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Low levels of hepatitis C diagnosis and testing uptake among people who inject image and  
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**Highlights**

- One in 20 people who inject image & performance enhancing drugs (IPEDs) have hepatitis C antibodies
- Uptake of hepatitis C testing was poor; less than two-fifths had ever been tested
- Among those *only* injecting IPEDs, most were not aware of having hepatitis C antibodies

**Abstract**

**Introduction:** People injecting image and performance enhancing drugs (IPEDs) have traditionally not been perceived as being at high risk of hepatitis C virus (HCV) infection. However, recent studies indicate the HCV antibody (anti-HCV) prevalence in this group is 10-times that in the general population. HCV testing uptake and undiagnosed infections are examined using data from a voluntary unlinked-anonymous survey.

**Method:** People injecting IPEDs across England and Wales completed a short bio-behavioural survey (2012-15). Anti-HCV status and self-reports of HCV testing were used in the analysis.

**Results:** The participants median age was 31 years, 98% were men, 14% had also injected psychoactive drugs and the anti-HCV prevalence was 4.8% (N=564). Among those who had never injected psychoactive drugs the anti-HCV prevalence was 1.4%; among those who had recently injected psychoactive drugs (preceding 12 months) prevalence was 39% and among those who had done this previously 14% ( $p<0.001$ ). Overall, 37% had been tested for HCV: among those who had recently injected psychoactive drugs 78% had been tested, as had 56% of those who had injected psychoactive drugs previously; 33% of those never injecting psychoactive drugs were tested ( $p<0.001$ ). Overall, 44% of those with anti-HCV were aware of this; however, only 14% of those who had never injected psychoactive drugs were aware.

**Conclusions:** One-in-twenty people who inject IPEDs have anti-HCV. HCV infections among those who had never injected psychoactive drugs were mostly undiagnosed, though this group had a lower prevalence. Targeted HCV testing interventions are also needed for those injecting IPEDs.

**Keywords:** Injecting drug use; image and performance enhancing drugs; hepatitis C; testing

## 1.0 Introduction

The injection and use of image and performance enhancing drugs (IPEDs) has, over recent decades, grown substantially in many countries, including the United Kingdom (UK) (ACMD, 2010; Iversen et al., 2013). IPEDs are a range of enhancement substances that are used to increase muscularity, strength, or to modify appearance (Evans-Brown et al., 2012). IPEDs can be taken either orally, or via intramuscular and subcutaneous injections, with the most commonly injected IPEDs in the UK being drugs marketed as anabolic steroids, growth hormone, human chorionic gonadotrophin, and melanotan (Bates and McVeigh, 2016). However, the range of IPEDs being used and injected is expanding, and psychoactive drugs can be used concurrently, therefore increasing harm (Sagoe et al., 2015).

Historically, people who inject IPEDs, unlike other groups of people who inject drugs (PWID), have not been perceived as being at high risk of hepatitis C and other blood borne viral infections, such as HIV (Crampin et al., 1998; Day et al., 2008). However, recent UK studies indicate that the prevalence of antibodies to hepatitis C virus (anti-HCV) in this group is 10 times that found in the general population, though it remains much lower than that found among those who inject psychoactive drugs (Hope et al., 2013). The advent of the new highly efficacious (>90%), well-tolerated direct acting antiviral (DAA) drugs for treating hepatitis C means this infection can now be easily cured (EASL, 2014). However, access to these DAA treatments requires the hepatitis C infection to be diagnosed.

In this paper, we present the first examination of the extent of undiagnosed hepatitis C infections among people who inject IPEDs. The uptake of diagnostic testing for hepatitis C and the extent of undiagnosed infection in this population are examined using data from a bio-behavioural survey of people injecting IPEDs in England and Wales.

## 2.0 Methods

Data from a national cross-sectional unlinked-anonymous survey were used. A biennial survey of people injecting IPEDs is undertaken as part of the UKs bio-behavioural surveillance of PWID. Methodological details have been published previously (Cullen et al., 2015b; Hope et al.,

2013; Noone et al., 1993). Participants recruited from across England and Wales complete a short behavioural questionnaire and provide a dried-blood spot (DBS) sample. Participation is voluntary and recruitment occurs through sentinel sites that provide services, such as, needle and syringe programmes (NSPs) and outreach, to people injecting IPEDs. The DBS samples collected are tested for anti-HCV using published methods (Cullen et al., 2015b). The surveillance programme has ethical approval.

Data from two survey waves (2012-2013 and 2014-2015) were used in this analysis. Participants in the second wave who reported participation in the first wave were excluded from the analyses. Hepatitis C testing uptake and the extent of 'undiagnosed' hepatitis C infections, were explored using participants' current anti-HCV status from the testing of their DBS samples, and their self-reported uptake of hepatitis C testing and of their most recent test result. All analyses were undertaken using SPSS.

### **3.0 Results**

During 2012-2015, 564 individuals who had ever injected IPEDs participated in the study: their median age at time of participation was 31 years (mean 32 years), the majority (98%, n=537) were men, 25% (n=137) had been imprisoned and 95% (n=531) had been born in the UK. During the year preceding participation, 95% (n=533) reported that they had injected drugs they believed to be anabolic steroids, 41% (n=231) growth hormone, 34% (n=192) human chorionic gonadotropin, and 17% (n=95) melanotan. One in seven participants (14%, n=79) had also injected a psychoactive drug (including heroin [7.6%, n=43], cocaine [6.9%, n=39], and amphetamine [6.7%, n=38]) at some point; with 6.4% (n=36) having injected a psychoactive drug during the year preceding their participation. Among those who had injected a psychoactive drug during the preceding year, the most commonly reported psychoactive drug that they had ever injected was amphetamine (75%, n=27/36).

The overall prevalence of anti-HCV was 4.8% (27/564); those with anti-HCV were older (median age for those antibody positive 39 years vs. 30 years for those negative,  $p<0.001$ ) and they were more likely to have ever been in prison (63% of those anti-HCV positive had ever been imprisoned vs. 24% of those anti-HCV negative,  $p<0.001$ ). Prevalence of anti-HCV was higher

( $p<0.001$ ) among those participants who had ever injected psychoactive drugs (25%) compared with those who had only injected IPEDs (1.4%), see Table 1.

Overall, 37% (211/564) reported that they had ever had a diagnostic test for hepatitis C, those tested for hepatitis C were older (median age 33 years vs. 29 years for those never tested,  $p<0.001$ ) and more likely to have ever been in prison (36% of those tested had been imprisoned vs 19% of those never tested,  $p<0.001$ ). Uptake of diagnostic hepatitis C testing was highest among those participants who had recently injected psychoactive drugs (78%,  $p<0.001$ ), see Table 1. Overall, 13% (71/564) of the participants reported that they had ever shared a needle, syringe or drugs vial. Sharing was more commonly reported among those who had ever injected psychoactive drugs (32%, 25/79 vs. 9.5%, 46/485,  $p<0.001$ ). However, sharing of injecting equipment was not associated with ever having been tested for hepatitis C (15%, 32/211 of those tested shared vs. 11%, 39/353 of those never tested,  $p=0.154$ ). Additionally, sharing was not associated with testing among those participants who had also ever injected a psychoactive drug (36%, 19/52 of those tested vs. 22%, 6/27 of those not,  $p=0.194$ ) and among those who had never injected a psychoactive drug (8.2% 13/159 of those tested vs. 10%, 33/326 of those not,  $p=0.492$ ).

Those who reported that they had ever been tested for hepatitis C were asked to provide the year of their last test, only 134 (64%) reported this. Of these, 54% (73) reported their last hepatitis C test as being recent (i.e., either in the year they were recruited or in the preceding calendar year); the ages of those recently tested and those not recently tested were similar (35 years and 33 years respectively,  $p=0.176$ ). The proportion recently tested for hepatitis C was similar among those who had also injected psychoactive drugs (62%, 21/34) and those who had never injected a psychoactive drug (52%, 52/100;  $p=0.323$ ).

Of the participants with anti-HCV, 44% (12/27) reported that they were aware of their status; awareness was higher among those participants who had also injected psychoactive drug (55% vs.14% for those who had not also injected psychoactive drug,  $p=0.091$ ), see Table 1. Of those who were *unaware* that they had ever had hepatitis C, two-fifths (40%, 6/15) had *never* injected a psychoactive drug.

#### 4.0 Discussion

One in 20 of the people injecting IPEDs sampled had anti-HCV, a level comparable to previous findings (Ip et al., 2016). After excluding those who were also injecting psychoactive drugs, one in 70 of those injecting only IPEDs had antibodies. The uptake of hepatitis C testing was poor with less than two-fifths having ever been tested, and only half of those tested having been tested recently. Worryingly, among those who had only injected IPEDs most of those who had been infected with hepatitis C were not aware of this, and so could not access appropriate care and treatment with the new DAA drugs and may unknowingly put others at risk.

The minority who had injected both IPEDs and psychoactive drugs had not only a higher hepatitis C prevalence but also higher uptake of testing than those who had just used IPEDs. However, among those injecting both IPEDs and psychoactive drugs the pattern of psychoactive drug use was different from that found among those who only inject psychoactive drugs in the UK (Public Health England, 2015), with much higher levels cocaine and amphetamine injection. The higher levels amphetamine consumption might possibly be related to their IPEDs use (George, 2000; Momaya et al., 2015), but this needs further examination.

The hepatitis C prevalence found among those injecting IPEDs is higher than in the general UK population, approximately 0.7% (ECDC., 2010); however, it is lower than the 50% found among those PWID who use only psychoactive drugs (Public Health England, 2015). This difference in prevalence between those injecting psychoactive drugs and those injecting IPEDs probably reflects the IPED injecting population being younger, with fewer years injecting, and likely to inject less frequently (Hope et al., 2015; Iversen et al., 2016). Thus, at a population level, those who inject IPEDs will have had overall fewer life-time injections and so potential risk events. This difference may also reflect the risk of hepatitis C transmission when injecting subcutaneously or intramuscularly possibly being lower than when injecting intravenously (Paez Jimenez et al., 2009).

The uptake of diagnostic testing for hepatitis C was low, with less than two-fifths ever tested overall, and only a third of those who had *never* injected a psychoactive drug were tested. This is much lower than the uptake among those who inject psychoactive drugs in the UK, four-fifths of whom report ever being tested for hepatitis C (Public Health England, 2015). The reasons for this lower level of uptake needs further investigation, but it may relate to those who use IPEDs and



healthcare workers not perceiving a risk when injecting *only* IPEDs. This poor uptake among those injecting IPEDs is reflected in the high proportion of undiagnosed hepatitis C infections among this group. The vast majority (over 85%) of the infections among those who injected IPEDs, but who had never injected a psychoactive drug, were unrecognised. These individuals will thus not be able to access the DAA treatments and so remain able to transmit hepatitis C to others. This level of unrecognised infection is higher than found among those using IPEDs who had also injected psychoactive drugs. It is also much higher than among those only injecting psychoactive drugs, around half of whom remain unaware of their hepatitis C status in the UK (Public Health England, 2015).

The low level of hepatitis C testing uptake, and the high proportion of infections that are undiagnosed, is a concern. It is possible that among those injecting IPEDs and not in contact with NSP and outreach services like those used to recruit our sample – a group that may be larger than the group in contact with services (Cullen et al., 2015a) – testing and awareness could possibly be even lower. Our findings indicate a clear need for interventions to improve testing uptake among those who inject IPEDs. Further research is needed to explore levels of awareness of hepatitis C risk; to identify the barriers to blood-borne virus testing among people who inject IPEDs; and to identify and develop the most effective approaches for delivering testing. However, improvements to the existing provision of testing services for PWID could be the most cost-effective approach as this would use existing infrastructure. This could be, for example, through offering testing for hepatitis C using DBS samples (Coats and Dillon, 2015) when delivering existing outreach NSP provision to people injecting IPEDs. People who inject IPEDs also use a range of general health services, including primary care, (Hope et al., 2013) so increased awareness of IPED use and the appropriate offer of testing in these settings could also be effective.

There are a number of limitations to our study. Firstly, the DBS samples collected in the survey were only tested for anti-HCV, and not tested for hepatitis C RNA. Therefore, we cannot look at awareness of current hepatitis C infection. Secondly, data on the uptake of testing for hepatitis C and the result of the last test were from self-reports which may be subject to recall bias, though studies of PWID indicate that self-reports are reliable (De Irala et al., 1996; Latkin et al., 1993). Finally, due

to limited data on the size and nature of this population, we are currently unable to assess representativeness of those recruited (ACMD, 2010). Considering these issues, our findings need to be generalised with caution.

### **5.0 Conclusion**

Hepatitis C infection is common among people who inject IPEDs, though the prevalence is currently lower than among those who inject psychoactive drugs. Among those who had only ever injected IPEDs, the majority of those with hepatitis C were undiagnosed. There are also unrecognised hepatitis C cases among those who had injected both IPEDs and psychoactive drugs. Targeted interventions to improve the uptake of hepatitis C testing among people who inject IPEDs need to be developed, evaluated and implemented.

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### **Authors' Contributions**

All authors contributed to the preparation, checking and approval of the manuscript.

VH, JMcV, JP and FN contributed to the design of the study.

VH lead the study implementation, assisted by JS and JMcV.

JP managed the laboratory aspects.

Analyses were undertaken by VH, with assistance from RG.

### **Conflicts of Interest**

No conflicts of interests declared.

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**Table 1:** Hepatitis C prevalence, uptake of diagnostic testing and awareness of status among people injecting image and performance enhancing drugs by psychoactive drug injection status, England and Wales, 2012-2015.

	<b>Total</b>	<b>Ever had a diagnostic test for hepatitis C</b>		<b>Tested hepatitis C antibody positive</b>		<b>Aware of hepatitis C positive status</b>	
<b>Never injected a psychoactive drug</b>	485	159	33%	7	1.4%	1	14%
<b>Ever injected a psychoactive drug</b>	79	52	66%	20	25%	11	55%
<i>Last injected a psychoactive drug over a year ago</i>	43	24	56%	6	14%	4	67%
<i>Last injected a psychoactive drug during preceding year</i>	36	28	78%	14	39%	7	50%
<b>Total</b>	564	211	37%	27	4.8%	12	44%