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## **Crack-heroin speedball injection and its implications for vein care: Qualitative study**

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Running head: Speedball injection in the UK

# Crack-heroin speedball injection and its implications for vein care: Qualitative study

## Abstract

**Background** We report on an exploratory qualitative study investigating drug injectors' narratives of vein damage and groin (femoral vein) injection associated with the injection of crack-heroin speedball. **Methods** We undertook 44 in-depth qualitative interviews among injectors of crack-heroin speedball in Bristol and London, England, in 2006. **Findings** Data suggests an emerging culture of crack-based speedball injection. Injectors' narratives link speedball injection with shifts towards groin injection articulated as an acceptable risk and not merely as a last resort in the face of increased vein deterioration associated with speedball. Accounts of vein damage linked to speedball emphasise 'missed hits' related to the local anaesthetic action of crack, the excess use of citric in the preparation of speedball injections, and 'flushing' when making a hit. We find that groin injection persists despite an awareness of health risks and medical complications. **Conclusions** We emphasise an urgent need for reviewing harm reduction in relation to vein care in the context of shifts to crack-based speedball injection, and the use of the femoral vein, among UK injectors. There is an additional need for interventions to promote safer groin and speedball injecting as well as to prevent transitions toward groin and crack injection.

**Keywords:** Crack; speedball; groin; femoral vein; injecting drug use; harm reduction; UK

## Introduction

Evidence suggests increased prevalence of crack use, particularly crack injection, in the UK over the past decade [1-5]. In the early 1990s, a significant increase in the proportion of London injecting drug users (IDUs) who were also using crack or cocaine was noted, with 16% (85/534) reporting the use of crack cocaine in a six month period in 1990 rising to 59% (297/507) in 1993 [4]. In this study, the proportions injecting crack at least once in the previous six months increased from 1% (3/531) in 1990 to 27% (132/493) in 1993. Surveys of IDUs in England a decade later indicate that 40% (381/952) inject crack in the previous four weeks, usually in combination with opiates [3]. In some UK metropolitan centres, almost three-quarters of IDUs are regular injectors of 'speedball' – the practice whereby crack and heroin are injected simultaneously [2,6]. In London, 53% of 428 recently initiated injectors had injected crack or cocaine in the last 12 months, usually as a speedball [7].

While there are reports of crack injection outside the UK, these are among a minority of injectors [8-11]. Of 2,198 IDUs in a multi-city study of young injectors in the USA, 15% reported crack injection, usually in combination with opiates [11]. There is an established culture of 'speedball' injection in some North American settings, but invariably this is the combined injection of heroin and powder cocaine [13-15]. While research has established a pattern of crack smoking alongside heroin injection [11,16-18], reports of crack-based speedball injection are rare among IDUs internationally. Despite indication of shifts towards crack-based speedball injection in the UK [1,2,5], there is an absence of related qualitative research.

A largely North American literature associates elevated health harm with cocaine and speedball injection [18-25], non-injected crack use among injectors [17,18,21, 26,27], and crack injection [11,12]. In England, there has been a recent rise in the estimated prevalence of HIV and hepatitis C virus (HCV), as well as bacterial infections, among injectors [1,6,7]. Odds of hepatitis HCV infection are elevated among injectors of crack and speedball compared with heroin injectors only, and this may in part relate to crack injection overlapping with vulnerable street-based populations of IDUs [6]. There is a higher risk of abscesses and injection site infections among crack injectors [28], including compared to cocaine and cocaine-based speedball injectors [12]. There has also been a marked recent rise in the number of drug-related deaths linked with crack or cocaine use in England [29].

Studies have noted shifts towards groin (femoral vein) injection among UK injectors [3,30], an injection site linked with increased health risks [31-33]. A survey of IDUs in multiple locations in England found 45% of 952 IDUs to regularly groin inject, rising to 58% in some cities [3]. HCV infection is elevated in the UK among regular groin injectors and among those in unstable housing, and crack-based speedball injectors are both more likely to be regular groin injectors and to have unstable housing [3,6]. UK groin injectors are more likely than those who do not groin inject to report an open wound at injection sites and to have had deep vein thrombosis [3].

## **Methods**

In 2006, we undertook exploratory qualitative interviews with 44 crack-heroin injectors as part of a wider project undertaking video-recorded observations of injecting drug use and injecting environments [34,35]. The study aimed to describe crack-based speedball injection and its association with health risks from the perspectives of injectors with current or past experience of injecting crack-heroin speedball.

### ***Sampling***

The study comprised people who were current injectors who reported ever injecting crack-heroin speedball. We defined 'current injecting drug use' as injection in the previous four weeks. The study adopted purposive sampling to recruit a minimum quota of female IDUs, and was weighted towards recruiting injectors with current or recent (that is, last year) experience of unstable housing. We defined unstable housing as living in temporary accommodation hostels, experience of homelessness, and being of no fixed abode. Our interest in purposively weighting the sample in this way related to wider project interests in public injecting environments [34]. The study adopted an a priori target of 40 interviews and a fixed data collection period enabling 44 interviews to be undertaken.

Bristol (West England) and London (and in particular Lambeth, South London) were selected as the two research sites because both cities have well established heroin and crack markets [2], including the emergence of 'speedball' injecting (termed 'snowball' in Bristol). Having recently completed observations of injecting drug use in both sites, the research team had established field contacts [6]. Access was gained by the authors through snowballing through networks of drug injectors, and in Bristol recruitment was also facilitated via a community-based drug service and syringe exchange. We emphasise that this qualitative sample is not necessarily numerically representative of the population of crack-based speedball injectors in each of the cities.

## ***Data collection and analysis***

In-depth interviews, facilitated by a topic guide designed to explore participants' accounts, were the primary means of data collection. These focused on: current injecting practices; sites of injection; experience of crack and speedball injection; perceived associated health risks of crack and speedball injection (including vein damage and site infections); and drug injecting environments. Interviews were undertaken during mid-2006 in a variety of locations, including parks, cafes, streets, lent office space, and at a community-based drug service in Bristol. Interviews were undertaken with only interviewer and interviewee present. Interviews lasted between 40 and 90 minutes, and were tape recorded for verbatim transcription with informed consent. All interviews were undertaken by the authors. Participants were also asked to complete brief questions on core quantitative indicators on sample characteristics. Participants provided signed informed consent, and received a cash incentive of £20. There were no refusals to interview. Interviews were supplemented by field observations of 'naturally occurring' crack and speedball injection in a range of injecting environments, leading to approximately 25 hours of unedited video-recorded observations [35].

All interviews were transcribed verbatim for coding and analysis. Once transcribed, interview data was categorised thematically, with the key areas of investigation reflected in the topic guide providing the overall framework for coding. Initial first-level coding was undertaken by two of the authors (TR and DB), with second-level coding serving to break down first-level categories into smaller units and sub-themes. Key first-level themes important for this analysis included: speedball effects; vein care; groin injecting; and groin risks. Data coding was undertaken without the aid of qualitative analysis computer software.

## ***Sample characteristics***

The sample comprised 44 IDUs, of whom 25 (57%) were recruited in Bristol and 19 (43%) in London. The median age was 33 years (range 23-53 years), and the median age at first injection 19 years (range 13-35 years). Three quarters of the sample were male (n=34) and two out of three reported homelessness in the past 12 months (n=31).

Participants had been injecting heroin for a median of 11 years (range 3-28 years), crack for a median of 7 years (<1-26 years), and crack-heroin speedball for a median of 7 years (range <1 - 23 years). Half were currently prescribed an opioid substitution treatment (n=23). In the past four weeks two thirds reported daily or more frequent injection (n=29) and outdoor injection (n=29); and near two-thirds (n=26) reported speedball as the drug type they had injected most frequently, with the remainder injecting heroin most frequently. Near two thirds had injected into

their groin (femoral vein) (n=27) in the past four weeks, with just under half reporting the groin as their current main injection site (n=19).

## Findings

Our findings are consistent with indications of transitions in UK cities from the primary injection of heroin alone towards the simultaneous injection of heroin and crack as a speedball [2,3]. The addition of crack was rationalised as driven by a search for a “better high”. Prior to experimenting with speedball, most had experienced smoking crack alongside their heroin use, and the injection of heroin had become functional or “normal”, no longer providing a “buzz”. Speedball was said to introduce a new “euphoria”, the heights of which had not been experienced before (“Man, it was unbelievable”). Whereas heroin was described as “medicine”, crack had “drug” potential, including among those also combining their heroin injection with crack smoking:

*The reason I started taking the crack was because I wanted a high. I started injecting it with brown [heroin] because everyone around me was, and they all seemed to think it was better. So I am chucking a few rocks [crack] in with the brown now, like one or two, then two bags in. Two of each in a spoon. [#29, Male, 32 years]*

With crack-heroin speedball injection normative for most participants, and described as qualitatively distinct from the consecutive use or injecting of crack alongside heroin, our findings are suggestive of an emerging culture of speedball injection distinct from that associated with heroin. A key feature of accounts of speedball was *not being able to do one without the other*. Drug patterns were defined by doing *both* crack and heroin, and *in a single shot*. While reinforced through local heroin and crack markets converging (“The dealers don’t help either because they sell them together”), this extended to situations in which individuals would be in withdrawal with access to one drug but not the other:

*So it was always injecting them together. Some dealers will only have brown [heroin] and they’re waiting for the white [crack], and I won’t buy the brown because otherwise it just ends up in the pocket for ages and you run around frustrated cos you can’t have a dig. I’ve got to have both together. [#6, male, 46 years]*

*I don't do one without the other. And it's been like that for the last ten years. If I'm sick [in withdrawal] and I've got these [crack] in my pocket I won't do it until I've made another tenner [ten pounds] to go with it. [#20, male, 33 years]*

Injectors' accounts of the everyday health implications of speedball injection identified vein damage as a primary concern alongside that of transitions to groin (femoral) injection. We turn to these themes below.

## **Vein damage**

Participants associated the crack in a speedball with the speeding up of deterioration to injecting sites. Crack, and the impurities within it, was said to “destroy” or “annihilate” veins, with crack causing damage to veins “quicker” than heroin alone:

*I'm trying not to snowball at the moment cos it seems to be making my veins collapse. There is bruising... Crack does destroy the veins anyway like, like the veins in my arms as well are really sore... When I'm just using gear it doesn't seem to bruise the vein so much. [#3, male, 34 years]*

Crack associated vein damage was exacerbated by “missed hits”. These were common, and linked to the crack in speedballs acting as a local anaesthetic at the injection site. A missed hit was one which missed the vein, in part or in full, including an injection in which the needle slips out of the vein or even pierces through the vein, thus distributing some or all of the drug solute into surrounding tissue. As a consequence of the local anaesthetic action of crack, often the only indication injectors had of their speedball being a missed hit was that they did not “feel the effects” or when the injection site “lumps up” soon after injection:

*I can get a vein, and I'll pull back the blood, and start pushing it in, and then maybe half way through it will decide to miss cos I've slightly moved. And then usually it lumps up, so I tend to realise... If you've shot the lot in, you only realise it's a miss either when you see it lumping or when you realise there is no hit. [#9, male, 30 years]*

*You won't know that you've missed it. You just won't get no buzz from it. And then the next day you'll wake up and you'll probably have a great big lump there [around the femoral vein], and won't hardly be able to walk. Whereas if you're missing with gear, you know straightway and you know to stop. [#7, male, 25 years]*

For some with problems finding an injection site, or where injection sites had become painful, the anaesthetic properties of speedball enabled injection:

*If it's just gear on it's own, I'll push it in and the pain is that unbearable I can't push it in, whereas if I've got crack in there, I'll push the first bit in, the pain will be, it'll really hurt, but then the crack numbs it so I can push the rest in and it's ok. But without the crack I wouldn't be able to push it in, I'd be in trouble, I'd end up pulling the pin out, I can't do it, it hurts so much. [#1, male, 31 years]*

Concern over missed hits increased the likelihood of “flushing” when making a speedball injection. This is the practice of repeatedly injecting the drug solute then drawing it back into the syringe before re-injecting it, usually as a precaution to ensure an injection had been successful, that it had not missed, and that venous blood had properly entered the syringe. Flushing was associated with the exacerbation of vein damage: “The more you flush, the more you kill your veins”:

*With the snowball you never know because when you inject, you put it in, draw it back, put it in again, and it numbs the pain, and it looks as if you are missing, and sometimes I can't tell, so I am drawing it back to and forth. [#28, male, 28 years]*

Crack related vein damage was also linked by participants to citric powder, commonly used by injectors in both sites to break down the heroin and crack from base form to a solute when preparing a speedball: “I use citric, and citric fucks your veins really badly, that burns them”. There was uncertainty about how much citric to use, and how much more should be used when preparing speedball than heroin alone, with a rule-of-thumb to double the amount (“one for the brown, one for the white”). Speedball injectors may over compensate, using too much citric. As described by one injector when injecting speedball prepared by another:

*And you go “Oh you don't need to put that much [citric] in”. And they go “Oh I always put that amount in”. So then when you have a dig, you don't miss, but you feel the citric and it burns. And you think that never happens when I do it, cos I only puts a little bit of citric in. [#6, male, 46 years]*

## **Groin injection**

Older, and longer-term, injectors tended to indicate that groin (femoral) injection was seen as a “last resort” as a consequence of vein damage. Such accounts are in keeping with a ‘linear progression’ description of transitions in injection sites:[3] arms, then hands, then legs, then

chest and feet to the groin and neck. For those having difficulty finding a vein, groin injection presented immediate relief, and once found, was generally used for as long as the vein held out.

Findings suggest however, a shift towards using the groin as a primary site of injection, even when other sites remain accessible. In this respect, there was a clear demarcation in accounts between older more experienced injectors and younger less experienced injectors in their representations of the groin as an acceptable site of injection. Older IDUs depicted younger IDUs as accepting of groin injection out of preference rather than necessity:

*The young kids in Bristol that start using, they've got this huge thing, they go straight to the groin... And it's insane. It's fucking insane, man... That's one of the worst places for it to go wrong, do you know what I mean? [#17, male, 26 years]*

*The older generation... They see it [groin injection] as completely different to the younger generation, whereas the younger generation seem to think that is the right place to go there, it's like the 'in thing'. [#8, male, 31 years]*

Our findings show multiple reasons proffered by injectors for using the groin. First, being a larger vein with faster blood flow, injecting in the groin was described as a “better rush”, a “better feeling”, providing a “bigger and quicker” hit, and by some as the “best buzz in world”:

*People always want to know how to get the best hit. My mate suggested it because I was complaining about my arms... He said it was a quicker rush, that it was immediate. He said you get it quicker and feel it more. That's why I use my groin. [#28, male 28 years]*

*I know of people that could quite easily inject in their arms who have got massive veins in their arms, and they inject in their groin knowing that you do get a better hit from injecting in your groin. [#7, male, 27 years]*

Second, groin injection was described as discreet and convenient: “It's easy and quick”; “I thought they were crazy, why risk losing a leg? But they said it was quick, simple and easy.”; “You can whosh, bang, in, whosh, bang, out”). Groin injection was therefore seen to go “hand in hand” when injecting in public places and when under potential scrutiny from passers or the police:

*I started using my groin cos I was having all these problems [with veins] and that, and once you get your groin, and especially if you are homeless, you're outside and that, I*

*mean there's public walking about and that, so you want to be as quick as possible so no-one can see you... At the worst, if anyone sees you, it looks like you're having a pee or something. Once you've got it, you just push it in, draw back. It's so quick, it's over in seconds. [#20, male, 33 years]*

Groin injecting is also discrete in the sense that injection track marks remain hidden from friends or family members:

*I'd go and see my parents I couldn't ever like wear a T-shirt around the house. Now I can just like take my top off and lounge about and they don't know any different. [#7, male, 25 years]*

*Mainly I groin inject. Not because I need to, but to be quite honest with you, I find it easier for one, and for two, it's sort of like, it's not on sight to my family who look at my arms and legs... I could be going elsewhere. [#8, male, 31 years]*

Lastly, the use of the groin was rationalised as relatively safe because it enabled a single injection and 'sure shot' without the need for repeated injection attempts in multiple sites, which might increase or sustain vein damage as well risk spreading bacterial infections. Groin injection was presented as an 'acceptable risk':

*The risks are outweighed by the fact that it's quicker and a lot of times it's safer. [How's it safer?] Because like I said, when you use like, you know I've been six hours [trying to find a vein]. And that ain't like in the same site, so I might, I've probably used about 15 pins. And I've got all them dent marks on my leg, like all these marks. And each time I've attempted right, I've just run the risk of missing. [#6, male, 46 years]*

*To begin with, you know, I had thought it was not so safe. But you know, because it's an actual normal vein, I think, look at the overall picture, there's not much difference really. If you're going to get a clot, you're going to get one you know, whether you inject in the arm, legs or groin. [#8, male, 31 years]*

### ***Risk awareness and acceptability***

Injectors' accounts at once associated groin injection with multiple health risks while rationalised the use of the groin as an acceptable risk given perceived situated benefits. Of immediate

concern was damage to the femoral vein. Finding the femoral vein was more difficult over time, requiring longer and longer needles, and increasingly painful injections:

*As far as I was concerned I could use it and use it and use it. And it would never end. Not realising when you batter a vein it sinks, and sometimes burns like mad, cos it's telling you ain't coming in here. [#9, male, 30 years]*

*You end up pushing the vein back, you end up pushing it back and back... And now, I'm trying to get it, and I can't find it. I have to stab it in to get it. Then I went onto long orange [longer needle] for a few months and it got to the point where I'd push it, it would go right through the vein, and I'd have to pull it out a bit to get the hit. [#7, male, 25 years]*

Difficulty hitting the femoral vein increased the chances of missing the hit, and importantly, accidentally hitting neighbouring femoral nerves or the artery, with potentially serious health consequences:

*I done it first in my arms and that's when my mate said I should try the groin. After a few times, I started to get myself and I did it for a couple of years in the groin, and they just started going. I started hitting arteries, I was missing, hitting nerves. My legs went to pieces. I was in hospital three times. The last time, my legs were so bad, they just told me not to do it. [#29, male, 32 years]*

*I know where they [femoral nerves] are now. I could be here [acts out injecting in right side of groin] or could move just a little touch and the blood could be lighter, and I push it in just 20 digits and it starts to go warm and tingly. That's when I know I have hit a nerve. Actually, I did it five days ago. Just woke up, put it in, and the blood was like pink. I put 10 digits in, I was half asleep but clucking [withdrawing]. It was constant bleeding and the pain was continuous. [#28, male, 28 years]*

As with speedball injection in general, the anaesthetic effects of crack on the injection site increased the chances of missing the femoral vein: "They won't even know they are missing the vein because the crack is numbing the site. I think it has happened to me once or twice". Awareness of having missed the femoral vein was said to be less immediate than when injecting into surface veins elsewhere on the body: "Go in your groin, and you don't know if you're missing". The pain emanating from a missed groin hit into the artery or surrounding nerves was described as acute by all who had experienced it (almost all we interviewed), and likened to "setting fire" to one's leg. For example:

*I was in the toilet. I've pulled it back and I could see blood's filled up. But it's one of those ones with the ultra violet lights in, so you can't see properly. So I just assumed it was in, just went, whacked in the whole lot, and just all of a sudden got this pain. And I just ripped the pin out my leg, and fucking just like bouncing around inside this cubicle trying to be quiet... Fucking painful. [#7, male, 25 years]*

*One time, I clipped the artery and I nearly hit the fucking ceiling... See your tooth nerves, if you stick a pin in it hard, that is what the pain is like going into your nerve. [#31, male, 39 years]*

Multiple complications were associated with groin injection, including deep vein thrombosis (DVT), septicaemia, and bacterial infections. Injectors spoke of having “multiple blood clots in both legs”, of fearing that “I’m going to lose my legs if I carry on”, of getting to a stage “where I couldn’t literally walk anymore”, and for one person we interviewed, having had a leg amputated. Yet the need to inject, and the greater certainty and ease the groin provides for a successful injection, means that groin injection persists in the face of heightened awareness of health risks as well as experience of missed hits and complications resulting from sustained groin injection:

*The pain [of hitting the artery] is so intense. Tears coming out my eyes. I've hit my nerve as well. Oh, I nearly jumped through the ceiling when I did that. The damage, it's frightening. You've got to be so careful. So many, you know, intimate body parts in your groin. But you know, you carry on doing it. [#16, male, 32 years]*

*When you see people who have lost their legs and stuff. You know the risk involved is DVT and blood clotting of arteries and circulation to the leg but you are desperate for a hit and your veins have run out in your arms and your ankles, and the only place you know where you can go is your groin. If you can get it once, you'll go there. If it is bad, then you go there. It is scary. [#27, male, 43 years]*

*It is dangerous like. It's stupid. I have got blood clots. I have been in hospital for two weeks. When I started, I used the arms, but now I don't really want to go there because I know the feeling is not as good. [#28, male, 28 years]*

We identified in injectors’ accounts five main strategies used to reduce risks associated with groin injecting. These included, first, seeking assistance from other injectors to help locate and administer an injection into the femoral vein. While some described this process as “hit and miss”, technique was said to usually improve through “trial and error”, once knowing “where it is

you are going". Second, rotating injections between groins, once one side had become "overused", "sore", or if infections were suspected, though most we interviewed had a favoured or "good" side and were reluctant to shift sides once one had become regularly amenable to successful injection. Third, selecting an appropriate length needle to reach the vein without piercing through the vein entirely. Fourth, cleaning the injection site, though few we interviewed mentioned doing this routinely, and field observations showed that injectors rarely washed their hands prior to injection or swabbed injection sites [35]. And most commonly mentioned, checking the colour of the blood flushing into the syringe. Here, "dark blood" would indicate that the vein had been found, but "pink blood" would indicate that the injection was being made into an artery. However, this strategy was not failsafe, especially in low light conditions. As one injector describes of the difficulties of distinguishing venous from arterial blood flushing into the syringe:

*I felt the pressure all the way down my leg and felt my feet swelling up. Lots of pins and needles. I got blood back in the syringe. Sometimes it is hard to identify that. What you have to be careful of is the colour of the blood coming out. The vein is supposed to be darker than the artery in the book, because artery blood is pink. I normally squeeze a little bit of the hit in first to see if there is a little bit of pain and then I know there is not an artery. The reason I think I hit the artery was because I didn't feel the hit. [#27, male, 43]*

## **Discussion**

This exploratory study emphasises a need for harm reduction services in the UK to target crack and speedball injectors to promote improved needle hygiene, vein care and safer groin injection. Three key hypotheses emerge from this study: that there is an emerging culture of crack-based speedball injection in some UK cities; that shifts towards crack injection introduce elevated levels of harm related to vein damage; and that there are shifts towards the 'risk acceptability' of groin injection. The generalisability of these hypotheses are inevitably limited to the samples and settings selected, with the focus of analyses being participant personal accounts of lived experience. Our findings thus warrant further substantiation via epidemiological studies of the extent and distribution of vein damage and related infections associated with crack-based speedball injection and of transitions towards groin injection. We also highlight the need for comparative research to assess the relative distribution of vein damage and injection site infections of cocaine-based and crack-based speedball injection.

Findings suggest an emerging culture of crack-based speedball injection as distinct from opioid use and the consecutive use of crack and heroin, a hypothesis to some extent corroborated by

crack-based speedball injection becoming increasingly normative among UK injectors [2,5,6,36]. Clinical studies imply that the simultaneous administration of cocaine and opioids “does not induce a novel set of subjective effects” but instead “induces, simultaneously, effects that are typical to both drugs” which can be “more reinforcing than either drug alone” including especially when “low doses of heroin and cocaine are mixed” [15: 11-12]. Our study suggests that a ‘social pharmacology’ of drug effect [37] associated with crack and speedball injection distinguishes speedball as offering an enhanced drug effect over heroin alone, that is distinct from the consecutive use of crack and heroin, and which symbolically affords speedball greater hierarchical status as a ‘drug’ in a context of opioid dependency. Speedball was commonly characterised as ‘euphoric’, with transitions towards speedball injection largely rationalised as a search for a ‘better high’. Whereas heroin was characterised in functional terms as a ‘medicine’ to prevent withdrawal and maintain normality, crack in a speedball was articulated as pleasurable, as provided the ‘high’.

As elsewhere [12,28,38-39], we found that speedball injection, and crack specifically, is strongly associated by injectors with the rapid deterioration of veins at injection sites, and to related health harms including abscesses, cellulitis and other skin infections. It is important to note that increased reports of injection site infections in the UK have coincided with the changing epidemiology of injecting drug use towards crack injection [2]. Injectors associated vein damage with ‘missed hits’ resulting from crack anaesthetising the injection site, but also as a direct effect of crack (and properties mixed with it). The use of citric powder in the preparation of speedball injections was also linked with vein damage. While there exists a small literature on the use of citric and other acids in the preparation of heroin injection [40-45], there is a lack of clinical literature assessing the optimum amounts of citric powder required to acidify crack relative to its weight and purity in a speedball. The amount of citric powder required to acidify crack in a speedball is, however, considerably more than that required when preparing heroin only injections, and perhaps in the order of two thirds of the weight of citric to the weight of crack, excluding impurities (Jenny Scott, personal communication, 2007). Although associated with less injecting related harms than other forms of citric, such as lemon juice, citric powder is a known irritant to vein tissue, and is associated with greater pain and burns at injecting sites than other acidifiers, such as vitamin C powder (ascorbic acid) [40,41]. Citric powder, however, is more commonly distributed than vitamin C powder by harm reduction projects in the UK, including in our study sites.

In addition to citric powder, injectors associated ‘flushing’ with increased vein damage, a practice largely borne out of heightened awareness of the risk of missed hits, and in the context of groin injection, anxiety over accidentally hitting the femoral artery. While there is not a clinical literature

on the potential aggravation to veins caused by flushing when making injections, it is logical that repeated flushing of the drug solute could increase irritation to the vein lining and thereby also increase the risk of phlebitis (Jenny Scott, personal communication, 2007). These findings emphasise the need for UK drug services to place strong and specific emphasis on vein care among crack-based speedball injectors, including advice in relation to the use, amount and availability of acidifiers in preparing speedball injections.

We found that groin injection may be considered an 'acceptable risk' given perceived situated benefits, particularly among younger speedball injectors, but that groin injection was also perceived to have come about as a result of the deterioration of veins, in part as a consequence of speedball injection. Aside from lack of other vein options, common reasons for groin injection included speed, ease, discretion, a better rush, and relative safety in comparison with injecting in previously damaged injection sites [3,30]. Most injectors seemed aware of the multiple health complications of groin injection and perceived it to have been a 'risk boundary' crossed. Long-term use of the femoral vein may lead to vascular complications and circulatory problems such as deep vein thrombosis, leg ulcers and infections, in extreme cases resulting in leg amputation [32,33,46]. We found that most persisted with groin injection despite awareness of risk and despite having experienced medical complications or missed hits into the neighbouring femoral nerves or artery.

Given the health risks associated with groin injection [32,33,46], we recognise that there is a need for balance in the extent to which safer groin injection should be promoted as harm reduction. However, our study emphasises that groin injection can be the norm among injectors, including younger less experienced injectors. With as many as half of UK injectors groin injecting [3], and with transitions to groin injection potentially intensified by vein deterioration associated with crack-based speedball injection, we identify an urgent need to provide UK injectors with harm reduction advice in relation to groin injection.

In conclusion, we emphasise that shifts towards crack-based speedball injection in combination with shifts towards the risk acceptability of groin injection present major challenges to harm reduction services in the UK, which evolved primarily in response to heroin injection [47]. We emphasise the need to tailor harm reduction services to speedball injectors as a distinct subgroup. There is a particular need to promote vein care and assist with the treatment to injecting site infections. The incorporation within harm reduction services of nurses specifically trained in treating injecting site wounds and infections would maximise opportunities for preventing long-term medical complications associated with vein damage, as well as likely save costs associated with accident and emergency admissions [48,49]. Lastly, we identify a need to consider

interventions to encourage transitions among current crack-based speedball injectors towards crack smoking and interventions to help prevent transitions to groin injection through the improved care of other injection sites.

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