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Association between harm reduction intervention uptake and skin and soft tissue infections among people who inject drugs

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ABSTRACT

Background: Bacterial skin and soft tissue infections (SSTIs) are a health issue for people who inject drugs (PWID). There is a lack of evidence on the associations between harm reduction (HR) uptake and SSTIs. This paper examines the associations between the uptake of injecting equipment (IE) and opiate substitution treatment (OST) on SSTIs among PWID, and the injecting behaviours associated with having had a SSTI. This is the first large-scale, national study to examine the association between IE uptake and SSTIs.

Methods: A cross-sectional, voluntary and anonymous survey was undertaken with PWID recruited from pharmacies/agencies providing IE across mainland Scotland during 2013-2014. Participants were asked: if they had a SSTI within the past year; about their uptake of HR within the past 6 months (including needle/syringes (N/S), paraphernalia and OST); and about their frequency of injecting, sharing of IE and re-use of own N/S. Data from 1876 PWID who had reported injecting within the past 6 months were analysed.

Findings: In multivariate logistic regression, those with high combined IE-OST uptake (adjusted odds ratio [AOR] 0.614, 95% CI 0.458-0.823, $p = 0.001$) and medium combined IE-OST uptake (AOR 0.725, 95% CI 0.546–0.962, $p = 0.026$) had lower odds of having had a SSTI compared to those with low combined IE-OST uptake.

Conclusions: IE and OST uptake may reduce the level of SSTIs among PWID, suggesting increasing combined uptake maybe beneficial. Nevertheless, a sizeable proportion of PWID with high HR uptake experienced SSTIs, suggesting the importance of other interventions.

Keywords: people who inject drugs; skin and soft tissue infection; bacterial infection; injecting equipment; opiate substitution treatment; harm reduction

1. Introduction

Bacterial skin and soft tissue infections (SSTIs) are a health issue for people who inject drugs (PWID). Infections are caused by a number of bacteria, such as those from the injectors' own skin, and those present in contaminated drugs, cutting agents or injecting paraphernalia (Gordon and Lowy, 2005). Although most of these infections are localised, mild and superficial, they can result in serious morbidity and mortality when associated with systemic symptoms such as fever, rapid heartbeat or low blood pressure, or with a co-morbidity, sepsis syndrome or a life-threatening infection, such as necrotizing fasciitis (Dryden, 2009). Harm reduction (HR), such as the provision of sterile injecting equipment (IE) or opiate substitution treatment (OST), may be important to help prevent the potential onset of serious infection (Hope, 2010).

Commonest forms of injection site SSTIs are abscesses or cellulitis (Fink et al., 2011; Hope, 2010). Prevalence studies from Europe, North America and Australia have shown that 21% to 32% of PWID had a current abscess (Binswanger et al., 2000; Morrison et al., 1997; Saeland et al., 2014); 7% to 36% had an abscess or open wound within the past year (Dwyer et al., 2009; Hope et al., 2010; Maloney, 2010; Phillips and Stein, 2010; Public Health England et al., 2014). Re-use or sharing of unsterile needles and syringes (N/S) has been shown to be associated with increased SSTI prevalence (Hope et al., 2014b; Hope et al., 2008; Lloyd-Smith et al., 2008; Maloney, 2010), as has the re-use and sharing of injecting paraphernalia, in particular, filters and flush water (Hope et al., 2010). More frequent injecting is also associated with SSTIs (Hope et al., 2014b; Hope et al., 2010; Phillips and Stein, 2010): repeated injections damage the skin and tissues providing a focus for infection (Pieper and Hopper, 2005). Limited research exists examining the association between HR, such as IE provision and OST, and SSTIs among PWID. The total number of clean N/S distributed from a needle exchange (NE) and the opening of a NE were shown to be associated with reduced SSTI prevalence (Bhattacharya et al., 2006; Hart et al., 1989; Tomolillo et al., 2007). None of these small scale single site studies showed the level of injection equipment (IE) uptake needed per individual for use sterile IE for every injection. Those who took OST in the past but not currently had higher odds of having had a SSTI in the past year (Hope et al., 2008). Others have demonstrated that combined high uptake of N/S and OST was associated with reduced incidence of HCV among PWIDs in Scotland (Palmateer et al., 2014); and OST and IE provision services have been shown to reduce self-reported injecting risk behaviours, such as the borrowing, lending, re-use of N/S or paraphernalia, and injecting frequency (MacArthur et al., 2014); and IE provision (IEP) and OST are associated with reduced HIV infection (Degenhardt et al., 2010; Palmateer et al., 2010). Notably, no study has examined the associations between the uptake of sterile IE, or the combined effect of IE and OST uptake, on SSTIs. This paper will be unique by analysing data from a national survey of PWID conducted in Scotland. The paper also examines injecting behaviours associated with having had a SSTI.

2. Materials and methods

2.1 Data source

Data used for this paper was gathered in 2013-2014 as part of the Needle Exchange Surveillance Initiative (NESI) Scotland study. NESI is a cross sectional, voluntary, and anonymous survey, which has been on-going since 2008 (University of the West of Scotland et al., 2015). Between February 2013 and February 2014, participants were recruited from 106 pharmacies and 28 agencies providing a fixed site, mobile or outreach IEP service across Scotland's eleven mainland NHS Health Boards. Healthcare for Scotland is devolved to regional Health Boards. Trained interviewers asked eligible participants to participate in a 15 minute face-to-face questionnaire. Those eligible had

injected drugs at least once in the past and had not already participated in the current data collection sweep. The questionnaire included questions on drug use history, injecting risk behaviours and harms, IE and OST uptake and participant demographics. All participants provided informed consent, were provided with a £5 shopping-voucher and interviews were conducted in a private room. Ethics approval was obtained from the West of Scotland NHS Research Ethics Committee.

2.2 Measures

2.2.1 Outcome measure

This was measured using the question 'In the last year, have you had a swelling containing pus (abscess), a sore or open wound at an injection site?'

2.2.2 Intervention measures

HR interventions considered were IE uptake and OST, that is, methadone. These measures which were derived from the questionnaire have been used in previous work (Palmateer et al., 2014) and included uptake of: i) N/S, ii) paraphernalia, iii) combined IE (N/S and paraphernalia), iv) OST, and v) combined IE and OST.

N/S uptake was derived by dividing the self-reported number of N/S obtained in the last six months by the self-reported number of injections in the last six months. This was categorised into high and low uptake. The threshold for high uptake (200%+, at least twice as many N/S as injections) has been used in previous work, where it was chosen on the basis of sensitivity analyses (Palmateer et al., 2014). Paraphernalia uptake was derived by combining filter and spoon uptake. Those who reported high uptake (200%+) of both spoons and filters were classified as having high paraphernalia uptake, with the remaining falling into low category. A combined variable, called IE uptake, was derived where those with high uptake (200%+) on both N/S and paraphernalia were categorised as high and the remaining were categorised as low. OST uptake was defined as 'never been on OST', 'currently on OST at the time of the study' or 'on OST in the past but not currently'. A final combined uptake variable was derived by combining IE and OST uptake, with categories low, medium and high. In order to derive this combined variable, those who had 'never been on OST' or 'on OST in the past but not currently' were combined to represent not currently on OST. The 'Low combined IE-OST' uptake category included those with low IE uptake and were not currently on OST; 'medium combined IE-OST' uptake included those with either low IE uptake and were currently on OST, or had high IE uptake but were not currently on OST; 'high combined IE-OST' uptake included those who had high IE uptake and were currently on OST.

2.2.3 Injecting behaviours

Injecting behaviours included frequency of injecting, sharing IE and re-use of one's own N/S. These were self-reported and related to the past 6 months. Frequency of injection was categorised as daily or more, or less than daily. Sharing IE (including N/S, spoons and filters) was categorised as yes/no. Re-using one's own N/S was measured as yes/no to record if the N/S had been re-used more than once.

2.3 Statistical Analysis

Logistic regression was used to calculate the odds of self-reported SSTI associated with i) uptake of the HR interventions and ii) injecting behaviours. Associations between other variables and SSTI were also explored using Pearson's χ^2 test (Table 1). The confounders selected for inclusion in the multivariate logistic regression were those found to be statistically significant ($p < 0.05$) using the bivariate analysis in Table 1 and those previously found to be associated with SSTI prevalence. The potential confounders included Health Board area, time since onset of injecting, injection of more than one drug ('poly-drug use'), gender and homeless in the past six months. Poly-drug use was

included, rather than stimulant use, to incorporate the number of emerging new psychoactive substances (NPS) injectors in the sample – such as ‘Burst’. For time since onset of injecting, ‘<5 years’ and ‘5-10 years’ was collapsed to ‘<10 years’ to give a reference group with a larger sample size. Injecting risk behaviour and injecting frequency variables were not considered for the regression models examining HR interventions and SSTI because they are on the causal pathway, but injecting frequency was included as a confounder in the regression model for SSTI and sharing IE, and re-use of N/S. Multivariate regression was generated by forward step-wise analysis and was statistically significant at $p < 0.05$ (Table 2 and Table 3). Analyses were undertaken with SPSS version 22.

3. Results

Of the 2463 participants, 119 duplicate records from individuals who had participated more than once were excluded. Of the remaining 2344 respondents, those who had not injected within the past 6 months ($n=402$), those who exclusively injected bodybuilding drugs ($n=58$), as this group were less likely to have had a SSTI, and those with missing injecting status ($n=9$) were excluded. The remaining 1876 participants were analysed.

Of the sample, 28% (533/1876) had reported a SSTI in the past year, 30% (555/1866) were female, 52% (984/1875) were aged 35 years or more and 38% (714/1874) had been injecting for less than 10 years. The majority were currently prescribed methadone (71%, 1326/1875), 78% (1472/1874) had injected heroin only in the past six months and 37% (530/1436) had been homeless in the past six months, and 66% (1240/1865) were ever in-prisoned. Table 1 shows that those who had a SSTI within the past year were more likely to be from an East of Scotland Health Board area, injected for 20 years or more, or were poly-drug injectors.

[TABLE 1 IN HERE]

Table 2 presents the associations between the uptake of HR interventions in the previous 6 months and having had a SSTI within the past year. The multivariable analysis was controlled for Health Board area, years of injecting, poly-drug use, gender and homeless in the past six months. Multivariable analysis demonstrates that those with high N/S (Model 1), high paraphernalia (Model 2), high IE (Model 3) uptake all had lower odds of having had a SSTI relative to those with low uptake. N/S and paraphernalia uptake was highly correlated (CRAMERS $V = 0.79$, $p=0.000$). Those individuals who had never been on OST or were currently on OST had lower odds of having had a SSTI than those previously on OST (Model 4). Further analysis shows that those who had never been on OST were more likely to be the early-stage injectors - 72% (117/162) of those who had never been on OST had been injecting for less than 10 years compared to 35% (467/1325) of those currently on OST and 33% (129/386) of past users of OST ($\chi^2=91.04$, $p=0.000$, $n=1853$), and they were on average 3 years younger (mean = 33.61, sd = 9.39) ($F(2, 1871) = 15.59$, $p=0.00$). However, a sizeable number of those never on OST injected daily (57%, 92/162).

Model 5 examines the combined IE-OST uptake. Those individuals with the highest or complete level of uptake (high IE uptake and currently on OST), and those with medium uptake (either low IE and on OST, or high IE and no OST) had lower odds of having had a SSTI compared to those with low uptake (low IE uptake and no OST). Across all five models, those with high combined uptake had marginally the lowest odds of having had a SSTI.

Table 3 shows that those who injected daily or more, shared any IE or re-used N/S had higher odds of having had a SSTI in the past year. Notably, 21% of those who did not inject daily or more, or re-use N/S and 25% who did not share any IE still experienced a SSTI.

[TABLE 2 IN HERE]

[TABLE 3 IN HERE]

4. Discussion

Our study shows that 28% of PWID had a self-reported SSTI within the past year and those PWID with high combined IE-OST uptake or medium combined IE-OST uptake had lower odds of having had a SSTI compared to those with low combined IE-OST uptake. Nevertheless, 24% of PWID with high HR uptake still experienced a SSTI within the past year.

Our prevalence of 28% is within the range of prevalence reported internationally where 7% to 36% of PWID had an abscess or open wound within the past year (Dwyer et al., 2009; Hope et al., 2010; Maloney, 2010; Phillips and Stein, 2010). However, it is difficult to make direct comparisons with other studies due to the heterogeneity of PWID definitions, recruitment strategies and sampling.

Little is known about the impact of HR interventions on SSTIs. During the late 1980s NE services were piloted in Scotland (Stimson et al., 1988) however a need to action an expansion and improvement of IEP services across all NHS Boards and the development of guidelines was identified as part of a national Hepatitis C Action Plan (Phase II: 2008-2011) (The Scottish Government, 2008, 2010). Scotland now has a comprehensive HR programme which provides unlimited free access to IE (including N/S, spoons, filters, acidifiers, water for injection and pre-injection swabs) as advocated in national IEP guidelines, and OST, mainly via pharmacies and drug treatment agencies (The Scottish Government, 2010). The IEP guidelines focused on the prevention of HCV but they recognised that provision of sterile IE alongside safer injecting advice (washing hands with soap and water before injecting, and the correct IE usage) may also impact on SSTIs.

Our findings suggest that Scotland's HR provision of IE and OST impacts on SSTIs but it is noteworthy that a sizeable proportion of PWID with high HR uptake still experienced SSTIs. High IE uptake relative to low IE uptake within the past six months was associated with lower odds of having had a SSTI within the past year, as was being currently on OST relative to having been on OST in the past. Approximately a third of PWID with low IE or OST uptake had a SSTI within the past year, compared to approximately a quarter of PWID with high IE or OST uptake. Notably, the combined effect of high IE and OST had marginally the lowest odds of having had a SSTI. Consequently, increasing the provision of clean IE coupled with OST may be a beneficial HR intervention for SSTIs. The mismatch in timeframes for IE uptake (six months) and presence/absence of a SSTI (one year) occurred because of the nature of the data available; SSTI over a one year period was collected to allow comparability with other prevalence studies. This mismatch may tend to under-estimate the association being measured, and therefore our finding is conservative.

Further analysis showed that those who shared any IE, re-used N/S or injected daily or more had higher odds of having had a SSTI in the past year. Others have also shown that sharing or re-using

N/S is associated with increased SSTI prevalence (Hope et al., 2014a; Hope et al., 2008; Lloyd-Smith et al., 2008; Murphy et al., 2001), as is the re-use and sharing of injecting paraphernalia (Hope et al., 2010). Earlier work using previous sweeps of NESI has established that high IE uptake and being on OST reduced the odds of sharing N/S, spoons or filters, and of injecting daily or more respectively (Palmateer et al., 2014).

The uptake of at least twice as much IE as needed, that is high uptake (200%+), may be protective against SSTIs. Firstly, injectors may have difficulty accessing veins (Hope et al., 2016) and may need several needles to achieve one successful injection. Secondly, plentiful supplies cover times of poor access to IEP services, for example, Sundays or evenings. An ample supply of sterile IE may negate the need to share or re-use needles that may have become contaminated with bacteria. Bacterial contamination of injecting equipment such as syringes, cookers (Tuazon et al., 1974) and filters (Cafilisch et al., 1999; Scott, 2008) has been observed. Equally, it cannot be discounted that participants may have over-estimated their IE uptake.

Interestingly, the odds of having had a SSTI were higher among those who were previously (but not currently) on OST; this is consistent with Hope et al.'s (2008) findings, and mirrors the pattern of association between OST and HCV infection (Allen et al., 2012). The nature of this association is unclear and further research is needed. It may be suggestive of a number of factors including: those no longer on OST were those who have failed in treatment, for whatever reason, and have relapsed into injecting representing a high-risk group by possibly engaging in riskier practices which contributed to a higher SSTI occurrence (e.g. more frequent injecting, experiencing more missed hits, less cleaning of injection sites) or there is less contact with HR information/advice from drug treatment services or the factors that explain why they were no longer engaging with OST also explain the higher SSTI occurrence. Also, those PWID who had never been on OST had the lowest odds of having had a SSTI – these individuals were perhaps those with less tissue damage because of shorter injecting careers or non-progression to groin injecting. However, a sizeable proportion of those who were never on OST were frequent injectors and it may be that, in time, this group will experience more SSTIs if interventions or safer injecting practices are not taken up.

Due to the cross-sectional nature of the data collection, we cannot infer causality and need to be mindful of alternative explanations for the associations between IE/OST uptake and SSTIs – that is, high IE uptake, per se, may not be the main reason for the lower SSTI prevalence but may be a marker for other factors associated with the outcome. For example, it is possible that those who have high IE uptake were a low-risk group who engaged in other safer practices (such as hand washing, injection site cleaning or injecting site rotation not included in the model) that reduced SSTI risk. Similarly, high IE uptake may reflect PWID who use HR services more frequently and are thus more likely to receive education/support about injecting practice and hygiene.

Equally, there are many potential causes of SSTI among PWID other than sharing/re-use of IE, including environmental contamination from public injecting, groin or hand injecting, poor personal hygiene, contaminated drugs, damaged skin/tissue due to missed hits or overuse of citric acid/Vitamin C. These other causes may explain why a quarter of PWIDs had experienced a SSTI within the past year despite high HR uptake. Additionally, approximately a fifth of those who did not inject daily or had not re-used their N/S had a SSTI and a quarter of those who had not shared any piece of IE had a SSTI. In other words, IEP and OST cannot mitigate against all risks of bacterial infection and other forms of HR are equally, if not more, important such as: promoting and facilitating hand washing, swabbing injection sites, injection site rotation, preventing transition to injecting, vein and wound care and advising PWID to seek timely healthcare during, for example, outbreaks of serious infections arising from spore-forming bacteria. However, the effectiveness of behavioural change interventions can be undermined by situational and social contexts of injecting

(Moore, 2004). Being in a hurry or impatient to inject, being in withdrawal plus not having clean supplies and not thinking about skin cleaning are barriers to self-initiated skin cleaning (Bonar and Rosenberg, 2014) ; also PWID keep used filters to extract residual drugs (Taylor A. et al., 2004) and these filters may harbour bacteria (Scott, 2008). Consequently, notwithstanding the high uptake of HR, health services will be needed to respond to SSTIs (Hope, 2010).

IEP services may provide more effective HR for SSTIs if combined with other services such as drug consumption rooms (DCRs) or nurse-led wound clinics (Bassetti and Battegay, 2004; Hope, 2010). Care for SSTIs can be delivered via specialised clinics set up in DCRs (Fast et al., 2008; Lloyd-Smith et al., 2010), hospitals (Harris and Young, 2002), IEP sites (Grau et al., 2002; Nesbitt, 2015) including mobile outreach IEP services (Robinowitz et al., 2014) and via charitable organisations (Finnie and Nicolson, 2002). Guidelines advocate that specialist IEP programmes should offer comprehensive HR packages including advice on safer injecting practices, assessment of injection site infections and SSTI treatment/referral (NICE, 2014).

Non-intervention variables found to be associated with increased odds of having had a SSTI included: residing in an East of Scotland Health Board area, longer injecting histories and poly-drug use. Further work is needed to explain the regional differences – these may in part reflect regional differences in the drugs taken – for example, SSTI problems are emerging among NPS injectors, specifically Lothian in the East of Scotland which has experienced an increase in injecting of ethylphenidate (Lafferty et al., 2016) or contamination of local drug supplies. Analysis (not shown) stratifying injecting history as “< five years” versus “≥ five years” was not statistically significant suggesting that within our sample, it is those with longer injecting histories (such as 20 years plus) rather than new injectors that were experiencing more SSTIs. Interventions targeted to the above groups may help reduce SSTI harms. The similar SSTI prevalence between those “ever been in prison” and “never in prison” may be explained by the low levels of in-prison injecting within Scottish prisons because of the range of HR policies, particularly the increased OST availability (Taylor et al., 2013). This suggests that most SSTIs were acquired within the community rather than in-prison.

4.1 Limitations

There are a number of limitations. Firstly, it cannot be discounted that selection bias occurred. The survey sampled PWID who are in contact with IEP services, which may result in an under-estimation of SSTI prevalence among high-risk injectors not in contact with such services. On the other hand, if these IEP services offered wound care clinics there may have been an over-representation of PWID with SSTI who were seeking advice/treatment. Secondly, we were unable to ask questions about other HR practices pertinent to SSTIs, such as hand washing, swabbing, injecting site rotation or other risk factors such as skin/muscle popping, quantity of citric acid used, filter re-use, needle licking or healthcare seeking behaviours for SSTIs. Thirdly, the uptake of IE was measured over a six month timeframe whilst the prevalence of SSTIs was measured over the past year. This occurred because of the nature of the data available, and may have lessened the association between the outcome and exposure variables. Fourthly, the presence/absence of a SSTI was determined by self-report. We cannot discount that for some participants a SSTI may have been forgotten, not deemed worthy of mention or another skin problem was reported as a SSTI. However, Morrison et al (1997) found that PWID self-report of current injecting related harm, including abscesses, conferred with medical examination, and suggests accurate self-reporting.

4.2 Conclusions and future research

Even though high IE-OST uptake was associated with the lowest odds ratio for having had a SSTI in the past year, a sizeable proportion of PWID with high IE-OST uptake still experienced SSTIs. This suggests that IE and OST are needed as part of a wider HR package for SSTIs. HR services which provide wound/SSTI clinics delivered via DCRs or NE maybe needed. In addition, an understanding of SSTIs and HR in relation to PWID lives and injecting experiences is needed to inform the development of services to reduce, and support PWID with, SSTIs.

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