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. Links to other documents. Hover over for notes. Click to highlight passage referred to. Unfold extra text The Summary conveys the findings and views expressed in the study. Below is a commentary from Drug and Alcohol Findings.

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▶ Recovery of infectious hepatitis C virus from injection paraphernalia: implications for prevention programs serving people who inject drugs.

Heimer R., Binka M., Koester S. et al.

The Journal of Infectious Diseases: 2017, in press.

Resources spent on supplying 'cookers' and filters at needle exchanges may not help curb the spread of hepatitis C. Laboratory simulation suggests infections thought to be have been spread by sharing this equipment may be a proxy for transmission that occurs due to sharing blood-contaminated equipment for dividing drugs.

SUMMARY Hepatitis C is among the most common viral infections in the world, and especially prevalent among people who inject drugs. As with HIV, hepatitis C is transmitted within populations of people who inject drugs primarily through unsafe injecting practices, but unlike HIV, incidence of hepatitis C is often not reduced by increasing access to sterile syringes (1 2).

After injecting, many injectors flush the syringe with blood which they draw back into the syringe and then inject, a practice called 'booting' [or 'flushing']. When a person has hepatitis C, the residual contents of the syringe consist almost entirely of blood that is contaminated. This, combined with no attempt to disinfect the syringe before it is reused, represents a 'worst-case scenario' for hepatitis C contamination and transmission if shared.

Researchers and public health officials have also been interested in the risk of transmission when sharing other equipment to prepare for an injection, specifically, 'cookers' used to dissolve solid drugs [commonly referred to as 'spoons' in the UK], filters used to filter dissolved drugs, and syringes used for adding water to dissolve the drug or distribute the drug once dissolved. If a contaminated syringe is used to add water, dissolve, and apportion the drug, then some of the contents of the contaminated syringe can pass through the 'spoons' or 'cooker' and filter and into the syringe of the uninfected person.

Key points
From summary and commentary

After replicating scenarios that occur when people prepare and share drugs to inject, this study tested which items of equipment may harbour and possibly transmit hepatitis C.

They found that sharing paraphernalia does not directly result in the transmission of hepatitis C, and conclude that paraphernalia sharing is a 'surrogate' or proxy for transmission that takes place from the use of contaminated syringes to share drugs.

This has important implications for prevention efforts, and programmes that provide education and safe injecting supplies to people who inject drugs.

The featured study sought to replicate (as closely as possible) the injecting scenarios that occur when people use a syringe which has been 'booted' [or 'flushed'] by someone infected with hepatitis C to prepare and share packages of drugs. The aim was to determine which equipment components posed the greatest risk of transmitting the virus.

Tests were performed to see whether the virus could be recovered from:
- the contaminated 'input syringe' after it had been used as a measuring device to add water for dissolving drugs;
- the 'spoon' or 'cooker', and filter;
- the 'receptive syringe' that would subsequently inject the dissolved drug.

Two types of syringes were compared: insulin syringes with fixed needles, and tuberculin syringes with detachable needles. Also, two different types of 'spoons' or 'cookers' were compared – both resembled the screw tops of soda bottles, but one was ridged, and the other smooth, which is the type generally distributed by harm reduction programmes.

Experiment one: Syringes were loaded with the hepatitis C virus at a concentration which previous analysis suggests would be equivalent to a high viral load in chronically-infected patients. Water was then introduced into the barrel of each contaminated input syringe, and expelled into a 'spoon' or 'cooker', and the water drawn up into receptive syringes through cotton filters.

Experiment two: The researchers recreated two scenarios based on observations from earlier studies that filters are occasionally saved and 'beaten' to extract whatever drug residue remains, and the recovered drug then pooled with other drugs (1 2 3):
• In the first, filters were combined, 'beaten', and the extracted material tested.
• The second modelled the more realistic scenario that pooled filters are stored for periods of time before their contents are extracted. Filters stored for up to 10 days were combined, 'beaten' and the extracted material tested.

Main findings

Experiment one: Recovery of hepatitis C using single filters

For each type of syringe, 70 sets of injecting equipment were tested for the recovery of infectious hepatitis C. The results revealed that the virus was recovered more often when using the detachable needle–syringe combinations.

When tested for infectious hepatitis C remaining inside input syringes used to deliver water into the 'spoon' or 'cooker', hepatitis was recovered from 61% (43 of 70) of syringes with detachable needles, but not recovered from syringes with fixed needles (0 of 70). This finding was consistent with past studies and the difference was statistically significant. The virus was, however, successfully passed from both types of input syringes into receptive syringes, but at a lower frequency for syringes with fixed needles. Hepatitis C was recovered from 94% (66 of 70) of syringes with detachable needles and 46% (32 of 70) of syringes with fixed needles. This difference was statistically significant.

Recovery of hepatitis C from 'spoons' or 'cookers' and filters was lower than from syringes: 27% of filters (19 of 70) when the input syringe adding the water had a detachable needle; but only 1% (1 of 70) when the input syringe had a fixed needle. This difference was statistically significant. No infectious hepatitis C was recovered from 'spoons' or 'cookers' regardless of the type of syringe introducing the contaminated water or the design of the 'spoon' or 'cooker'.

For both input syringes and receptive syringes, the concentration of hepatitis C was higher when the experiment was based on syringes with detachable needles, than syringes with fixed needles.

Experiment two: Recovery of hepatitis C using pooled filters

On day 0, only 2% (1 of 60) of single filters yielded hepatitis C when input syringes had fixed needles – consistent with the results of experiment one. With a pool of ten filters, 5% (3 of 60) yielded active hepatitis C.

The researchers were unable to recover hepatitis C from any of the pooled filters once the filters had been stored. They were able to recover the virus from 88% (53 of 60) of the input syringes before they were stored, but within a week of storage, none of the input syringes yielded active hepatitis C. In contrast, all receptive syringes, which contained the contaminated material that had passed through the filters, yielded replicating hepatitis C up to a week of storage.

Combined results of experiments one and two

Combining comparable conditions in the two sets of experiments allowed the researchers to increase the total number of input syringes with detachable needles, 'spoons' or 'cookers', single filters, and receptive syringes to 130. They found that 74% of input syringes (96 of 130), 15% of filters (20 of 130), and 94% (122) of the receptive syringes yielded infectious hepatitis C, while none of the 'spoons' or 'cookers' did.

The authors' conclusions

While previous studies found strong correlations between sharing equipment and contracting hepatitis C, they did not differentiate between the two alternative explanations about how hepatitis C transmission takes place. The featured laboratory study, which sought to replicate real-world conditions, provided "biological evidence that the more compelling explanation for the

association is that sharing of objects associated with the preparation but not the actual injection of drugs is a surrogate for shared injections in which the virus is introduced from a contaminated syringe".

Findings such as these challenge policies adopted by harm reduction programmes to provide not just sterile syringes, but also clean 'cookers' and filters when attempting to reduce the transmission of hepatitis C, and suggest that resources may be better spent by:
• Focusing more on the process of drug preparation. This could include providing guidance and materials to reduce the chances of using contaminated syringes to prepare or apportion drugs, and recommending the use of syringes without accompanying needles to introduce water into 'cookers' or apportion dissolved drugs.
• Providing sterile water supplies and training to minimise the mixing of water sources used to prepare drugs and rinse used syringes "will do more than the provision of 'cookers' and filters to prevent [hepatitis C]".
• Focusing on the distribution of insulin-type syringes with fixed needles, or for people who use syringes with detachable needles the distribution of reduced dead space syringes [see Effectiveness Bank entry] which retain less fluid.

FINDINGS COMMENTARY In the featured study, 'cookers' didn't harbour infectious hepatitis C, and though single use and pooled filters did, hepatitis C was considerably more likely to be retrieved from syringes used to dissolve, distribute, and inject drugs. These findings suggest that sharing ancillary injecting paraphernalia doesn't directly result in the transmission of hepatitis C – instead, when it is shared, so too are drug solutions via potentially contaminated syringes and needles.

The primary factor that mitigated transmission was found to be type of needle–syringe combination. For both input syringes and receptive syringes, the concentration of hepatitis C was higher when used with detachable needles, than fixed needles.

The findings have potential implications for the priorities of needle exchange services and the messaging around harm reduction in general. If, as the study showed, hepatitis C can be harboured in a syringe used to share and prepare drugs, and end up in a syringe use to inject drugs, but leave "little or no virus" behind in the ancillary paraphernalia, advice that sharing 'spoons' or 'cookers' and filters should be avoided *may* be overstating the risk. It may be more beneficial to focus advice and resources on the *acts* of sharing and preparing drugs, and how this stage can introduce risks to clients whether or not they refrain from sharing needles and syringes to inject.

Yet this is just one study, and others found to the contrary that there was an association between sharing injecting paraphernalia and recent hepatitis C infection when needles/syringes had reportedly not been shared (1 2 3 4 5). A further meta-analysis found that the risk of hepatitis C infection was similar as a result of shared drug preparation equipment and shared syringes.

The findings and implications of the featured study refer specifically to hepatitis C, and cannot speak to the transmission of other infections such as HIV and hepatitis B. They also only apply to one strain or 'genotype' of the hepatitis C virus, and not the most common type. The authors acknowledge this as a limitation of the work, saying "the predominant genotypes among [people who inject drugs] worldwide are genotypes 1 and 3, so it would be useful to replicate our findings with viruses of these genotypes should they become available."

For a thorough look at the virus that was once called a "sleeping giant" in Britain, turn now to a hot topic describing the different components of hepatitis C control, including diagnosis, treatment and prevention, the place of harm reduction, which up to now has been the mainstay of hepatitis C control, and what could be game-changing additions to this armoury in the form of new treatments for the infection.

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