Supporting Containment Standards for Poliovirus after Eradication

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Project Background

• **Purpose:**
  - Study currently-practiced *poliovirus risk assessment* and control measures
  - Set requirements for a **tool to support risk-based decision-making for poliovirus containment** activities under the WHO Global Action Plan III (GAPIII)

• **Team:** Sandia National Laboratories and Gryphon Scientific under the direction and funding of the CDC

• **Assumption:** Risk management of poliovirus will be aided by more rigorous and consistent risk assessment and risk-based decision-making.
  - Experience-based risk assessment is, by itself, inadequate to understand risk in a post-eradication world.
Data Sources and Methods

- Literature
  - Reviewed >150 articles relevant to poliovirus public health, safety and risk, dating between 1940 and 2018

- Oversight
  - Reviewed WHO GAPIII and GAPIII-derived guidance for references to and expectation for risk assessment and facility-based risk assessment

- Facilities
  - Solicited input from all US laboratories that declared intent to maintain PV2
  - Facilitated discussions with personnel from seven facilities

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Findings: Practices & Oversight

<table>
<thead>
<tr>
<th>Finding</th>
<th>Details</th>
</tr>
</thead>
</table>
| GAPIII and other poliovirus guidance is limited | • GAPIII and GAPIII-derived guidance, by design, relies heavily on facilities to make their own decisions on risk and risk management.  
  • Little poliovirus-specific information for choosing best practices is provided by GAPIII, GAPIII-derived guidance, or the literature. |
| Risk-based decision making varies            | • Risk-based decision-making at facilities varies in content, contributors, and rigor.  
  • All processes we observed are experience-based.                                                                                   |
| Silent infections create an unknowable risk  | • Due to current widespread vaccination and the likelihood of silent infection among those vaccinated, the frequency of facility-acquired infections is unknowable today  
  • This silent nature of laboratory-acquired infections likely skews experience-based perception of risk for poliovirus  
  • Disconnect between risks to worker safety and containment                                                                        |
| Facilities are willing partners but face challenges | • Capacity to meet GAPIII infrastructure requirements is limited  
  • Evolving oversight is confusing and can be frustrating                                                                           |
Findings: How a Tool Would be Used

• A more robust and standardized approach to risk-based decision making could provide several advantages:

<table>
<thead>
<tr>
<th>Findings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce facility burden</td>
<td>A tool could “prepackage” data and processes for conducting risk assessments</td>
</tr>
<tr>
<td>Elevate risk assessment practices</td>
<td>A tool could help facilities consider risks in a projected future no one has yet experienced</td>
</tr>
<tr>
<td>Identify unrecognized risk factors</td>
<td>By standardizing risk assessments, a tool could help facilities ensure they consider all relevant factors</td>
</tr>
<tr>
<td>Quantify risks</td>
<td>A tool could account for facility-specific differences in titers and volumes</td>
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<tr>
<td>Prioritize risk reduction</td>
<td>Due to the quantitative nature, a tool could also compute the risk reduction value of control measures and offer a prioritized list</td>
</tr>
<tr>
<td>Provide an evidence basis</td>
<td>Tool outputs could provide evidence for the necessity of control measures that may not be obvious</td>
</tr>
</tbody>
</table>

Notional Tool--Inputs

• A risk assessment tool would take information about the types of experiments conducted in the lab
  • For example, their frequency, strains, volumes and titers

<table>
<thead>
<tr>
<th>Experiment Type</th>
<th>Frequency (#/mo)</th>
<th>Strain</th>
<th>Are Samples Titered?</th>
<th>Titer (CCID50/ml)</th>
<th>Total Volume (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutralization</td>
<td>.20</td>
<td>OPV1</td>
<td>NO, infant stool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serotyping</td>
<td>1</td>
<td>UNK</td>
<td>NO, PIM- historic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutralization</td>
<td>.5</td>
<td>WT3</td>
<td>YES</td>
<td>1E7</td>
<td>100</td>
</tr>
<tr>
<td>Other—mouse study</td>
<td>.1</td>
<td>WT2</td>
<td>YES</td>
<td>5E5</td>
<td>1</td>
</tr>
</tbody>
</table>
Notional Tool—Inputs 2

- A risk assessment tool would take information about the safety features of the laboratory
  - Including equipment, materials, processes, SOPs, training, etc.
  - Considering taking information about environment, utilities, etc.

Notional Dashboard

Inputs 2—Safety Features

- Centrifuge with seals
- Centrifuge in BSC
- Vortexer in BSC
- Class III BSC
- Class I/II BSC
- Disposable lab coats
- HEPA filtered exhaust
- Shower out
- Liquid waste decon
- Secondary liq waste contain
- Liq waste overflow alarm
- Double gloving

Notional Tool—Behind the Scenes

- The tool would be loaded with quantitative data
  - Dose-response, stability, decontamination, transfer, source-terms, human reliability, etc.
- The tool would be based on several probabilistic, fault-tree models
  - Events and cascading errors that could lead to a LOC would be considered
Notional Tool—Behind the Scenes

• A risk assessment tool would provide simple, actionable information to help identify unappreciated aspects of risk
  • To be used in conjunction with current BRM approaches

Notional Tool—Outputs 2

• A risk assessment tool would provide simple, actionable information to help identify unappreciated aspects of risk
  • To be used in conjunction with current BRM approaches

Notional Dashboard—Final Tool will Have Graphical Output

Outputs 1—Risk Drivers
Click for mitigation measures to consider

1. Contaminated hands via glove and handwashing failure
2. Vortexing out of BSC
3. Improper inactivation
4. ....
**Notional Tool**

- A risk assessment tool would provide simple, actionable information to help mitigate these risks
  - This information would allow stakeholders to consider additional investments to further reduce risk
  - Outputs would be considered in the context of the ground-truth in their laboratory

**Notional Dashboard—Final Tool will Have Graphical Output**

<table>
<thead>
<tr>
<th>Outputs 2—Potential Risk Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Contaminated hands via glove and handwashing failure</td>
</tr>
<tr>
<td>1. Consider training (and annual refresher training) on hand washing—potential 10x reduction in risk</td>
</tr>
<tr>
<td>2. Consider double-gloving—potential 10x reduction in risk</td>
</tr>
<tr>
<td>3. Consider shower out—potential 40x reduction in risk</td>
</tr>
</tbody>
</table>

**Next Steps**

- We hope to receive funding to begin development of a prototype tool
- We would love your feedback on the features of the tool
THANK YOU

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