injected illicit drugs to participate in the annual surveys. Those drug users who agree to take part provide an oral fluid sample and self-complete a brief surveillance questionnaire. The

oral fluid samples are tested for antibodies to HIV (anti-HIV), hepatitis C (anti-HCV) and hepatitis B core antigen (anti-HBc). The agency selection reflects the range of services provided for IDUs as well as reported geographic variations in the extent of injecting drug use, with the sampling structure reviewed regularly. The survey received multi-site approval from the London Research Ethics Committee.

The survey's questionnaire is reviewed regularly, and since 2006 it has collected information on self-reported symptoms of injection site infections. The following question was added: '*In the last year have you had a swelling containing pus (abscess), sore, or open wound at an injection site*'. These symptoms are most likely to be due to a bacterial infection, although they could have other causes.

Those taking part in the survey between 2006 and 2008 inclusive, who completed the questionnaire and reported injecting illicit opiates (e.g. heroin) or stimulants (e.g. crack-cocaine, powder cocaine, or amphetamines) in the last year were included in the analyses. All analyses were undertaken in SPSS version 17 (SPSS Inc., USA). Univariate associations between the reporting of symptoms and the following variables were examined using the  $\chi^2$  test: demographic, service use and environmental characteristics; the drugs used; region of recruitment; and survey year. Those characteristics found to be associated in the univariate analysis were then entered using the forward stepwise procedure in SPSS into a logistic regression model with inclusion assessed using the likelihood ratio (with the stepwise probability for inclusion of 0.05 and exclusion of 0.1). As information on injecting practice such as frequency of injection, equipment sharing, and the body sites used for injection was collected only from those who reported injecting in the 4 weeks prior to taking part in the survey (current IDUs) a second analysis examining associations between injecting practice and reported symptoms was undertaken using this subgroup.

## RESULTS

Over the 3-year period there were 5209 participations by drug users who had injected illicit opiates or stimulants in the preceding year. Of these, 25% (1313) were female, 16% (821) were aged <25 years (mean age 32.5, median 32 years), and 24% (1230) had been injecting for <5 years (mean number of years since first injected 10.6, median 9). Just over two-thirds (69%, 3570) reported currently receiving prescribed

medication for their drug use (such as opiate substitution therapy), and 89% (4643) reported using a needle exchange service in the previous 12 months. Over half (56%, 2898) had injected both opiates and stimulants during the last year, with two fifths (40%, 2105) having injected only opiates and 4% (206) having injected only stimulants. During the year preceding participation 42% (2194) reported being homeless and 35% (1315) reported having been imprisoned.

Overall, 36% (1863) report having a 'swelling containing pus (abscess), sore, or open wound' at an injection site during the previous 12 months. This varied little over the 3-year period with 35%, 37% and 34% reporting this in 2006, 2007 and 2008, respectively (Table 1). Univariate associations between characteristics and the reporting of injection site symptoms are shown in Table 1. In the multivariable analysis a higher level of reported symptoms was found in 2007 compared to the other 2 years, suggesting a fluctuating level, but no trend, over time. Reporting symptoms was less common in the North East region compared to the other regions of England, Wales and Northern Ireland (Table 1). The reporting of symptoms increased with number of years injecting, and was higher in women, those recently homeless, those having recently used a needle exchange service, and those reporting injecting both opiates and stimulants, but lower in those only injecting stimulants (Table 1).

There were 3733 participations by those who reported last injecting during the preceding 4 weeks, representing 72% of those who had injected during the 12 months prior to participation. Of these current IDUs, 24% (913) were female, 17% (623) were aged <25 years (mean age 32.3, median 32 years), and 24% (893) had been injecting for <5 years (mean number of years since first injected 10.4, median 9). Those who had injected in the last month had similar levels of imprisonment and homelessness as those who had not. However, more of them had used a needle exchange (93% vs. 80%,  $\chi^2_{(1)}=179.5$ ,  $P<0.001$ ), fewer of them were currently receiving prescribed treatment for their drug use (66% vs. 75%,  $\chi^2_{(2)}=51.9$ ,  $P<0.001$ ), and more of them were injecting both opiates and stimulants (58% vs. 49%,  $\chi^2_{(2)}=36.1$ ,  $P<0.001$ ).

Of those who had injected during the preceding 4 weeks 37% (1375) reported having a 'swelling containing pus (abscess), sore, or open wound' at an injection site during the previous 12 months. The associations between reporting a symptom in the last

year and reported injecting practice in the last month are shown in Table 2. In the multivariable analysis higher levels of reported symptoms were associated with the following injecting practices: injecting daily; injecting  $\geq 10$  times a day; injecting into the hand, groin, or legs; sharing filters; and reusing water to flush syringes (Table 2).

## DISCUSSION

Symptoms of injection site infections are common in IDUs throughout England, Wales and Northern Ireland. These symptoms were reported by just over a third of IDUs, and while the level fluctuated over the 3 years examined, there was no clear trend. These symptoms were associated with injecting both opiates and stimulants, having been injecting for a long time, being female, homeless, and with recent use of a needle exchange. Symptoms were also associated with more frequent injection, use of particular body sites for injection, and the reuse of filters and flushing water.

The high prevalence of self-reported injection site infections found in this study, supports previous finding from England [8] and also elsewhere [3–7]. The costs associated with injection site infections are considerable, with conservative estimates for England suggesting total costs of at least £15.5–19.5 million per annum, but possibly as high as £47 million in 2006. Overall healthcare costs related to problematic drug use, both injecting and non-injecting, in England have been estimated to be around £500 million per annum in the financial year 2003/2004 [26], with £25 million of this due to bloodborne viruses (HIV, hepatitis B and C) in IDUs.

Injection site infections thus place a considerable burden on the healthcare system that may be greater than that due to infections by bloodborne viruses. The high costs associated with injection site bacterial infections are in part likely to be due to delays in seeking healthcare. Studies suggest that IDUs tend not to seek timely medical care for their injecting-related health problems, often resulting in emergency treatment at considerable cost [8, 10, 24, 27, 28]. The failure to seek earlier treatment probably reflects obstacles, e.g. barriers to accessing care and poor compliance with medication and follow-up care, and competing priorities such as obtaining money and acquiring and using drugs [10, 24, 28, 29]. Thus, the high levels of reported symptoms found here are a concern and highlight the need for interventions. Targeted prevention

Table 1. Factors associated with a self-reported abscess, sore or open wound at injecting site in the previous 12 months: injecting drug users, 2006–2008

Characteristic	Abscess, sore or open wound			Adjusted odds ratio (95% CI)
	Yes (%), n	Total		
Gender	Male	34% 1338	3896	1.00
	Female	40% 525	1313	1.43 (1.25–1.64)
	$\chi^2 = 13.61$	$P < 0.001$		
Age (yr)	<25	30% 249	821	†
	25–29	33% 397	1214	
	30–34	35% 410	1174	
	35–39	40% 419	1045	
	≥40	41% 388	955	
	$\chi^2 = 34.24$	$P < 0.001$		
Region/country	East England	35% 82	233	1.00
	London	41% 290	708	1.14 (0.83–1.56)
	South East	40% 345	866	1.11 (0.82–1.51)
	South West	40% 250	620	1.20 (0.87–1.65)
	West Midlands	33% 119	356	0.93 (0.65–1.33)
	North West	38% 282	747	0.98 (0.71–1.34)
	Yorkshire & Humber	33% 47	141	0.93 (0.59–1.45)
	East Midlands	31% 160	516	0.82 (0.59–1.15)
	North East	26% 133	507	0.67 (0.47–0.94)
	Wales	31% 98	320	0.81 (0.56–1.17)
	Northern Ireland	29% 57	195	0.83 (0.55–1.26)
	$\chi^2 = 55.14$	$P < 0.001$		
Survey year	2006	35% 587	1695	1.00
	2007	38% 718	1893	1.18 (1.03–1.36)
	2008	34% 558	1621	1.00 (0.86–1.15)
	$\chi^2 = 6.08$	$P = 0.05$		
Years since first injected	<5 years	29% 361	1230	1.00
	5–9 years	35% 510	1448	1.30 (1.10–1.54)
	10–14 years	36% 424	1172	1.38 (1.15–1.64)
	≥15 years	42% 568	1359	1.74 (1.46–2.06)
$\chi^2 = 43.82$	$P < 0.001$			
Drug types used last year	Opiate, no stimulant	33% 688	2105	1.00
	Stimulant, no opiate	19% 39	206	0.49 (0.34–0.71)
	Stimulant and opiate	39% 1136	2898	1.24 (1.09–1.40)
	$\chi^2 = 48.98$	$P < 0.001$		
Prescribed treatment for their drug use	Never in treatment	29% 206	706	†
	Currently scripted	37% 1321	3570	
	Previously scripted	36% 336	933	
$\chi^2 = 15.74$	$P < 0.001$			
Used needle exchange last year	No	27% 150	566	1.00
	Yes	37% 1713	4643	1.65 (1.35–2.01)
$\chi^2 = 23.72$	$P < 0.001$			
Anti-HIV status	Positive	46% 26	56	†
	Negative	36% 1837	5153	
$\chi^2 = 2.80$	$P = 0.09$			
Anti-HCV status	Positive	39% 854	2163	†
	Negative	33% 1009	3046	
$\chi^2 = 22.25$	$P < 0.001$			
Homeless last year	No	34% 1022	3015	1.00
	Yes	38% 841	2194	1.18 (1.05–1.33)
$\chi^2 = 10.87$				
Ever imprisoned	No	34% 536	1570	‡
	Yes, not last year	37% 844	2289	
	Yes, in last year	36% 469	1315	
$\chi^2 = 3.03$	$P = 0.22$			

CI, Confidence interval.

† Not in final multivariable model.

‡ Not entered into multivariable analysis.

Table 2. *Injecting practices in last month associated with a self-reported abscess, sore or open wound at injecting site during the previous 12 months, injecting drug users 2006–2008*

Characteristic	Abscess, sore or open wound			Adjusted odds ratio (95% CI)	
	Yes (% , n)	Total			
Times injected last full day	1	30% 321	1068	1.00	
	2–4	38% 856	2252	1.14 (0.95–1.36)	
	5–9	45% 159	352	1.32 (0.99–1.76)	
	≥10	64% 39	61	2.99 (1.65–5.44)	
	$\chi^2=52.20$	$P<0.001$			
Number of days injected last 4 weeks	<14	32% 411	1291	1.00	
	14–27	36% 285	800	1.07 (0.87–1.31)	
	≥28	41% 679	1642	1.23 (1.03–1.48)	
	$\chi^2=28.77$	$P<0.001$			
Shared needles and syringes last 4 weeks	No	35% 1014	2917	†	
	Yes	44% 361	816		
	$\chi^2=24.62$	$P<0.001$			
Shared spoons last 4 weeks	No	33% 767	2340	†	
	Yes	44% 608	1393		
	$\chi^2=44.34$	$P<0.001$			
Shared filters last 4 weeks	No	33% 831	2525	1.00	
	Yes	45% 544	1208	1.31 (1.09–1.59)	
	$\chi^2=51.61$	$P<0.001$			
Shared water for drug preparation last 4 weeks	No	35% 1068	3057	†	
	Yes	45% 307	676		
	$\chi^2=26.12$	$P<0.001$			
Shared water for flushing works last 4 weeks	No	34% 996	2914	1.00	
	Yes	46% 379	819	1.28 (1.03–1.59)	
	$\chi^2=40.21$	$P<0.001$			
Injected into arms last 4 weeks	Yes	36% 836	2352	†	
	No	39% 539	1381		
	$\chi^2=4.54$	$P=0.03$			
Injected in to hands last 4 weeks	Yes	48% 448	936	1.54 (1.29–1.82)	
	No	33% 927	2797	1.00	
	$\chi^2=65.32$	$P<0.001$			
Injected in to groin last 4 weeks	Yes	39% 491	1248	1.28 (1.09–1.51)	
	No	36% 884	2485	1.00	
	$\chi^2=5.07$	$P=0.02$			
Injected in to legs last 4 weeks	Yes	62% 426	683	3.24 (2.69–3.90)	
	No	31% 949	3,050	1.00	
	$\chi^2=234.33$	$P<0.001$			
Injected in to feet last 4 weeks	Yes	58% 245	422	†	
	No	34% 1130	3311		
	$\chi^2=92.11$	$P<0.001$			
Gender	Male	35% 989	2820	1.00	
	Female	42% 386	913	1.41 (1.19–1.66)	
	$\chi^2=15.40$	$P<0.001$			
Region/country	East England	34% 48	142	1.00	
	London	45% 205	458	1.52 (1.00–2.33)	
	South East	41% 272	660	1.32 (0.88–1.98)	
	South West	40% 182	454	1.27 (0.83–1.94)	
	West Midlands	36% 99	278	1.26 (0.80–1.98)	
	North West	40% 224	561	1.40 (0.93–2.12)	
	Yorkshire & Humber	36% 27	74	1.31 (0.70–2.46)	
	East Midlands	30% 121	406	0.82 (0.53–1.27)	
	North East	25% 105	415	0.73 (0.47–1.14)	
	Wales	31% 62	201	0.99 (0.61–1.62)	
	Northern Ireland	36% 30	84	1.67 (0.92–3.03)	
		$\chi^2=58.41$	$P<0.001$		

Table 2 (cont.)

Characteristic	Abscess, sore or open wound			Adjusted odds ratio (95% CI)	
	Yes (%), n	Total			
Survey year	2006	36%	450	} †	
	2007	39%	529		
	2008	35%	396		
	$\chi^2 = 5.50$	$P = 0.064$			
Drug types used last year	Opiate, no stimulant	34%	484	1.00	
	Stimulant, no opiate	21%	30	0.47 (0.30–0.75)	
	Stimulant and opiate	40%	861	1.06 (0.91–1.24)	
	$\chi^2 = 27.39$	$P < 0.001$			
Years since first injected	< 5 years	30%	266	893	1.00
	5–9 years	36%	385	1055	1.27 (1.03–1.56)
	10–14 years	38%	317	839	1.24 (1.00–1.54)
	$\geq 15$ years	43%	407	946	1.46 (1.18–1.82)
	$\chi^2 = 35.01$	$P < 0.001$			
Used needle exchange last year	No	28%	75	270	1.00
	Yes	38%	1300	3463	1.44 (1.07–1.93)
	$\chi^2 = 10.26$	$P = 0.001$			
Homeless last year	No	35%	746	2145	} †
	Yes	40%	629	1588	
	$\chi^2 = 9.15$	$P = 0.002$			

CI, Confidence interval.

† Not in final multivariable model.

and healthcare have been shown to reduce emergency department attendances, the need for surgery, and in-patient days [30, 31].

The current study found that frequent injection, the use of certain injection sites (hand, groin, legs), and the reuse of injecting paraphernalia were all associated with reporting symptoms of injection site infections during the last year. Previous studies have found similar associations [8, 11, 12, 14, 15], and also associations with inadequate washing of hands or cleaning of the injection sites [6, 11, 12], and the use of multiple injection sites [11, 12]. The associations with particular injection sites needs further examination, but may reflect some of these sites being more difficult to keep clean or the need to use certain sites due to others becoming unusable due to vascular damage, injury, or infection. The association with femoral ('groin') injection in the current study is of particular concern as this practice has become more common in the UK over the last decade [32], with indications of increased hospital admissions related to femoral injection in IDUs [19].

The association with injecting both opiates and stimulants is a concern. The mostly widely injected stimulant in the UK is crack-cocaine, with this often being injected either in combination or in parallel with

heroin. A previous study in England found that those reporting crack-cocaine use also reported higher levels of injection site infections, and studies elsewhere have observed similar associations with injection of cocaine [7, 10] and heroin and cocaine combinations [11, 15]. There is also evidence that suggests that crack-cocaine use, which has been associated with risky behaviours [32, 33], has become more common in the UK in recent years [34].

Women were more likely to report an injection site infection, and this has also been found in other studies [7, 8, 11, 15]. This could reflect a greater awareness of infections, and/or a greater vulnerability to injection site infections in female injectors [14]. As women are more likely to be injected by others, or to need assistance with injecting, it has been argued that as a result they may be at increased risk of exposure to contaminants [4]. The reason for the difference in prevalence with gender needs further investigation.

The positive association with needle exchange use in the last year is an interesting, if counter-intuitive, finding. However, this needs to be interpreted with care as those reporting needle exchange use in the last year will include not only those making extensive regular use of needle exchange services but also those making irregular or limited use of these services.

Studies suggest the consistent high coverage of interventions like needle exchange is needed for them to be effective against bloodborne viruses [35–37], and it is likely that such coverage issues would similarly affect their impact on injection site infections. It should also be noted that not all needle exchanges in the UK provide a full range of injecting equipment, and that some IDUs may also have accessed a needle exchange service either as a route to wound care or as a preventive measure following an injection site infection. However, this association requires further examination.

In our study homelessness was associated with higher rates of reporting of injection site symptoms, while a previous study in England did not find any association with homelessness [8]. Studies elsewhere have found similar associations with poor housing and homelessness [3, 4, 13]. Homelessness is possibly an indicator of increased rates of injection in public or semi-public environments, which has been related to poor injection hygiene [11, 12].

Preventive interventions should thus focus on further reducing the re-use of injecting equipment, and target frequent injectors, those injecting into groin, legs or hand, using both opiates and stimulants, and female injectors; these interventions should also aim to reach those who are homeless. Development of community-based interventions, such as targeted wound clinics, may be effective [30, 31]. While further work needs to identify, develop, and evaluate suitable interventions, our findings suggest a need to focus on improving injection hygiene, the better management of the body sites used for injection, and access to services, including the provision of paraphernalia and sterile water.

The 3 years' data presented here did not indicate any overall upwards or downwards trend in symptoms associated with injection site infection, with the level much the same as that found in a study of current IDUs recruited in the community at seven sites in England conducted 2 years earlier [8]. This suggests that the recent level of symptoms may have been relatively stable; however, this may not remain so. The concerns expressed earlier this decade about the extent of infections in IDUs [17–19, 21–23] have resulted in increased efforts to reduce infections, both viral and bacterial. The National Institute for Health and Clinical Excellence has recently issued guidance on optimizing needle exchange provision [38] and a national awareness and information campaign has recently been launched in England [39]. Ongoing

surveillance of symptoms of injection site infections may shed light on the impact of these initiatives.

It is important to consider the limitations and generalizability of these findings. Self-reported symptoms of injection site infections were used in this study. While some may question the accuracy of these, studies have shown good agreement between self-reported symptoms and clinical diagnosis [24]. The comparative rarity, marginalization and illegal nature of injecting drug use impedes the recruitment of a representative sample of injectors. This study aimed to minimize sampling biases and maximize representativeness by using an established survey utilizing widespread service provision as a sampling structure. However, bias might arise if those using services where the sampling occurred were either at higher or lower risk than the overall IDU population. Those not in contact with services might be those most marginalized and so at highest risk but, alternatively, they may be those most stable and integrated with well-controlled drug use and so at low risk. Both of these groups are possibly under-represented; however, surveys recruiting independently of services through community settings, using a range of sampling approaches, find that most IDUs recruited in the UK have, or have recently had, service contact [40].

Taken together these findings suggest injection site infections are a common experience in IDUs in England, Wales and Northern Ireland, and that the resultant healthcare burden is substantial. Further research is also needed to explore issues around the robustness of self-reports and the relationship between reported symptoms and actual infections. Moreover, interventions need to be developed and piloted to reduce the level of infections. Continued surveillance should provide the means to shed light on the impact of new initiatives to reduce infections in IDUs.

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## DECLARATION OF INTEREST

None.

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