



## Research paper

# Not in the vein: ‘missed hits’, subcutaneous and intramuscular injections and associated harms among people who inject psychoactive drugs in Bristol, United Kingdom



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## ABSTRACT

**Background:** The extent of intentional or accidental subcutaneous and intramuscular injections and the factors associated with these have rarely been studied among people who inject drugs, yet these may play an important role in the acquisition bacterial infections. This study describes the extent of these, and in particular the factors and harms associated with accidental subcutaneous and intramuscular injections (i.e. ‘missed hits’).

**Methods:** People who inject drugs were recruited using respondent driven sampling. Weighted data was examined using bivariate analyses and logistic regression.

**Results:** The participants mean age was 33 years (31% aged under 30-years), 28% were women, and the mean time since first injection was 12 years ( $N = 329$ ). During the preceding three months, 97% had injected heroin, 71% crack-cocaine, and 16% amphetamines; 36% injected daily. Overall, 99% (325) reported that they aimed to inject intravenously; only three aimed to inject subcutaneously and one intramuscularly. Of those that aimed to inject intravenously, 56% (181) reported ever missing a vein (for 51 this occurred more than four times month on average). Factors associated with ‘missed hits’ suggested that these were the consequence of poor vascular access, injection technique and/or hygiene. ‘Missed hits’ were twice as common among those reporting sores/open wounds, abscesses, or redness, swelling and tenderness at injection sites.

**Conclusion:** Intentional subcutaneous and intramuscular injections are rare in this sample. ‘Missed hits’ are common and appear to be associated with poor injection practice. Interventions are required to reduce risk through improving injecting practice and hygiene.

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## Introduction

People who inject psychoactive drugs (such as heroin, cocaine and amphetamine) normally aim to inject intravenously, but often have difficulty with venous access either as a result of poor injection technique or because of the vascular damage that can occur over time when injecting regularly (Harris & Rhodes, 2012; Rhodes, Briggs, Kimber, Jones, & Holloway, 2007; Rhodes, Stone-man, Hope, Hunt, & Judd, 2006). As a result they may have to make several injection attempts to gain venous access or use multiple

areas of the body for injection (Darke, Ross, & Kaye, 2001; Harris & Rhodes, 2012; Maliphant & Scott, 2005). This difficulty with vascular access can result in accidental subcutaneous and intramuscular injections – ‘missed hits’ (Hankins, Palmer, & Singh, 2000; Rhodes et al., 2007). In addition, for some people who inject psychoactive drugs (and also for those people who inject image and performance enhancing drugs, such as anabolic steroids and melanotan) their usual injection practice will be subcutaneous (‘Skin Popping’) or intramuscular (‘Muscle Popping’) (Binswanger, Kral, Bluthenthal, & Rybold, 2000; Hope, McVeigh, et al., 2015; Pirozzi, Van, Pontious, & Meyr, 2014).

Intentional or accidental subcutaneous and intramuscular injections among people who inject psychoactive drugs are known to be a risk factor for injection related bacterial infections (Binswanger et al., 2000; Pirozzi et al., 2014), particularly those

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caused by anaerobic organisms, such as, wound botulism and tetanus (Brett, Hood, Brazier, Duerden, & Hahne, 2005; CDC, 1995; Palmateer et al., 2013). Injections under the skin and into the muscle, particularly if they are accidental, could cause physical damage to tissues as a result of poor injection technique (Nicoll & Hesby, 2002; Ogston-Tuck, 2014). In addition, the two most commonly injected psychoactive drugs in the United Kingdom, brown heroin and crack-cocaine, both need to be dissolved in acidic solutions (Scott & Ponton, 2004; Scott, Winfield, Kennedy, & Bond, 2000). These acidic solutions when injected into vascular system are likely to be quickly diluted, but if injected under the skin or into the muscle (either during intentional subcutaneous and intramuscular injections or due to a 'missed hit') they could cause injecting site problems through chemical irritation and damage to these soft tissues (Lake & Beecroft, 2010).

The extent of subcutaneous and intramuscular injections, including 'missed hits', and the factors associated with these have very rarely been studied. Several studies in the western USA, have reported on subcutaneous and intramuscular injections among people who inject drugs, though not on whether these injections were intentional or accidental. In a study from 1997 conducted in San Francisco, California, 22% reported subcutaneous or intramuscular injections in the previous 30 days (Binswanger et al., 2000), and a more recent study from 2003 to 2005 indicated these practices were also common in Los Angeles, Oakland, and Berkeley, California, but did not report on their extent (Fink, Lindsay, Slymen, Kral, & Bluthenth, 2013). In a third study undertaken during 2010 in Seattle, Washington, 56% had ever injected intramuscularly (Coffin, Coffin, Murphy, Jenkins, & Golden, 2012). However, the extent of these practices in the western USA may, in part at least, be related to the injection of 'black tar' heroin and the particular problems associated the use of this drug (Coffin et al., 2012), thus limiting the generalisability of these findings other areas with different patterns of drug use.

Considering the extent of injecting site infections among people who inject drugs in the United Kingdom (Hope, Kimber, Hickman, Vickerman, & Ncube, 2008), in particular the substantial and ongoing problems with wound botulism and tetanus (Anonymous, 2015; Palmateer et al., 2013), data on the extent of, and the harms associated with, both intentional and accidental subcutaneous and intramuscular injections among this population are needed to help inform public health responses. Our study aimed to address this knowledge gap by asking participants about intentional subcutaneous or intramuscular injections and also about 'missed hits'. This paper describes: (a) the extent of subcutaneous injections, intramuscular injections, and 'missed hits'; (b) the factors associated with reporting a 'missed hit'; and (c) the extent of symptoms of injection site infections and injuries among those who report 'missed hits'.

## Methods

People who inject drugs were recruited into a voluntary unlinked-anonymous cross-sectional survey in Bristol, a major urban area in the south west of England, United Kingdom, using respondent driven sampling (RDS) during the September and October of 2009. RDS is an established recruitment process which has been explained fully elsewhere (Heckathorn, 1997, 2002; Salganik & Heckathorn, 2004). Briefly, RDS starts with the selection of the initial recruits, or 'seeds', with further subjects then recruited through the participant's social networks. The 'seeds' ( $n = 10$ ) were selected in relation to location and gender through key informant referrals and street outreach. To be eligible, participants had to be aged over 15-years, have injected drugs during the preceding four weeks, live within the Bristol urban area (population: urban area 617,000; city 432,500) and give consent.

Participants provided a dried blood spot (DBS) sample (which was tested for antibodies to HIV [anti-HIV], the hepatitis B core antigen [anti-HBc], and the hepatitis C virus [anti-HCV]), underwent a computer-assisted interview, and were then offered an acknowledgement. Participants were then asked to act as recruiters, and those who agreed to this were given three uniquely numbered and date-limited coupons. They were instructed to give these coupons only to eligible individuals whom they knew and received a further acknowledgement for each coupon that led to a successful participation. A single fieldwork co-ordinator screened all participants for eligibility and also for attempted repeat participations. The study had ethical approval (London REC, MREC/98/2/51).

The questionnaire used in the study was developed from ones that had previously been used with people who inject drugs in the United Kingdom (Hickman et al., 2007, 2009; Hope, Ncube, Parry, & Hickman, 2015; Judd et al., 2005). The questions on injection technique were developed from the existing questions about injecting practice. Participants were asked "How do you usually try to inject?" with answer options "In to a vein", "Under the skin – Skin Popping", or "In to the Muscle – Muscle Popping". Those injecting into vein were then asked if they had missed the vein when trying to inject and how often this occurred. The questionnaire was reviewed by members of the study team, including the fieldworkers, and by people working with people who inject drugs in the study area. The two main foci were: (1) injecting drug use (drugs used, paraphernalia used and injection practices); and (2) health harms (particularly infections) and uptake of health care related interventions. In addition, the questionnaire asked about demographics, environmental factors (such as contact with the criminal justice system and homelessness), and sexual behaviours.

In RDS studies there is a tendency for participants' to recruit people like themselves, and a higher probability that people with large networks will be recruited. For example, in our survey people who inject drugs who had been homeless in the last year had larger networks than those who had not, and recruited proportionally more people who were also homeless. RDSTAT software (Version 5.4.0. Ithaca, New York: Volz E, Heckathorn DD; 2005) was used to test for evidence of selection bias and to generate sample derived weights; with age-group, homelessness and crack injection used to weight the data for analysis.

Weighted data were used in all of the analyses, which were undertaken using SPSS 19. First, bivariate associations between reporting a 'missed hit' and demographic characteristics, environmental factors, the drugs used, and injecting practices were examined using the  $\chi^2$  test. The environmental, drug use and injecting practice variables used in the analyses were for factors that had been shown in previous studies of either injecting risk practice or bacterial infections among people who inject drugs to be related to those outcomes (Hickman et al., 2007; Hope et al., 2008; Salmon et al., 2009). Those characteristics found to be associated in the bivariate analyses were 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).

Finally, considering that 'missed hits' may be a factor in the development of injecting site problems, the extent of symptoms of injection site infections or injuries among those who had aimed to inject intravenously were examined. Associations between these symptoms and reporting 'missed hits' were examined using the  $\chi^2$  test and logistic regression to adjust for possible confounding variables. In addition, associations were then examined using the  $\chi^2$  test between the frequency of reporting 'missed hits' and, (a) symptoms of injection site infections and injuries, and (b) seeking healthcare in response to these symptoms.

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