

Survival of Hepatitis C Virus is Temperature, Syringe Type, and Volume Dependent: Implications for Infection Control Strategies

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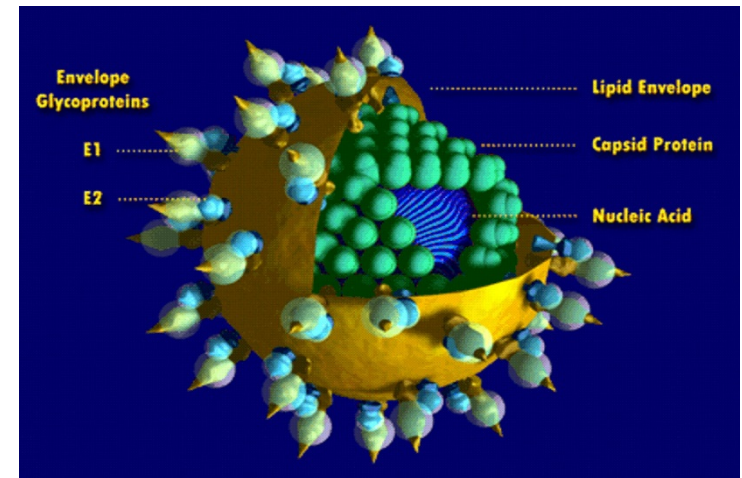
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- No conflict of interests

Global Burden of Hepatitis C virus Infection

- 170 million people are infected worldwide with hepatitis C virus
- 70 to 80% develop chronic HCV infections
- Cost of liver transplantation



HIV and HCV among IDUs

- Injection drug use is second most common risk factor for HIV.
- In the U. S., 1 in 7 IDUs is HIV seropositive.
- Prevention programs can reduce HIV transmission.
- Injection drug use is most common risk factor for HCV.
- In the U. S., 3 in 4 IDUs are HCV seropositive.
- Prevention programs do not seem to reduce HCV transmission.



Occupational Transmission of HCV

- **Accidental needle stick injury:** HIV 0.3% and HCV 3%
- In an Italian study of 214 patients with acute HCV the most relevant associated risk factors were:

history of medical procedures/hospitalizations - 32%

intravenous drug use - 30%

sexual contact (10%); household contact (7%); accidental exposures (5%), and tattoos and/or body piercing (3%)

unknown (13%);

Short & Bell 1993 *Amer. J. Infect. Control* 21:343-350

Santantonio et al. *CID* 2006;43:1154-1159

Routes of Transmission of Hepatitis C Virus



Survival of the Big 3 at Room Temperature

- HIV dries in room temperature in about 3 hours¹
- HIV Retains infectivity for up to 7 days²
- **HBV Up to 7 days³**
- Dried HBV contaminated plasma exposed to 70% isopropyl alcohol or 2% glutaraldehyde at pH 8.6 was not infectious in chimpanzees⁴
- **HCV?**

1. *Van Bueren J et al. 1994 J Clin Microbiol*
2. *Barre-Sinoussi F et al. 1995 Lancet*
3. *Bond et al. Lancet 1981*
4. *Bond et al. J Clin Microbiol 1983*

Physical Comparison of HIV AND HCV

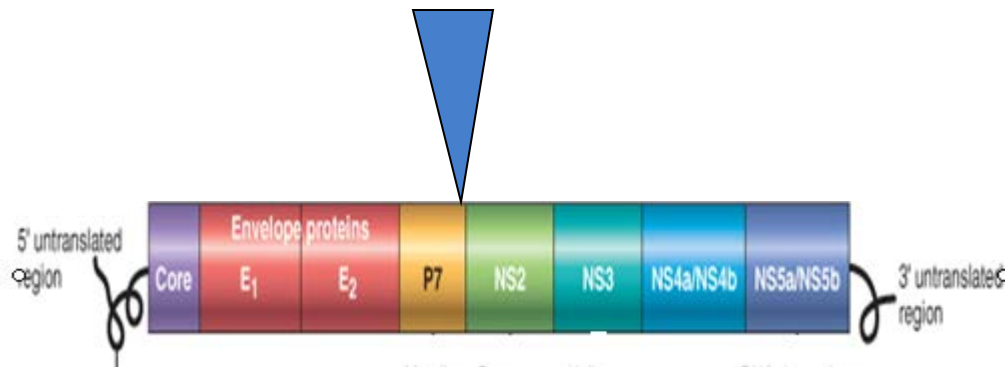
- Both HIV and HCV are RNA viruses containing single stranded RNA
- HIV viral genome is similar in length to HCV viral genome
- RNA is surrounded by a protein capsid
- Enveloped in a membrane containing proteins encoded by the virus and lipids derived from the infected cell



We hypothesized that the high prevalence of HCV healthcare transmission and among IDUs may be due to the ability of the virus to remain viable on contaminated surfaces and in syringes for prolonged periods

HCV Reporter Virus

- Jc1/GLuc2A is a genotype 2a virus with a luciferase gene from *Gaussia princeps* inserted between the p7 and NS2 genes



- Viral stocks of Jc1/GLuc2A reporter virus were prepared by RNA transfection of Huh-7.5 cells.

Time to Dryness of HCV drops on surfaces

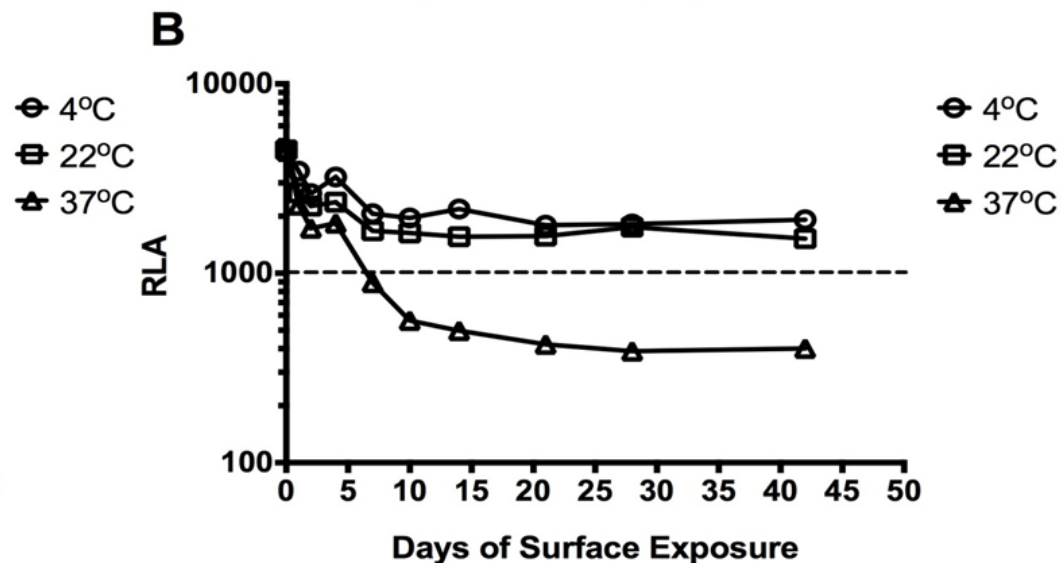
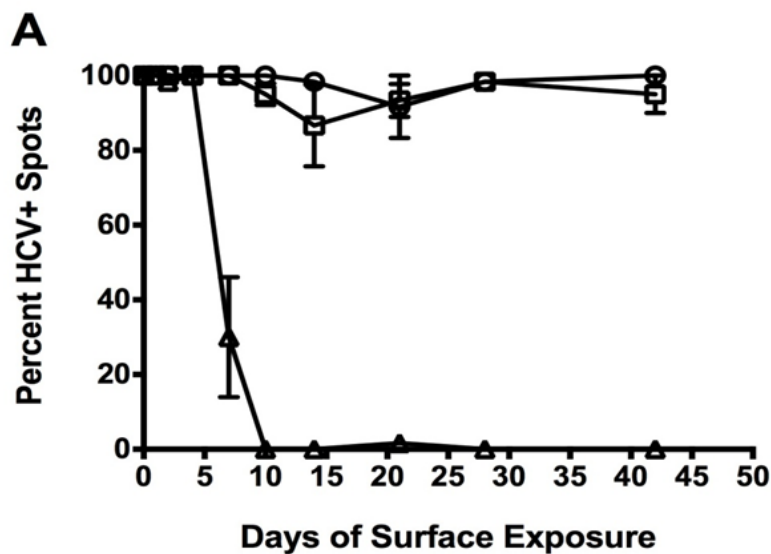
- Benchtop – 4 hours;
- Refrigerator – 24 hours
- Incubator -28 hours

- Humidity at storage condition: 4° , 22° , 37° was 53%, 44% and 82%, respectively

- Time to dryness correlated positively with the humidity

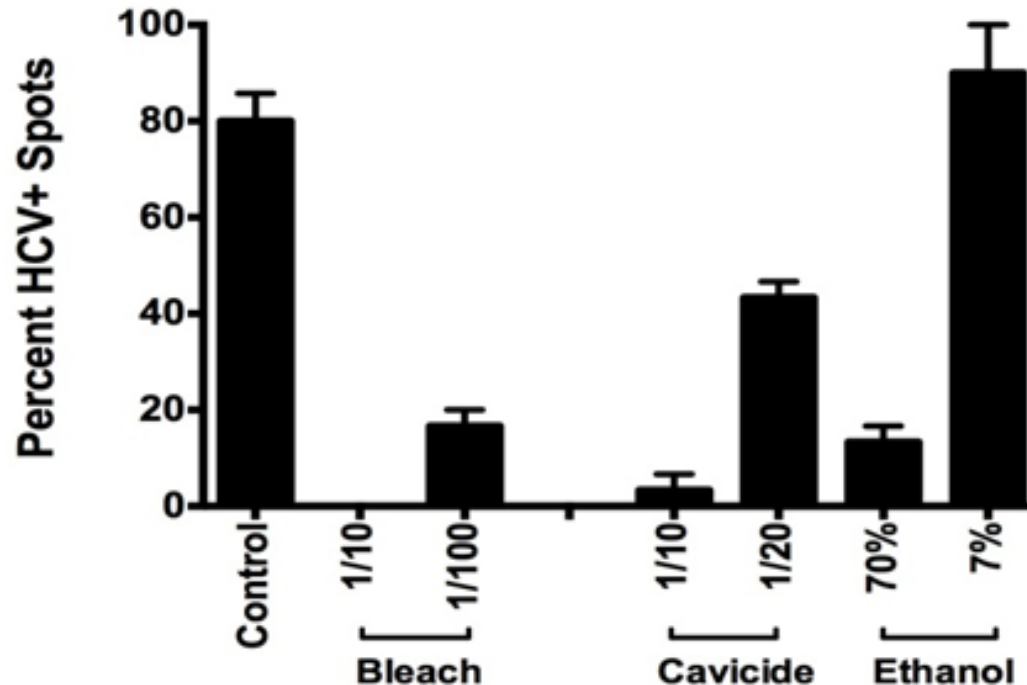
Paintsil et al. J Infect Dis. 2014 Apr 15;209(8):1205-11.

Hepatitis C Virus Survives for Weeks after Drying on Inanimate Surfaces at Room Temperature



Paintsil et al. J Infect Dis. 2014 Apr 15;209(8):1205-11.

Effectiveness of Antiseptics on HCV Contaminated Surfaces

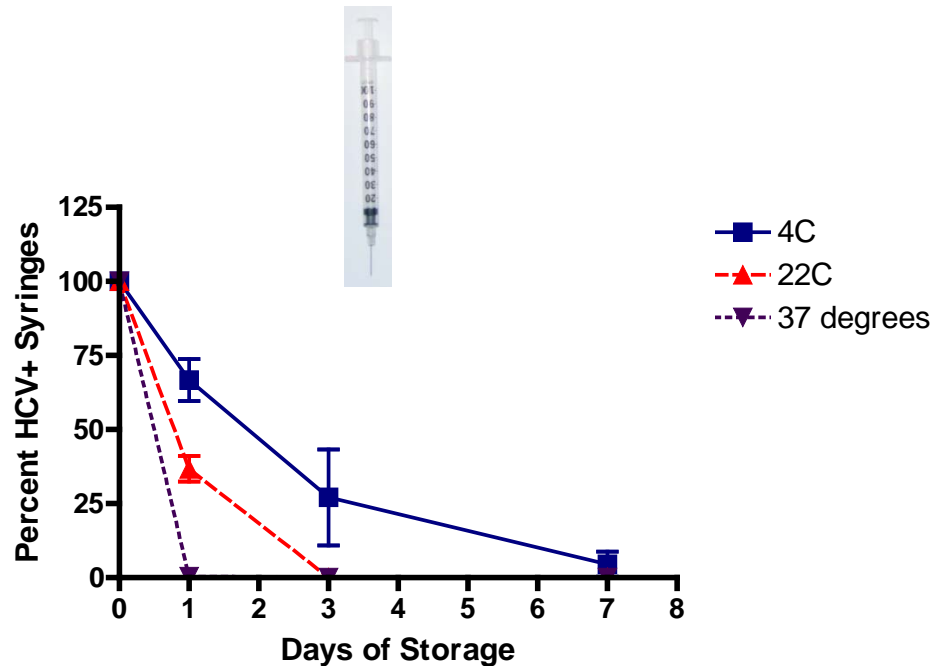


Bleach at recommended concentration is efficient

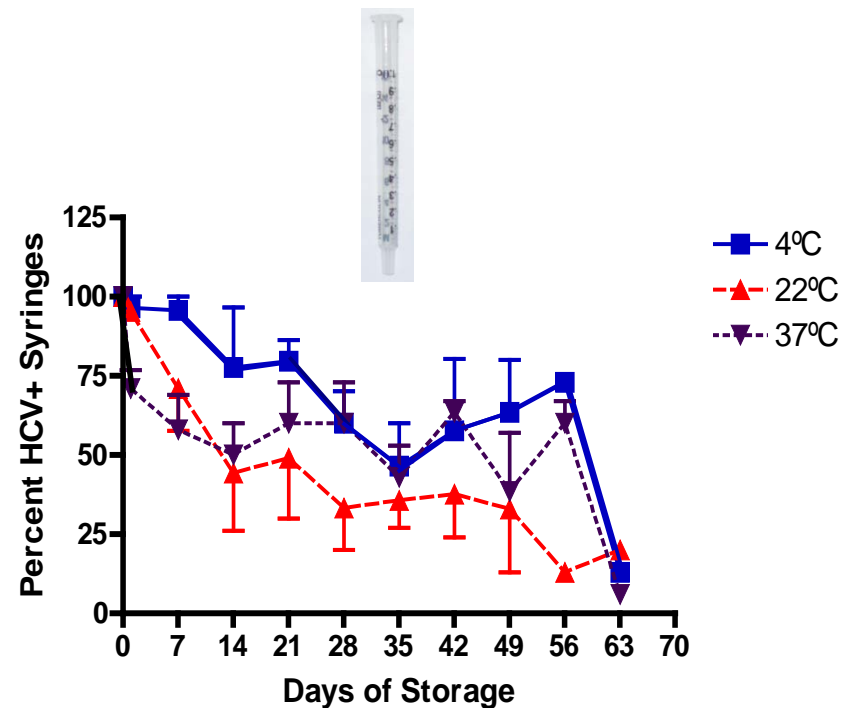
Paintsil et al. J Infect Dis. 2014 Apr 15;209(8):1205-11.

HCV remains viable in high volume syringes for up to 63 days

Insulin syringe (low-dead space, LDS)

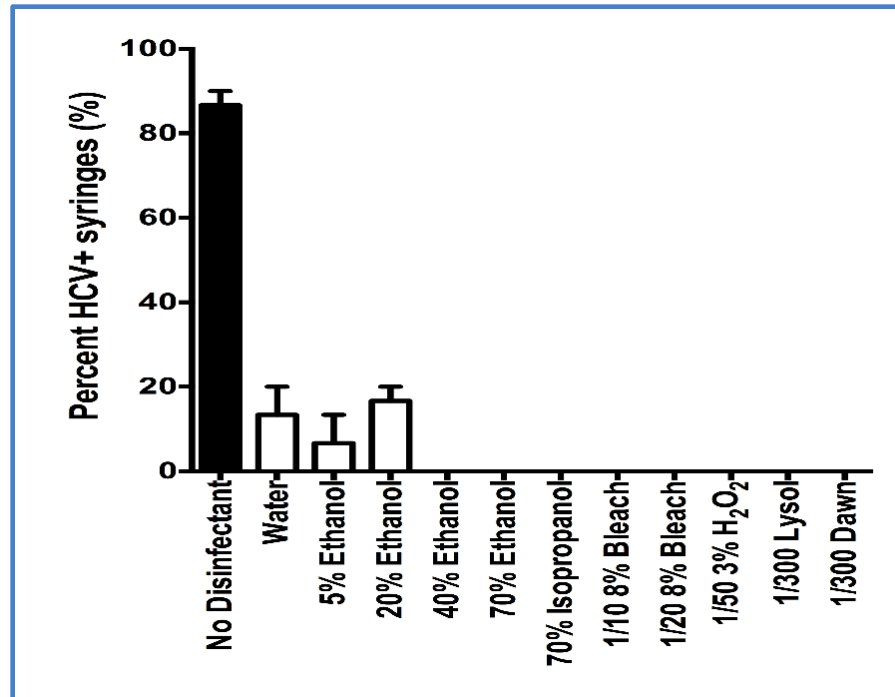


Tuberculin syringe (high dead space, HDS)



Paintsil et al. *J Infect Dis.* 1 2010;202(7):984-990

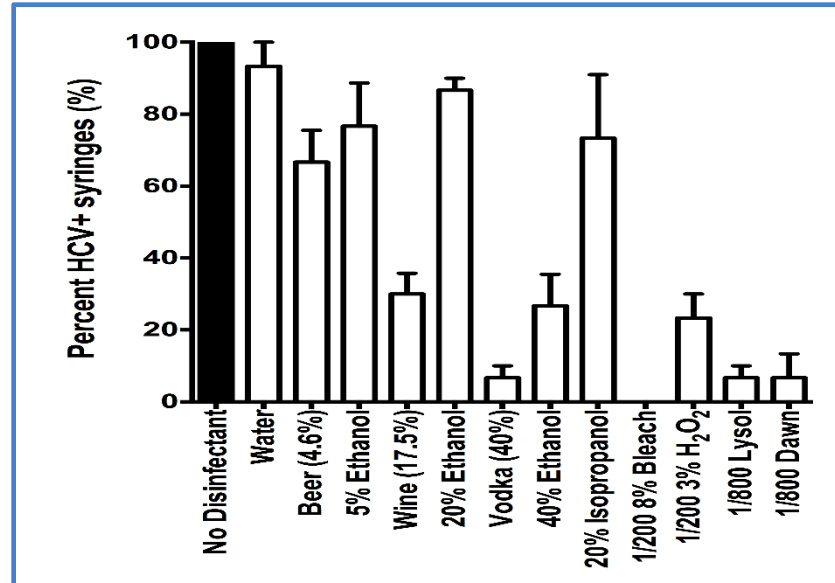
Survival of HCV in Insulin Syringes after rinsing once with household products



Household products efficient in low-dead space syringes

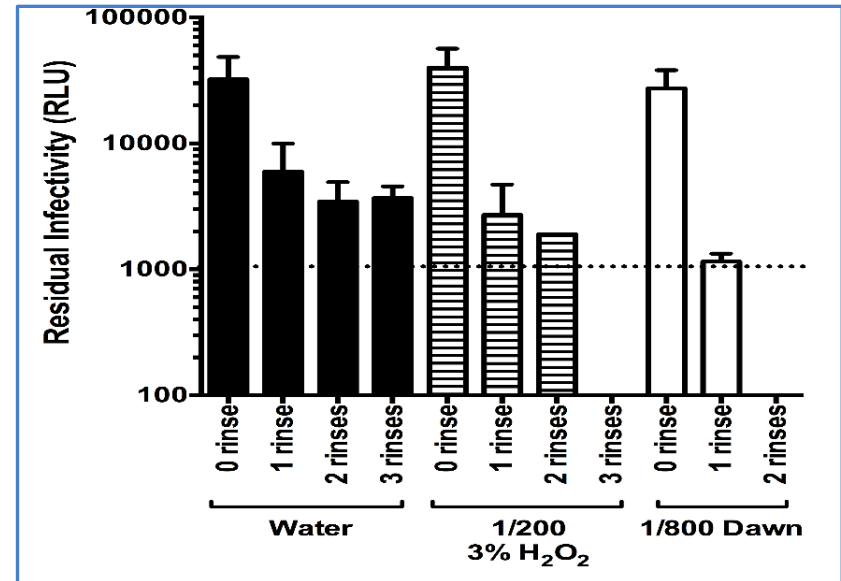
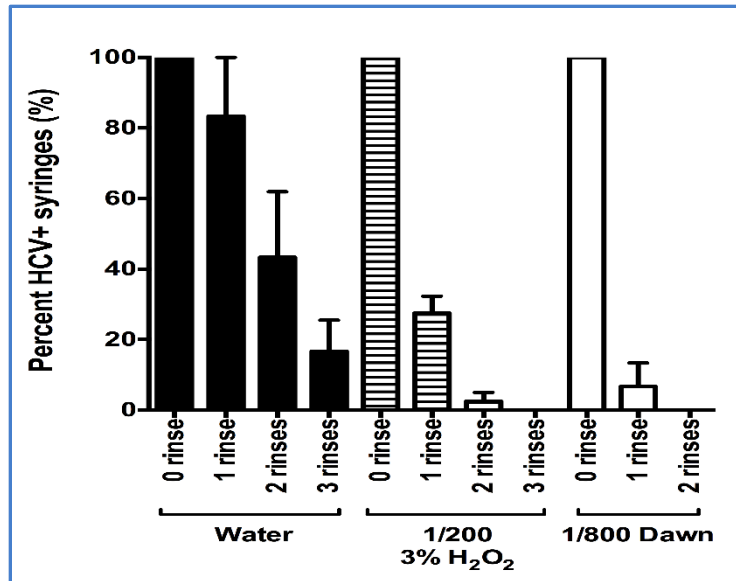
Binka et al. 2015. OFID

Survival of HCV in Tuberculin Syringes after rinsing once with household products



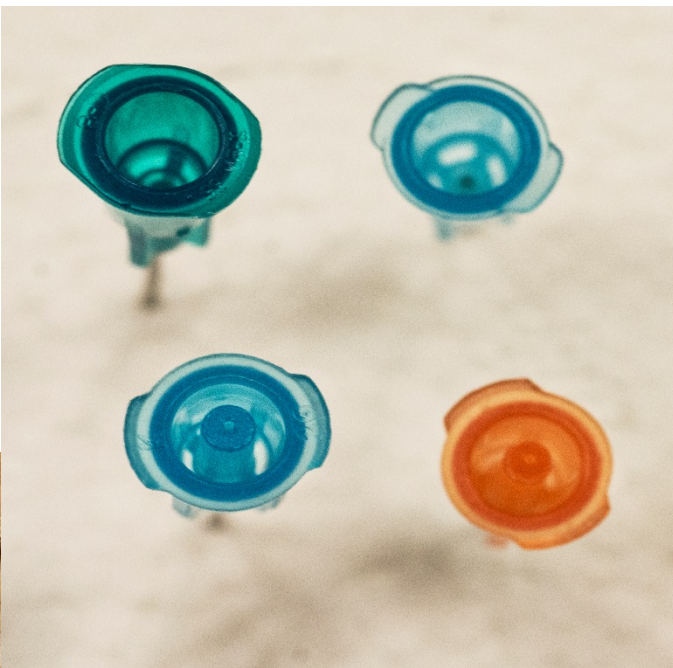
**Bleach out performs all;
But when in doubt go for Vodka!**

Survival of HCV in Tuberculin Syringes after multiple rinses with household products

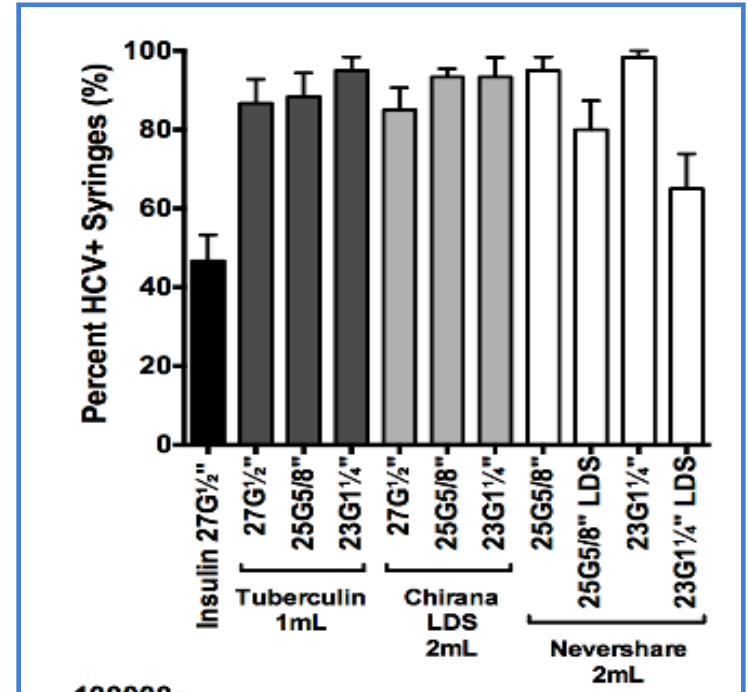
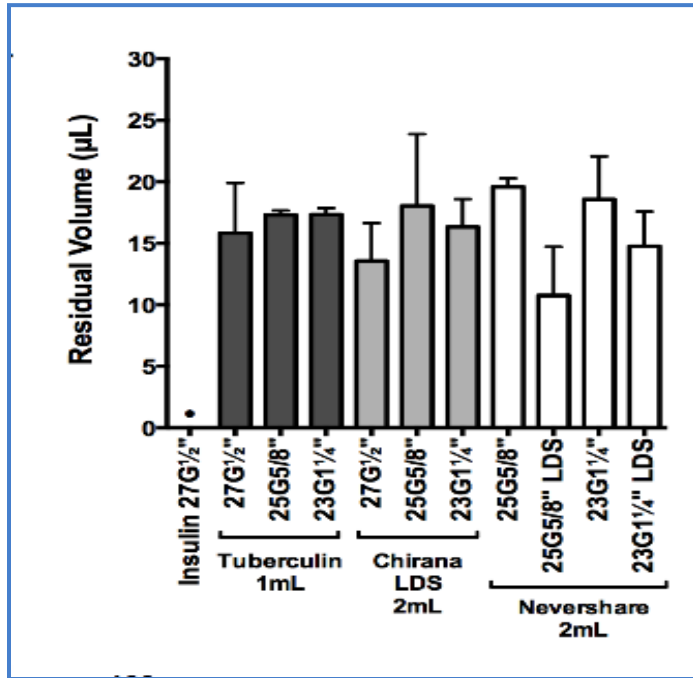


Multiple rinses (at least 3) with household products needed to reduce HCV infectivity

Does Syringe Type/Design Matter?



Insulin Syringes with fixed 27G1/2" most Effective



LDS needles/syringes intermediate between Fixed-needle syringes and HDS combination

Binka et al. PLoS One 2015

Conclusions

- Survival is dependent on syringe type – syringes with detachable needles appear far more likely to transmit HCV
- Lower temperatures preserve HCV viability in low void volume syringes more than in high void volume ones
- HCV appears to survive longer than HIV in high void volume syringes
- Anti-HCV activity of commercial/household antiseptics varies
- Our findings may be used to guide prevention strategies

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