Switching people who inject drugs from high dead space to low dead space syringes as a structural intervention to prevent injection-related HIV epidemics

William Zule; Harry Cross
RTI International, United States
Presented at
AIDS 2012 – XIX International AIDS Conference
Washington, DC • July 22–27, 2012
Syringes used by people who inject drugs vary in size and design.

Factors influencing syringe preference:
- Syringe barrel capacity
- Removable vs. permanently attached needle
- Needle gauge and length
- Quality
High dead space and low dead space syringes

Biomedical interventions (ART, PREP, male circumcision) reduce the probability of HIV transmission associated with a behavior and do not rely on people reducing their risk behaviors.

Would the risk associated with sharing these syringes be same?
Topics to be covered

- Scientific evidence
- Advocacy
- Barriers
- Solutions
- Next steps
Biological basis: HIV viral burden influences transmission

- The quantity of HIV in an exposure is a function of:
  \[ \text{viral load} \times \text{volume of inoculum} \]

- This is referred to as “viral burden.”

- In syringe sharing, the “inoculum” is the “blood” in the syringe that is shared.
HIV viral burden in an exposure by stage of infection and type of syringe

<table>
<thead>
<tr>
<th>Stage of infection</th>
<th>HIV viral load copies/mL</th>
<th>HIV RNA Copies(^a) per exposure</th>
<th>1-ml high dead space syringe with standard needle (1 µL of blood)</th>
<th>1-ml low dead space syringe with fixed needle (0.001 µL of blood)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>10,000,000</td>
<td>10,000</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Latent</td>
<td>10,000</td>
<td>10</td>
<td>0.01(^b)</td>
<td></td>
</tr>
<tr>
<td>End stage (AIDS)</td>
<td>1,000,000</td>
<td>1,000</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Each HIV virion contains 2 copies of HIV RNA;  
\(^b\)1 copy in every 100 exposures
Preliminary results of ecological study of syringe use and HIV prevalence in 67 cities in 30 countries across Europe and Asia

- 86% of cities with mostly low dead space syringes (n=7)
- 14% of cities with mostly low dead space syringes (n=7)
- 67% of cities with mostly high dead space syringes (n=60)
- 33% of cities with mostly high dead space syringes (n=60)

≥ 50% use LDSS & < 50% use High dead space syringes (HDSS)

HIV prevalence
- < 10%
- ≥10%

p < 0.05
Projected impact of switching PWID in China from high dead space to low dead space syringes on HIV infections due to syringe sharing

Modeling conducted by Futures Institute using the Goals Model
Zule et al. (in press) International Journal Drug Policy
Advocacy: Promoting the evidence and pushing for change

- Presentations and meetings with key stakeholders
  - US CDC, WHO, UNAIDS, Global Fund, PEPFAR
- Presentations at scientific conferences
- Commentary in International Journal of Drug Policy (forthcoming)
Global Fund commissioned Eurasian Harm Reduction Network (EHRN) to assess syringes used in Eastern Europe and Central Asia

- **Findings**
  - PWID use high dead space syringes
  - PWID prefer syringes with detachable needles
  - PWID need syringes larger than 1-ml

- **Barriers**
  - *Perception that low dead space syringes are 1-ml and have permanently attached needles*
  - *These syringes are not acceptable to PWID in Eastern Europe and Central Asia*
Solution

- Identified low dead space alternatives
  - Low dead space syringes that use standard detachable needles
  - Low dead space needles that fit on standard syringes
- Obtained syringes and conducted laboratory experiments
- Results of laboratory experiments
  - Low dead space syringes retain too much fluid
  - Low dead space interchangeable needles show great promise
- Working with major harm reduction supplier to ensure availability of low dead space needles at competitive prices
Illustrations of dead space in needle and syringe combinations

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard syringe with standard needle</td>
<td>Average dead space (99 µ)</td>
</tr>
<tr>
<td>Low dead space syringe with standard needle</td>
<td>Average dead space (45 µ)</td>
</tr>
<tr>
<td>Standard syringe with low dead space needle</td>
<td>Average dead space (13 µl)</td>
</tr>
<tr>
<td>Low dead space syringe with fixed needle</td>
<td>Average dead space (3 µl)</td>
</tr>
</tbody>
</table>
Pictures of needle and syringe designs

Needle and syringe designs

A. Standard syringe with standard needle
B. Low dead space needle/standard syringe
C. Low dead space syringe with fixed needle
D. Standard syringe/no needle
E. Low dead space syringe/no needle
F. Standard syringe plunger
G. Low dead space syringe plunger
H. Standard needle hub
I. Low dead space needle hub
Action: program implementation and continued research

- Population Services International (PSI) conducted market research in Vietnam and found
  - most PWID use high dead space needles and syringes.
  - most PWID prefer detachable needles and larger syringes
- PSI is preparing a campaign using social marketing to increase PWID access to low dead space needles and syringes across Vietnam
- RTI will be conducting additional research to demonstrate the feasibility of switching PWID from high dead space to low dead space syringes and estimate effects
Conclusions and recommendations

- Converging scientific evidence suggests that low dead space needles and syringes reduce HIV transmission among PWID.

- Structural interventions to promote the use of low dead space needles and syringes should be implemented carefully and evaluated rigorously.

- For more information and updates, please visit Facebook at: Low Dead Space Syringes.
Acknowledgements

- Funding for this work was provided by National Institutes of Health Grant Numbers R01DA013763, U01DA017373, and R03DA026725 from the National Institute on Drug Abuse. Additional funding was also provided by RTI International’s Asia HIV Program, Global Health Group and an RTI Professional Development Award.

- Dead Space Syringe Project Staff and Consultants
  - Staff: Curtis Coomes and Winona Poulton
  - Consultants: David Otiashvili, Sam Friedman, Don Des Jarlais, Anna Gyarmathy

- All of the other people who have contributed to this work over the last 22 years
Peer-reviewed and other publications on high and low dead space needles and syringes

Laboratory studies


Peer-reviewed and other publications on high and low dead space needles and syringes

**Bio-behavioral studies**


**Mathematical modeling studies**


**Historical case study**

Commentaries and reviews


Miscellaneous Reports

