

Maximising the effectiveness of needle exchange

with low dead space syringes and prevention of accidental sharing



About us

Exchange Supplies is a social enterprise established to supply products, information, and services to improve and prolong the lives of people who inject drugs.

Being a social enterprise means that we are principally driven by our health and social objectives rather than profit – which, in our case, means that we have as key priorities:

- reducing the health impacts of injecting drug use
- developing injecting equipment that causes less harm
- providing employment and training to people with a history of drug dependence
- improving the understanding of injecting drug use

By choosing us as a supplier, you are providing equipment designed to maximise the benefits of service provision, and contributing to the research and development of new and existing products.

Low dead space

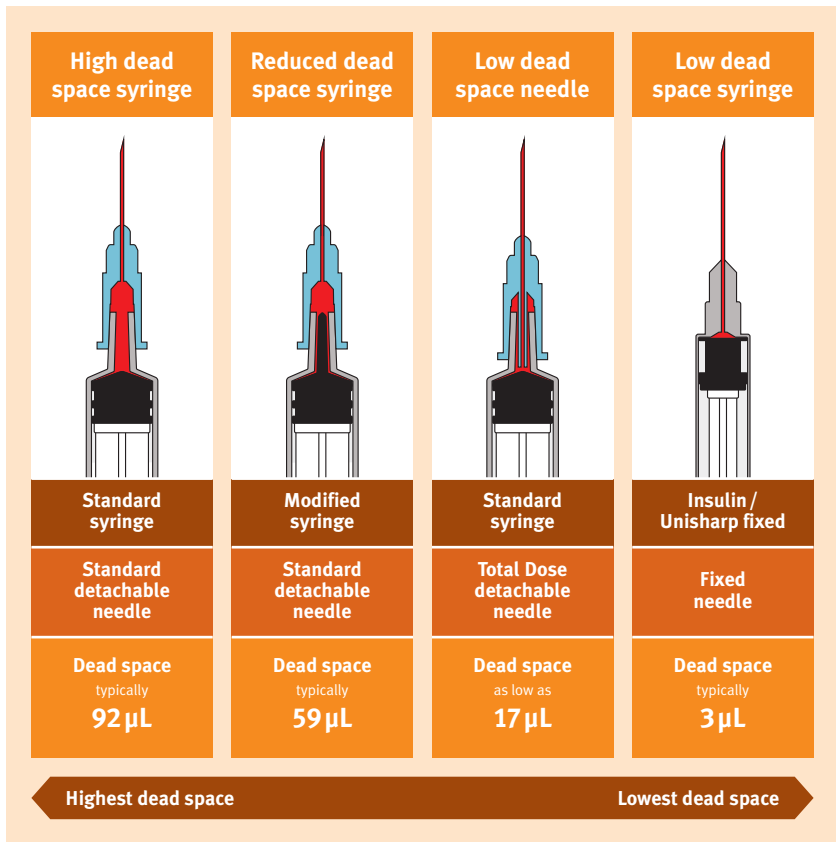
Dead space

'Dead space' is the name given to the void space in a needle and syringe combination that still has liquid in it following an injection.

Injecting drug users flush out the tiny amount of drug left in the syringe after injection by drawing blood back into the syringe, and re-injecting.

This means that after use, syringes have the dead space filled with blood that may be infected with HIV and/or hepatitis C.

Dead space compared



All dead space measurements independently carried out by the Department of Engineering and Microfluidics, Southampton University.

Infection risk

When injecting equipment is shared, infections can be transmitted if an infective dose of virus is present in the blood and injected by another person.

The main factors that determine if an infective dose of virus is present are the:

- **viral load** (how many viral particles per ml of blood)
- **dose of blood**
- **time delay and ambient temperature** between use and re-use by someone else

The 'dead space' in syringes is a significant factor in both the dose of blood left in used syringes (**less dead space = less virus**), and the viral survival time (**lower dead space = reduced viral survival**).

Ambient temperature is important, with the virus surviving significantly longer if its surroundings are cool (**higher temperatures = reduced viral survival**).

Dead space and HIV: the evidence

The amount of virus in the blood (the viral load) of someone with HIV does not remain constant.

After infection there is a period of high viral load, and how low it falls after that depends on if and when people start taking anti-retroviral drugs.

During this initial infection period, a high dead space needle and syringe can contain 10,000 HIV copies, whereas a low dead space syringe could contain around 10 copies.

The survival of viruses in syringes is much better in high dead space syringes than in low dead space syringes because the blood can form a protective boundary, keeping the central blood moist.

As syringes are often re-used – and shared – hours or days after the first use, the benefits of reducing the dead space are increased, because not only is there less virus, it also reduces its ability to infect more quickly.

In a study done by Robert Heimer and colleagues at Yale University¹ it was shown that Total Dose needles give better protection from HIV than standard Luer slip needle/syringe combinations, and also greater protection than syringes with displacement spikes.

1. Recovering Infectious HIV from Novel Syringe-Needle Combinations with Low Dead Space Volumes.
Abdala N, Patel A, Heimer R.
Aids Research and Human Retroviruses Volume 00, Number 00, 2016

Dead space and hepatitis C: the evidence

The Total Dose needles and other dead space reduction measures also had their effectiveness at reducing hepatitis C infectivity tested by Professor Robert Heimer's team at Yale University, and the results published in the online journal PLOS ONE in November 2015.²

The findings of this research are:

- **Insulin type fixed needle syringes have the lowest blood-borne virus transmission risk;**
- **Rinsing syringes before re-use with water and bleach is an effective and essential process** for the prevention of both HIV and hepatitis C, and should be encouraged;
- For people who are unable, or cannot be persuaded, to use insulin type syringes, and instead **use 2 ml or 5 ml syringes** for detachable needles, the **Total Dose needles are, overall, the best of the dead space reducing** measures available – and reduce the dead space more than syringes with modified plungers; and
- **The more the dead space is reduced, the greater the effect on hepatitis C survival infectivity**, and that this is most marked when the syringes had been stored for a few days.

This was a reassuring finding. There was previously the concern that as catching an infection is a binary thing – either the virus is transmitted or it isn't – that the reductions in dead space might not be enough to prevent infections. **Now it is clear that incremental reductions in the dead space lead to a reduction of infection risk.**

Using Total Dose needles compared to standard needles gave gains of up to 35% reduction in hepatitis C; and 6 fold in hepatitis C reduction after three days. Total Dose needles give better protection from hepatitis C than syringes with modified plungers.

2. Survival of Hepatitis C Virus in Syringes Is Dependent on the Design of the Syringe-Needle and Dead Space Volume (2015)
Binka M, Paintsil E, Patel A, Lindenbach BD, Heimer R
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0139737>

Rinsing and storage

Because people often rinse syringes after use, and again before re-use (especially if the re-use isn't on the same day) real life rinsing practice of injecting drug users often exceeds the one or two times in the study. In these cases the HIV and hepatitis C reductions will be greater than the one to two rinses performed in the study.

We know that equipment is often stored and re-used some time later, so in these cases because of reduced viral survival when there is less blood, reducing the dead space could make the difference between someone catching hepatitis C or not.



Cleaning works DVD – also available to view online at exchangesupplies.org

The evidence for cleaning

Robert Heimer's team have developed a reliable scientific method to measure both the amount of virus present in a used syringe, and its infectivity.³

They used their methods to assess the effectiveness of a range of household products in syringe cleaning.

They tested:

- Water alone
- Bleach
- Hydrogen peroxide
- Ethanol alcohol
- Isopropanol
- Lysol (an American brand of disinfectant)
- Dawn Ultra (an American brand of washing up liquid)

Their methods were very thorough to find out which was the most effective thing to use to prevent hepatitis C transmission and they tested all the substances at different concentrations.

They tested immediately, and if there was viable virus, they stored samples at 4°C, 22°C, and 37°C for up to 21 days and tested for viral infectivity.

They tested both 1 ml fixed needle syringes, and Luer slip high dead space syringes.

They found that bleach was the most effective disinfectant, and that it was effective after just one rinse. This was in contrast to all the other substances tested, which required multiple rinses to eliminate hepatitis C.

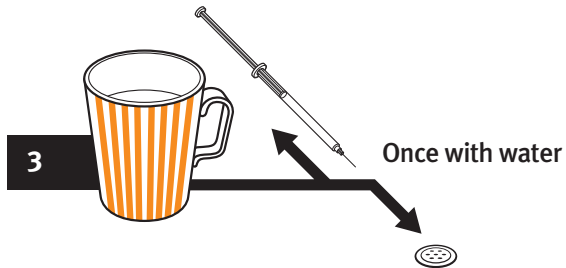
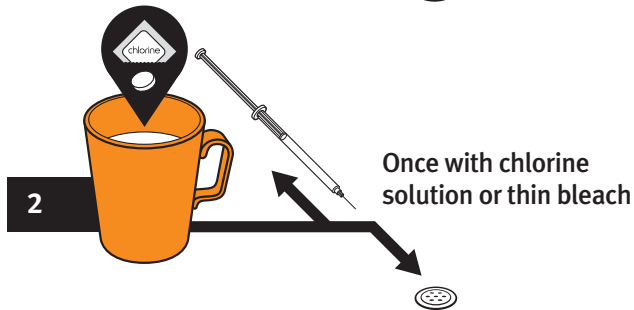
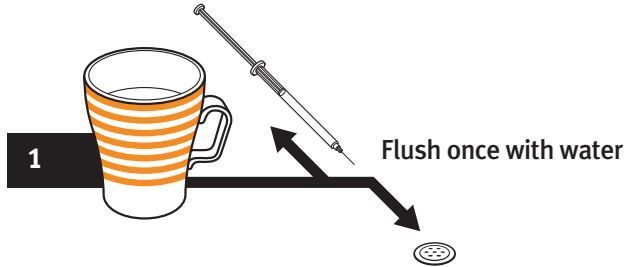
This result was consistent with previous studies done by the same team that found the same level of fast effectiveness for bleach in eliminating residual HIV infectivity in contaminated syringes.

Cleaning syringes works.

3. Disinfection of syringes contaminated with hepatitis C virus by rinsing with household products.
Binka M, Paintsil E, Patel A, Lindenbach BD, Heimer R.
Open Forum Infect Dis. 2015 Feb

Syringe cleaning

If you have to re-use a syringe get three clean cups and fill two with cold water. Pour out a capful of thin bleach, or dissolve a chlorine tablet in the other cup.



Total Dose

Low dead space detachable needles

Working closely with Dr Zule, who first highlighted the impact of dead space in syringes, Exchange Supplies have developed the Total Dose low dead space needle range.

With a plastic spike that fits down inside the tip of the syringe filling this void and preventing the accumulation of blood, the Total Dose needle reduces the dead space by around 75%! Significantly reducing viral burden and survival times for both HIV and hepatitis C.



Now available in 30 mm 23G blue (22 μ L), 40 mm 21G green (27 μ L), and 16 mm and 25 mm 25G orange (17 μ L), the Total Dose needle is an important step forward in reducing the risk of blood-borne virus transmission.

Total Dose needles significantly reduce:

- the amount of virus that could be left in the used syringe
- survival time of any virus left in the syringe
- the need to ‘flush’ with blood post injection
(a practice which causes significant vein damage)

For more information go to exchangesupplies.org/totaldose

16 mm	5/8 inch orange	total dose Hypodermic needles (Low dead space)	LOT 100815
25G 0.5mm			EXP 2016 08
EXCHANGE SUPPLIES	MANUFACTURED FOR EXCHANGE SUPPLIES BY ZHEJIANG KINDLY MEDICAL DEVICES CO., LTD. EC REPRESENTATIVE: SHANGHAI INTERNATIONAL HOLDING CORP. GMBH (EUROPE).	STERILE EO	2021 07

The Total Dose dead space reducing needles therefore represent an important step forward, and are an intermediate step between high dead space injecting equipment, and insulin type low dead space syringes for people who need to use higher volume syringes, or longer / thicker needles than are available on insulin syringes for the prevention of hepatitis – and there is room for optimism that the impact on HIV prevention will be even greater.

We are, of course, working to further reduce the dead space in detachable needle and syringe combinations, and demand for the Total Dose needles is helping us maintain momentum with this process.

There is no suggestion that we have achieved risk equivalence with insulin type syringes, or that Total Dose needles are the end point in reducing dead space in syringes for detachable needles.



Will injectors accept a change of equipment?

The experience of our customers is that drug users are acutely aware of the loss of drugs in syringes, and are positive about the ability of Total Dose needles to reduce this problem.

In order to conduct an objective assessment of the acceptability of Total Dose needles for their clients, Bristol Drugs Project in partnership with a number of other organisations carried out a study to collect data to establish the acceptability of Total Dose needles.⁴

Semi-structured interviews were conducted with 23 people who inject drugs.

Acceptability of low dead space syringes and implications for their introduction: A qualitative study in the West of England

The study, which was the first qualitative study assessing the acceptability of detachable low dead space syringes (LDSS) to people who inject drugs (PWID), concluded that while changing equipment is difficult for PWID, the benefits of detachable LDSS were viewed favourably, and gradual change in equipment, supported by verbal and written information from needle and syringe programmes (NSP) which empowers PWID, is expected to enhance their acceptability.

This mirrors our experience.



4. Acceptability of low dead space syringes and implications for their introduction: A qualitative study in the West of England Joanna M. Kestena, b, c, *, Rachel Ayresd, Jane Nealed, Jody Clarke, Peter Vickermanb, c, Matthew Hickmanb, c, Sabi Redwood International Journal of Drug Policy 39 (2017) 99 – 108

- a, c a NIHR Collaboration for Leadership in Applied Health Research and Care West (NIHR CLAHRC West) at University Hospitals Bristol NHS Foundation Trust, UK
- b NIHR Health Protection Research Unit on Evaluation of Interventions, University of Bristol, UK
- c School of Social and Community Medicine, University of Bristol, UK
- d Bristol Drugs Project, Bristol, UK e Bristol City Council, Bristol, UK

WHO and NICE guidance

Low dead space equipment is recommended by the **World Health Organisation Guidance**⁵ on prevention of viral hepatitis B and C among people who inject drugs, which has the recommendation that:

- “...needle and syringe programs also provide low dead space syringes for distribution to people who inject drugs.”

It is also recommended in the Consolidated Guidelines HIV prevention,⁶ diagnosis, treatment and care for key populations:

- All individuals from key populations who inject drugs should have access to sterile injecting equipment through needle and syringe programmes...
- It is suggested that needle and syringe programmes also provide low dead space syringes along with information about their preventive advantage over conventional syringes...
- Injecting equipment should be appropriate to the local context, taking into account such factors as the type and preparation of drugs that are commonly injected (page 31).

The UK NICE guidance PH52 for needle and syringe programmes

recommends the distribution of low dead space injecting equipment to reduce blood-borne virus transmission.

Recommendation 7: Provide people with the right type of equipment and advice states: “Where possible, make needles available in a range of lengths and gauges, provide syringes in a range of sizes and **offer low dead-space equipment.**”

NICE guidance recommendation 3 advises services to “Encourage identification schemes (involving, for example, the use of coloured syringes)” and it is this issue that the next section of this booklet addresses.

5. WHO ‘Guidance on prevention of Viral Hepatitis B & C among people who inject drugs’ (2012)

6. WHO ‘Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations’ (July 2014)

Preventing accidental sharing

Another previously overlooked cause of blood-borne virus transmission was accidental sharing caused by:

- shared storage of used injecting equipment;
- collective preparation of drugs for injection; and
- mix ups in injecting environments with multiple syringes/injectors.

Where syringes are all identical, this creates an environmental risk that increases the chances of BBV transmission regardless of the intentions of the injecting drug users.

Our Nevershare and Unisharp ranges of 1 ml fixed needle and 2 ml syringes have different colour plungers to promote syringe recognition, and prevent accidental sharing.

The range of colours allows couples to choose a colour that they stick to, and also allows people to collect equipment for use by others that is clearly differentiated.

When encouraged to do this by needle and syringe programme staff it provides a positive way for people to request more equipment for others which increases coverage, and reduces sharing.

Building change into the environment maximises the benefits, and is more likely to reduce sharing than relying on people to mark their injecting equipment to identify it.

Having the difference built into the syringes, and not requiring any further action by the user of the syringe maximises the chances of the strategy working.

Nevershare fixed needle 1 ml syringe

The first 1 ml low dead space fixed needle syringe with plungers in a range of colours to prevent accidental sharing.

The low dead space in insulin type syringes (such as the Nevershare fixed) can only contain up to 3 microliters of blood, which may sometimes be less than that which is required to transmit HIV infection.⁷

There is strong observational evidence from around the world that points to low rates of HIV being associated with predominant use of insulin type syringes, and high rates being associated with use of syringes for detachable needles.



By comparison, a standard detachable needle fixed to a used 2ml syringe with a Luer fitting has around 90 microlitres of blood remaining in the dead space between the plunger and the top of the inside of the hub.

This meant that until 2013 the switch to detachable needles involved a significant step up in blood-borne virus transmission risk because of the increase in dead space.

Our 1 ml fixed needle coloured syringes therefore reduce both BBV infection risk, and risk of accidental sharing.

7. Are major reductions in new HIV infections possible with people who inject drugs?
The case for low dead-space syringes in highly affected countries
Zule, W.A., Cross, H.E., Stover, J., & Pretorius, C.
International Journal of Drug Policy (January 2013)

Unisharp fixed needle 1 ml syringe

A 1 ml low dead space fixed needle syringe with plungers in a range of colours to prevent accidental sharing. Currently available with 29G and 30G needles. A 27G needle will be in production soon.



Unisharp fixed 1 ml syringe in 5 colours and with a 29G needle



Unisharp fixed 1 ml syringe in 5 (different) colours and with a 30G needle

Nevershare 2 ml syringe

A 2 ml syringe for Total Dose and other detachable needles with plungers in a range of colours. Available with Luer slip or Luer lock fitting.



2 ml Nevershare Luer slip syringes



2 ml Nevershare Luer lock syringes

This briefing outlines the evidence for supplying injecting equipment that has the smallest possible amount of blood remaining after it has been used and ensuring that it is possible for people to tell their syringes apart.

Low dead space syringes are part of our comprehensive range of injecting equipment and paraphernalia designed to reduce injecting related harm including Unisharp and Nevershare syringes with coloured plungers to reduce the risk of accidental sharing.

**For more information go to exchangesupplies.org
or email andrew@exchangesupplies.org**