


DRUG & ALCOHOL FINDINGS *Research analysis*

This entry is our analysis of a study considered particularly relevant to improving outcomes from drug or alcohol interventions in the UK. The original study was not published by Findings; click [Title](#) to order a copy. Free reprints may be available from the authors – click [prepared e-mail](#). The summary conveys the findings and views expressed in the study. Below is a commentary from Drug and Alcohol Findings.

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► Usage of low dead space syringes and association with hepatitis C prevalence amongst people who inject drugs in the UK.

Trickey A., May M.T., Hope V. et al.

Drug and Alcohol Dependence: 2018, 192, p. 118–124.

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For people who share injecting equipment, 'low dead space' syringes may lead to a reduced risk of becoming infected with blood-borne viruses by limiting the volume of fluid that is drawn up but not injected. However, they may not (yet) be suitable for all types of injectors or injections.

SUMMARY People who inject drugs are at risk of becoming infected with hepatitis C and other blood-borne viruses when they share needles, syringes and other injecting equipment. Although there is a large body of evidence that needle and syringe programmes and opioid substitution therapy can decrease this risk, simulation models [suggest that](#) these interventions alone will be unable to reduce hepatitis C to low levels even when they achieve a high level of 'coverage' – reaching a large proportion of the intended client population. Additional prevention and treatment strategies are therefore required to further reduce the burden of disease.

'Dead space' refers to the volume of fluid that is drawn up by a syringe but not injected. Syringes with attached needles retain far less blood following an injection – they have 'low dead space' – than syringes with detachable needles, which have a 'high dead space'. For people who inject drugs and share injecting equipment, using low dead space syringes instead of high dead space syringes may lead to a reduced risk of becoming infected with blood-borne viruses because the volume of blood held in a syringe is an important predictor of the viral load (the amount of virus) transmitted. The World Health Organization [recommends](#) that needle and syringe programmes supply low dead space syringes to people who inject drugs, despite there being a limited evidence base about their prevention benefits.

The featured study investigated the characteristics of people in the UK who use low versus high dead space syringes, and whether low dead space syringes were associated with reduced risk of hepatitis C infection.

The study's participants were recruited [from the 2014 and 2015 Unlinked Anonymous Monitoring Survey](#). They were eligible to participate if they reported injecting in the past month, had a hepatitis C test result, and could provide information on use of low dead space syringes.

For each participant, the percentage of low and high dead space syringes used in the past month was calculated based on self-reported use of syringes with either attached needles (indicative of low dead space syringes) or detachable needles (high dead space syringes). Low dead space syringes with detachable needles were rare in the UK at the time, as they had not yet been introduced by needle and syringe programmes. The wide availability of needle and syringe programmes in the UK, combined with the restriction on over-the-counter sales, means that needle and syringe programmes should account for the vast majority of needles provided to people who inject drugs.

The median or midpoint age of the 2,174 people who joined the study was 37 years, 24% were women, and 95% were born in the UK. On average they had started injecting 15 years ago and in the past month had injected 17 times. Just over half (55%) tested positive for hepatitis C antibodies, indicating that at some time they had become infected with hepatitis C, but not necessarily that they were currently infected.

Main findings

Characteristics associated with use of low dead space syringes

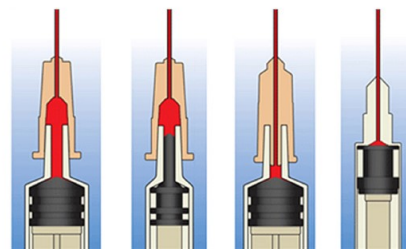
Over half of participants (55%) reported always using low dead space syringes, 17% used both low and high dead space syringes, and 27% always used high dead space syringes. A third of participants (32%) said they had injected into their groin in the past month. Almost all (90%) had injected heroin in the past month, and of the 10% who had not, 72% had injected amphetamine.

Key points From summary and commentary

The World Health Organization [recommends](#) supplying low dead space syringes to people who inject drugs. By retaining less fluid, these may help prevent the spread of hepatitis C and other blood-borne viruses due to sharing injecting equipment.

Among a sample of people who inject drugs in the UK, the featured study found that use of low dead space syringes was associated with a lower prevalence of hepatitis C infection, especially among people newer to injecting.

Although promising, the protective effect of low dead space syringes may have been limited to certain types of injectors or injections. For example, people injecting into their groin were much more likely to use high dead space syringes, due in part to needing larger needles to inject into the femoral vein.



'Dead space' in different syringes indicated in red. From left to right: standard detachable needle on standard syringe; standard detachable needle on low dead space syringe; low dead space detachable needle on standard syringe; low dead space syringe with fixed needle. (Illustration from a [study](#) about the acceptability of low dead space syringes.)

Use of low dead space syringes varied by geographical region, with 45% of people in the East Midlands exclusively using low dead space syringes in the past month, compared with 66% in London and 68% in the West Midlands.

In some respects participants who exclusively used low dead space syringes were similar to those who use high dead space syringes – in age, number of days injecting in the past month, years since first injection, number of different types of drugs injected, and whether they had shared injecting equipment in the last month (37% of each group had). However, there were differences when it came to imprisonment, crack cocaine injecting, and injecting into the groin.

- Two-thirds (66%) of participants who always used low dead space syringes had ever been to prison, compared to 77% who used high dead space syringes.
- Injecting crack cocaine during the last month was more common in people using high dead space syringes than those who always used low dead space syringes (47% versus 39%).
- Injecting into the groin during the last month was strongly associated with high dead space syringe use; nearly two-thirds of people (64%) who used high dead space syringes injected into the groin, compared with 20% only using low dead space syringes.

Factors associated with participants exclusively using low dead space syringes included the geographical region they lived in, type of drug injected, and injection site.

- Whereas injecting heroin was associated with people using low dead space syringes, injecting crack cocaine and 'other drugs' was associated with *not* using low dead space syringes.
- Those injecting into the groin were very unlikely to use low dead space syringes compared to those not injecting into the groin.
- Combined use of different substances was also negatively associated with exclusive use of low dead space syringes, with the odds of only using low dead space syringes decreasing more with each additional type of drug injected.

Use of low dead space syringes and hepatitis C infection

Over half of participants (55%) tested positive for hepatitis C antibodies. The prevalence of hepatitis C was lower among those exclusively using low dead space syringes (50%) than people using high dead space syringes (61%).

Among those who were newer to injecting drugs, participants exclusively using low dead space syringes had lower odds of testing positive for hepatitis C antibodies. The strength of the association was greater among those who had injected for fewer than three years.

In addition to the number of years since first injection, a number of factors were independently associated with increased odds of testing positive for hepatitis C antibodies: sharing injecting equipment; injecting crack cocaine; and having been to prison.

The authors' conclusions

Over half of study participants reported always using low dead space syringes. This was associated with a lower prevalence of hepatitis C, especially among people who were newer to injecting.

People less likely to exclusively use low dead space syringes fell into the following categories: people who had previously been in prison; people who injected crack cocaine; and people who injected into the groin. The association between groin injecting and use of high dead space needles was probably related to the need for larger needles to inject into the femoral vein. Previous studies have [reported that](#) injecting into the groin is often considered a last resort once the peripheral veins are no longer useable. People who inject drugs may also prefer high dead space syringes with detachable needles because they allow them to replace the needle, for example if it gets blocked or blunt from repeated attempts to find a vein (1 2). Resources and information about safer injecting practices and maintaining better vein health should be used to reduce the extent of injecting into the groin and other deep and/or central veins.

While the study showed a link between groin injecting and high dead space syringes, it could not determine whether groin injecting heightened the odds of hepatitis C infection amongst those who use high dead space syringes, or alternatively whether groin injecting was a more reliable marker of the use of high dead space syringes in the study. Other risk factors for hepatitis C infection were present among people using high dead space syringes which may have accounted for some of the difference. However, the use of low dead space syringes probably did lead to a reduction in the risk of hepatitis C transmission as high dead space syringes [retain more blood](#) following an injecting episode and therefore [transmit a higher](#) viral load (the amount of virus) when shared.

World Health Organization guidelines on the prevention of blood-borne viruses [recommend](#) making low dead space syringes available to people who inject drugs. Although the featured study supports these guidelines by suggesting that the use of low dead space syringes may be associated with lower odds of infection, further research is still needed to obtain stronger evidence on this effect.

Use of low dead space syringes is highly related to the type of drug used and the body site injected into, so in order to operationalise the World Health Organization guidelines, needle and syringe combinations must meet the needs of all people who inject drugs while also minimising the dead space in the syringes they use. Detachable syringes and needles with lower dead space have been developed and are now being distributed in some settings. While these are an improvement on high dead space syringes, they still have a more dead space than fixed-needle low dead space syringes, [meaning that](#) they still pose a greater risk for transmitting hepatitis C if the injecting equipment is shared.

FINDINGS COMMENTARY In the event that fresh syringes and needles are not available, people may re-use their own injecting equipment and/or share with someone else. This creates a need to both minimise the number of situations where re-using and sharing will arise (eg, [by needle and syringe programmes](#) supplying more than one syringe for every injection) and deliver pragmatic advice about how people who inject drugs can reduce the risks to themselves and others if they re-use or share injecting equipment (eg, [methods for rinsing](#) and using low dead space syringes).

Syringes carry [varying levels](#) of risk of transmitting blood-borne viruses such as HIV and hepatitis C. Standard injecting equipment with detachable needles, for example, contain ten times more 'dead space' (the volume of fluid that is drawn up but not injected), and transfer more blood if re-used (even if rinsed) than

equipment with fixed needles. Viruses can also survive for longer in high dead space syringes. The featured study examined the use of low and high dead space syringes among people who inject drugs, and the association between use of different types of syringes and exposure to hepatitis C. It found that there was a lower prevalence of hepatitis C among people who exclusively used low dead space syringes, suggesting that low dead space syringes could help to reduce opportunities for transmission of the virus among people who share injecting equipment.

The study was not designed to establish cause and effect between use of a particular syringe type and transmission of the virus. One constraint on drawing this kind of line between the intervention and the outcome was that the study could not determine the window for infection with hepatitis C, or distinguish between whether people had been exposed to the virus at some point in the past but were no longer infected or had an active hepatitis C infection which needs treatment. Having said that, it did establish that the odds of a person being infected with hepatitis C at some point were lower if they currently only use low dead space syringes, versus use high dead space syringes.

Another important finding was that the potential for low dead space syringes – syringes with attached needles in this study – to have a protective effect may have been limited to certain groups of injectors or certain types of injections. For example, people injecting into their groin were considerably more likely to use high dead space syringes, related to their need for larger needles to inject into the femoral vein. Injecting into the femoral vein (known as 'groin injecting') risks complications and trauma around the site, including deep vein thrombosis and ulcers. Compared to research into these adverse consequences, [little has been written](#) about what motivates the practice of groin injecting.

In 2004, 47 people who inject drugs who were currently injecting in their femoral vein were [recruited through](#) the Bristol Drugs Project Harm Reduction Service, and interviewed about their transition to groin injecting, rationale for injecting in this way, and the incidence of problems. The [average](#) length of time between first injection and first injection into the groin was seven years. One person had used no other area for vein access prior to using the groin, nine people had used one, nine people had used two, 10 people had used three, five people had used four, and 13 people had used more than four areas. The main reason given for starting to inject in the groin was that 'no other sites were left'. However, further discussion identified this meant no other *convenient* sites were accessible. Practices such as the rotation of injecting sites, as advocated in many harm reduction publications, were reported to be difficult and unreliable. The risk of missing the vein and subsequently losing the 'hit' was considered high. The groin site was reported to be convenient, provide quick access, with little mess and less pain than smaller, more awkward veins.

The Global Fund to Fight AIDS, Tuberculosis and Malaria (known as the Global Fund) and the Eurasian Harm Reduction Network have [acknowledged](#) "emerging evidence suggest[ing] that a switch to low dead-space ... syringes could have a major impact on HIV", but also that such an intervention "can only succeed if it is fully informed by – and with the full backing of – local drug users, taking into account their needs, preferences and the local drug markets, and where reliable supplies of new products can be ensured at similar costs to existing syringes". For people who inject drugs in Eastern European and Central Asian countries, represented in a [linked paper](#), the acceptability and feasibility of using low dead space syringes was influenced by practical considerations, such as the availability of syringes with larger barrel capacities, ranging from 2 ml to 10 ml, and detachable needles.

[According to](#) the first study of the acceptability of switching to lower-risk, low dead space syringes, changing equipment can be difficult for people who inject drugs but key features of detachable low dead space syringes tend to be viewed favourably. Factoring in the practices of people who inject into their groin, the study concluded that detachable low dead space needles should be offered to those using detachable high dead space syringes and/or fixed 1 ml low dead space syringes for injection into deeper femoral veins. Furthermore, the study recommended that an intervention to support their introduction should involve:

- training for needle and syringe programme staff about the benefits of detachable low dead space syringes, how to identify people who inject drugs who may benefit from them, and how to encourage behaviour change;
- verbal and written information for people who inject drugs, which will raise awareness of the benefits of detachable low dead space syringes and provide reassurance that the injecting process and experience would not be affected;
- the spread of information via peer networks within needle and syringe programmes;
- encouraging appropriate syringe-rinsing methods for people who inject drugs known to re-use or share equipment;
- gradual introduction of detachable low dead space syringes rather than replacing equipment without warning or support for people who inject drugs; once the majority of needle and syringe programme users have received information and new equipment to try, old high dead space syringes can be phased out.

There is [evidence](#) to indicate that replacing high dead space syringes with detachable low dead space syringes in needle and syringe programmes in the United Kingdom would be a cost-saving

Understanding the difference

A Drink and Drugs News article from 2013 explained the [difference](#) between high and low dead space syringes:

"Every syringe inevitably retains some fluid when its plunger is fully depressed, in what is known as the dead space. [...] 'High dead space' syringes with detachable needles will retain fluid in the tip of the syringe, the hub of the needle and the needle shaft itself. In 'low dead space' designs with permanently attached needles – such as the 1 ml insulin needles used by many people who inject drugs – fluid is only retained in the needle shaft."

"The difference can be up to 40 times more fluid being retained in high dead space syringes compared to low dead space ones. In laboratory experiments that simulated common injection practices, low dead space syringes retained up to 1,000 times less blood than high dead space syringes, so if a person shares a low dead space syringe with someone living with HIV there will be less blood retained in the syringe and therefore less viral load and a lower risk of transmission."

approach for reducing hepatitis C virus transmission. In a study set in Bristol (city in South West England), it was [estimated that](#) introducing detachable low dead space syringes would be associated with a small increase in intervention costs (£21,717) compared with not introducing detachable low dead space syringes, but considerable savings in hepatitis C-related treatment and care costs (£4,138,118). Overall cost-savings were estimated at £4,116,401 over 50 years, with an estimated 30% reduction in new infections over the 10-year intervention period. The UK's health advisory body set up a multi-disciplinary committee to [consider the evidence](#) on needle and syringe programmes. In 2014 this Public Health Advisory Committee "was satisfied that the provision of low dead-space injecting equipment was justified if its price was the same as, or only marginally higher than, other equipment".

Countries such as the UK [still have](#) high levels of hepatitis C despite considerable investment in needle exchange and methadone and buprenorphine maintenance. Where conventional substitute and equipment supply programmes already reach a high proportion of injectors, a [simulation study](#) in the UK suggests that additional alternative measures are indeed required to make substantial further progress. UK guidance from the National Institute for Health and Care Excellence (NICE) [recommends that](#) needle and syringe programmes "offer, and encourage the use of, low dead-space injecting equipment". The findings of the featured study are consistent with this guidance.

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STUDY 2017 [Acceptability of low dead space syringes and implications for their introduction: A qualitative study in the West of England](#)

STUDY 2015 [Randomized controlled trial of motivational interviewing for reducing injection risk behaviours among people who inject drugs](#)

DOCUMENT 2014 [Needle and syringe programmes](#)

MATRIX CELL 2017 [Drug Matrix cell A1: Interventions; Reducing harm](#)

STUDY 2018 [Impact of current and scaled-up levels of hepatitis C prevention and treatment interventions for people who inject drugs in three UK settings – what is required to achieve the WHO's HCV elimination targets?](#)

STUDY 2019 [Using interrupted time series analysis to measure the impact of legalized syringe exchange on HIV diagnoses in Baltimore and Philadelphia](#)

REVIEW 2012 [Needle exchange and the HIV epidemic in Vancouver: Lessons learned from 15 years of research](#)

DOCUMENT 2011 [Prevention and control of infectious diseases among people who inject drugs](#)

MATRIX CELL 2017 [Drug Treatment Matrix cell E1: Local and national systems; Reducing harm](#)

DOCUMENT 2014 [Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations](#)