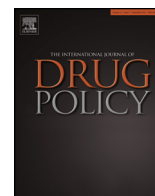




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## Research Paper

## Injection into the jugular vein among people who inject drugs in the United Kingdom: Prevalence, associated factors and harms

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## ABSTRACT

**Background:** While people who inject drugs (PWID) typically use peripheral veins, some inject into their central veins, including the femoral and jugular veins. Injection into the jugular vein can have serious adverse health consequences, including jugular vein thrombosis, deep neck infections, pneumothorax, endocarditis and sepsis. This study examined the prevalence of, and factors associated with, jugular vein injection among a large sample of PWID in the United Kingdom.

**Method:** Unlinked anonymous surveys (2011–14) recruited PWID from agencies providing services to this population. Self-reported demographic and injection-related data were collected from consenting respondents using a brief questionnaire and dried blood spot samples were tested for exposure to HIV, hepatitis C virus (HCV) and hepatitis B virus (HBV). Univariate and multivariable logistic regression were used to examine factors associated with jugular vein injection.

**Results:** Among 5261 PWID, one third had injected into a central vein in the previous 28 days, including 6% (n = 339) who had injected into their jugular vein and 1% (n = 52) who had used this site exclusively for recent injections. Factors independently associated with recent jugular vein injection in multivariable analysis included female gender, a lifetime history of imprisonment, sharing needles and syringes, poly-drug injection and injection into multiple body sites. Jugular vein injection was also associated with experiencing injection-related injuries, although no associations were identified with respect to exposure to blood borne viral infections.

**Conclusion:** A significant minority of PWID inject into the jugular vein in the United Kingdom. Public health responses should investigate ways to support and promote good injection site management in order to minimise vascular damage and reduce problems with peripheral venous access. Women who inject drugs, PWID with a history of imprisonment and those people who are experiencing early signs of injection-related skin and soft tissue injuries are priority sub-populations for interventions.

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## Introduction

People who inject drugs (PWID) typically inject into the peripheral veins in their arms (Harris & Rhodes, 2012). Problems with vascular access to peripheral veins may arise as a consequence of the vascular damage that can occur after regular injection into a body site over a long period of time. Damage to a peripheral vein, such as venous sclerosis (the hardening and thickening of the walls of a vein), can limit venous access at that

site by making it difficult to locate the vein or inject into it. This limited venous access may result in people making several attempts to inject into a body site or using multiple sites on their body for injection (Darke, Ross & Kaye, 2001; Harris & Rhodes, 2012; Maliphant & Scott, 2005). It may also result in accidental subcutaneous and intramuscular injections, or ‘missed hits’, which can result in soft-tissue damage and infections (Hope, Parry, Ncube, & Hickman, 2016). Over time injection into accessible peripheral veins, such as the arms or legs, can become increasingly difficult (Darke et al., 2001). An alternative is to inject into central veins, such as the femoral or jugular veins (Ciccarone & Harris, 2015). Injection into the central veins can be more difficult, and has high risk of complications and harm (Darke et al., 2001). The use of such veins was often regarded as the “last resort” for people with

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vascular damage who had exhausted the option of using an alternate injection site (Darke et al., 2001; Maliphant & Scott, 2005; Rhodes, 1995). However, studies indicate that the practice of injection into the central veins might have become more common in some countries, such as the UK, over time (Rhodes et al., 2006; Hope et al., 2015). Although a number of studies have examined injection into the femoral vein ('groin injection') and the factors associated with this practice (Maliphant & Scott, 2005; Rhodes et al., 2006; Coffin, Coffin, Murphy, Jenkins, & Golden, 2012; Ti et al., 2014; Hope et al., 2015), there have been very few studies that have investigated injection into the jugular vein ('neck injection').

The few studies that have investigated injection into the jugular vein have reported substantial differences in the prevalence of this practice. In a recent study in Tijuana (Mexico) one third of PWID reported that the neck was the main site used for injection in 2011 (Rafful et al., 2015). The high prevalence of jugular vein injection in Tijuana may reflect the predominance of black tar heroin in this region, the use of this form of heroin has been associated with venous sclerosis that makes intravenous injection difficult (Ciccarone, 2009; Rafful et al., 2015). In a cohort study in Vancouver (Canada), around one quarter of participants who were followed-up during 2004–2005 had used the jugular vein as an injection site during the preceding 6 months (Hoda, Kerr, Li, Montaner, & Wood, 2008). In this Canadian study, injection into the jugular vein was associated with daily injection and the authors hypothesized that venous access difficulties were likely to occur among people engaging in high frequency injecting drug use (Hoda et al., 2008). Frequent injection (that is injecting more than once daily) was also associated with jugular vein injection in Tijuana (Rafful et al., 2015), and in both the Canadian and Mexican studies people who had injected into their jugular vein were more likely to require or seek assistance with injecting (Hoda et al., 2008; Rafful et al., 2015). In a national study undertaken in Iran in 2007, 12% of people who injected heroin daily or more frequently reported their neck as their usual injection site (Karimi et al., 2014). However, an older study undertaken in Sydney (Australia) in 1999, found jugular vein injection to be much less common, with 10% of PWID reporting that they had ever injected into their neck and 4% reporting that they had done so in the previous six months (Darke et al., 2001).

These studies support the notion that the practice of injection into the jugular vein may be relatively common. This is a concern as injection into the jugular vein has been associated with a number of significant, and potentially costly, health problems (Lewis et al., 1980; Myers, Kirkland, & Mickey, 1988; Hoda et al., 2008; Rafful et al., 2015), including jugular vein thrombosis, deep neck infections, pneumothorax, endocarditis and sepsis (Lewis et al., 1980; Myers et al., 1988). This study used data from a large national cross-sectional survey of PWID in the United Kingdom (UK), which purposively collected information on the injection sites used during the previous 28 days. Using this data we investigate a) the extent of jugular vein injection in the UK, b) factors associated with jugular vein injection, and c) health-related harms associated with this practice.

## Methods

### Recruitment and data

PWID at sentinel locations have been recruited into a voluntary unlinked-anonymous monitoring (UAM) system in the UK since 1990. Methodological details of this system, a series of annual cross-sectional surveys, have been published previously (Hope et al., 2014). Briefly, agencies providing services to PWID (e.g. needle and syringe programmes and providers of addiction services such as opiate substitution therapy) invite clients who

have ever injected psychoactive drugs to participate in the survey each year. The agencies are sentinel locations throughout the UK, except Scotland, and are selected to reflect both the geographic distribution and range of services offered to PWID. People who consent to participate provide a fingerstick capillary dried blood spot (DBS) and self-complete a short questionnaire focused on the injection of psychoactive drugs. The survey instrument includes a multi-response question on the use of specific injection sites, participants who had injected during the preceding 28 days were asked: "In the last 28 days, into which parts of your body did you inject drugs?" and indicate all of the listed body sites that they had used. In 2011, as part of questionnaire review and stakeholder feedback, the response categories were expanded to additionally include the 'neck'. The UAM Survey has multi-site ethics approval.

DBS specimens were tested for antibodies to HIV (anti-HIV), hepatitis C virus (anti-HCV) and hepatitis B core antigen (anti-HBc). Anti-HIV was detected using an in-house GACELISA with similar performance to GACELISA HIV 1+2 (Abbott Murex Diagnostics Ltd., Dartford, UK). Reactive specimens underwent further testing according to a proven algorithm that included a second ELISA and Western Blot (Connell, Parry, Mortimer, & Duncan, 1993). Anti-HCV was detected using a previously validated commercial enzyme-immunoassay (Ortho HCV 3.0 SAvE, Ortho Diagnostics) (Judd et al., 2003) and anti-HBc was detected using an in-house modification of the Biorad MONOLISA Anti-HBc PLUS Assay (code 72315/6) optimised and validated to detect anti-HBc in DBS.

### Eligibility & analysis

We analysed data collected in UAM Survey over the period 2011–2014 inclusive. Where respondents participated in more than one survey wave, only their first participation record was retained. Respondents who had not injected during the preceding 28 days, and those who provided no response to the question on body sites used for injection were also excluded.

Bivariate associations ( $p < 0.05$ ) between the outcome variable, that is reporting the use of the neck as an injection site during the preceding 28 days, and covariates (demographics, injecting practices (during the preceding 28 days), sexual behaviour (during the preceding year), and health services' use (during the preceding year)) were examined using Pearson's Chi-square test. Where possible associations were observed ( $p < 0.10$ ) these were further examined via logistic regression to estimate crude and adjusted odds ratios (AOR) and 95% confidence intervals (CI) using a forward stepwise procedure to select variables for inclusion in the model based on the likelihood ratio test ( $p < 0.05$ ). All analyses were undertaken using SPSS 23.

Associations between using the neck as an injection site and four health-related harms (testing anti-HIV, anti-HBc, anti-HCV positive, and self-reported recent symptoms of injection site infection during preceding year) were explored by examining the prevalence of injection into the neck among those with and without each of these four harms. Data were adjusted for age, gender and region as these factors are known to be associated with these health-related harms (Judd et al., 2007; Hope et al., 2005; Hickman et al., 2007).

## Results

### Sample characteristics

During 2011–14, a total of 5261 unique individuals were recruited. Just over half (51%,  $n = 2,679$ ) were aged 35-years or older (mean age 35 years, median 35 years), 23% ( $n = 1216$ ) were women and 6% ( $n = 316$ ) were born outside of the UK. Almost two

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