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### THE NEED

- **138,000 global deaths/year** for snake bites (figure 1); over half in India<sup>1,2,3</sup>
- Neurotoxins in snake venom cause **reduced muscle function and paralysis**, leading to death<sup>4</sup>
- Average time to antivenom administration **3.2 hours**, allowing toxins sufficient time to cause irreparable damage<sup>5</sup>
- Delaying neurotoxic effects will prevent life threatening damage and allow patients additional time to seek medical care

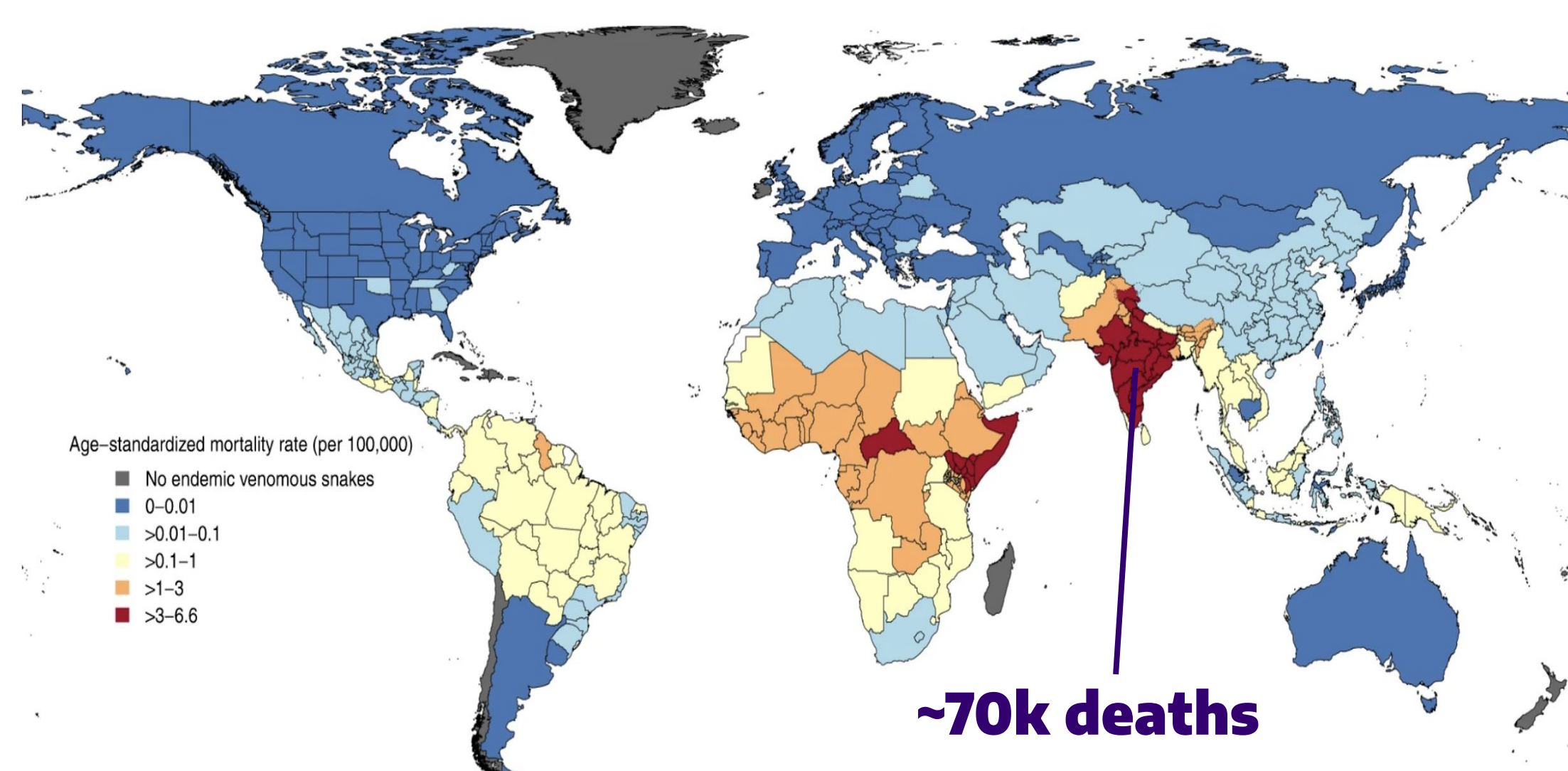


Figure 1. Age-Standardized Snakebite Envenoming Mortality Rates in 2019<sup>6</sup>

### NEED STATEMENT

A way to address the lack of accessible snake bite specific medical tools for envenomed victims in rural communities of India, so that neurotoxic disorders are temporarily stabilized within the body.

### DESIGN AND PROTOTYPE

**Initial Prototype:** Single Injection chamber device with auxiliary chambers two drugs

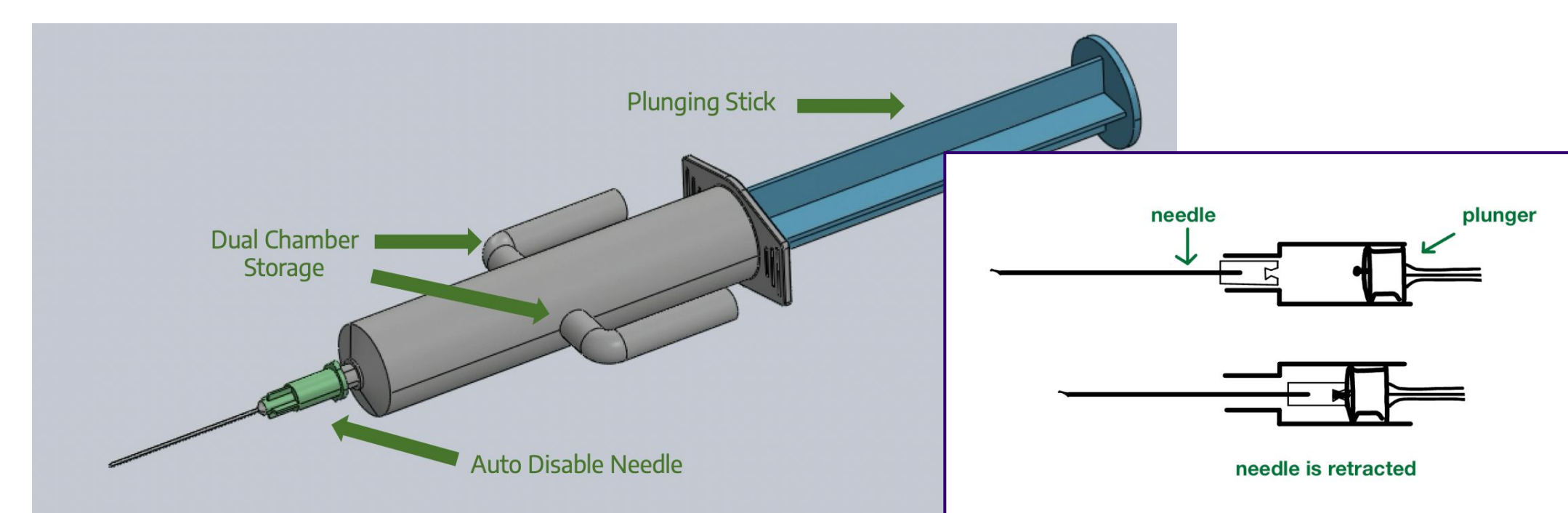


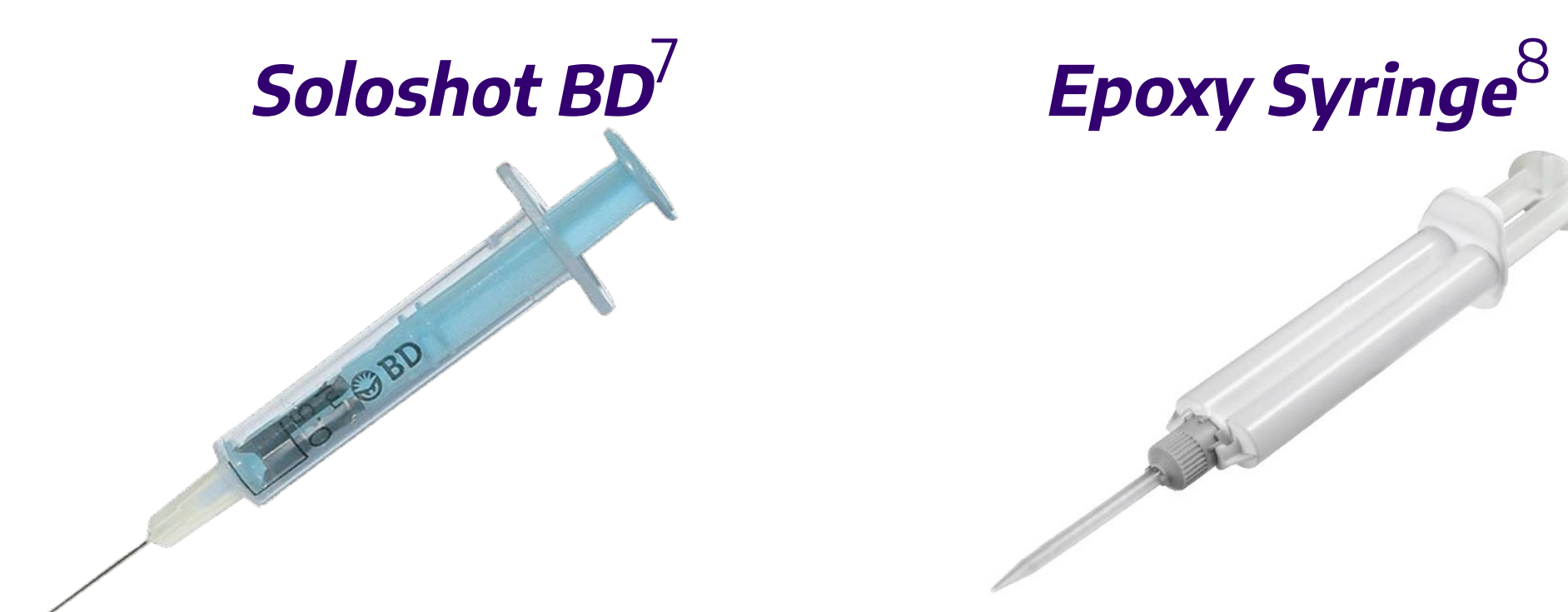
Figure 2(a) CAD of Single dual chamber injector (b) auto disabled diagram

- Device could not be injected in any orientation due to excess backflow into storage chambers;
- Differential pressure caused issue releasing drug into main chamber

Primary Needs	Existing Solutions		Our Product
	BD SoloShot mini syringe	Epoxy Syringe - dual chambers	Neuro-ject
Ease of use via untrained personnel	✓	✓	✓
Administers two drugs intramuscularly	✗	✗	✓
Auto-disable mechanism	✓	✗	✓
Drugs are stored separately prior to injection	✓	✓	✓
Maintain low moisture and light exposure	✗	✗	✓
Orientation Independent	✓	✓	✓

Table 1. Quality Function Deployment of current solutions and our design

### BENCHMARKING



\*No in-the field injection device currently available in the market for snakebite treatment

**Final Prototype:** Double syringe device with mixing chamber attached to a single needle for simultaneous Neostigmine and Atropine injection

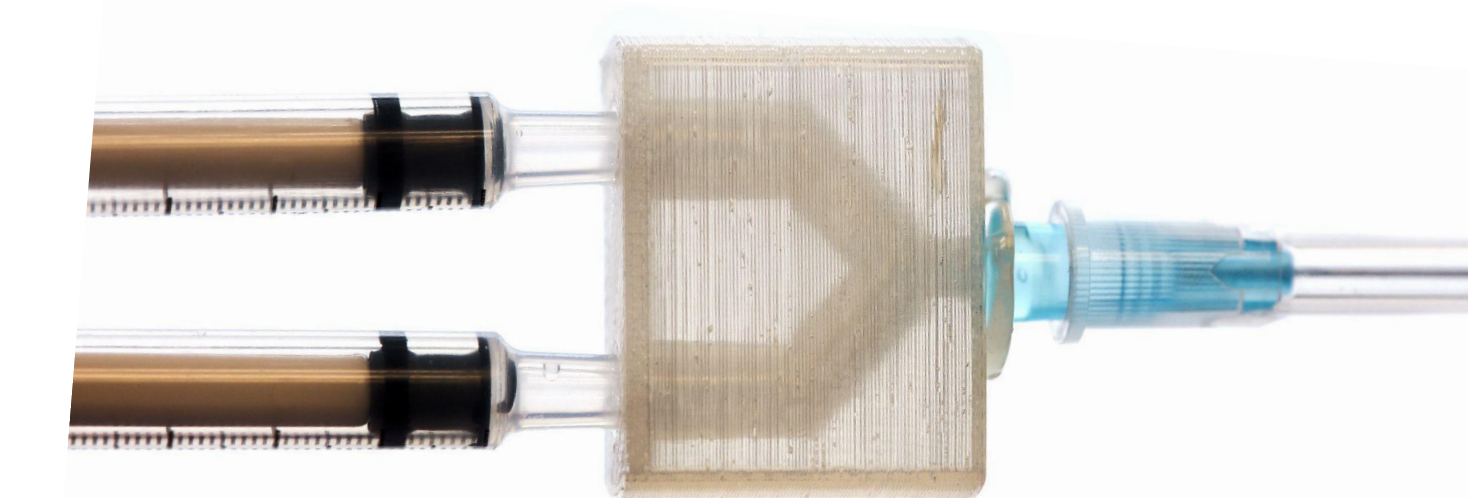


Figure 4. close up of internal tubes in mixing chamber

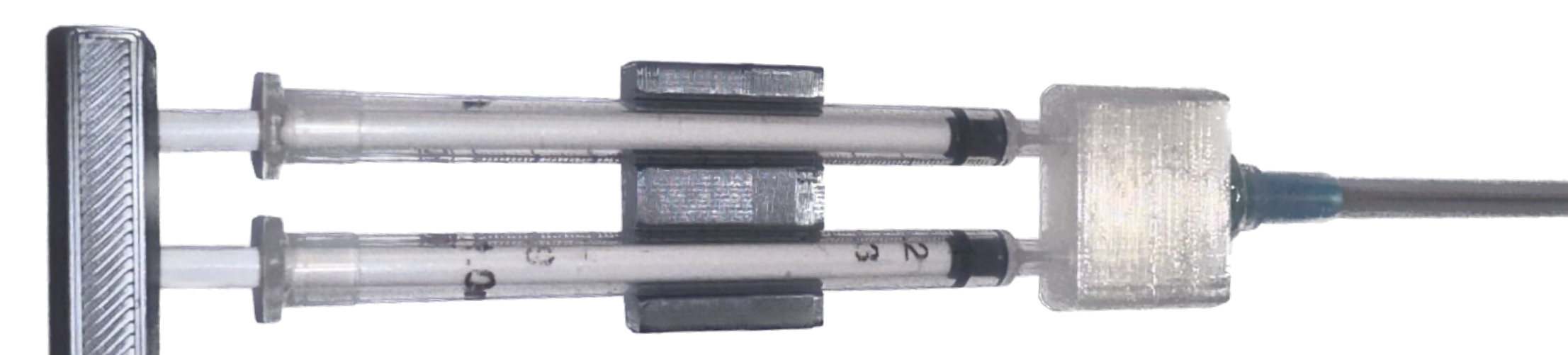


Figure 5. Assembled double syringe device

### DESIGN SPECIFICATIONS

- Two individual syringes w/ independent needle adaptor
- Stabilization bridge holds syringes
- Internal auto-disable mechanism
- Prefilled syringes w/ two drugs: Neostigmine and Atropine having shelf life of >2 years
- Clear instruction manual to use the syringe

### THE MARKET

- Disposable syringe industry is valued at **\$13.5B** in 2021 with a projected 6% growth rate through 2030<sup>9</sup>
- **Our customer:** local community members in Indian villages, with PATH as a sponsoring partner to aid in distribution
- **1.8 to 2.7 million** snakebite cases occurs which affects about **400,000** individuals each year

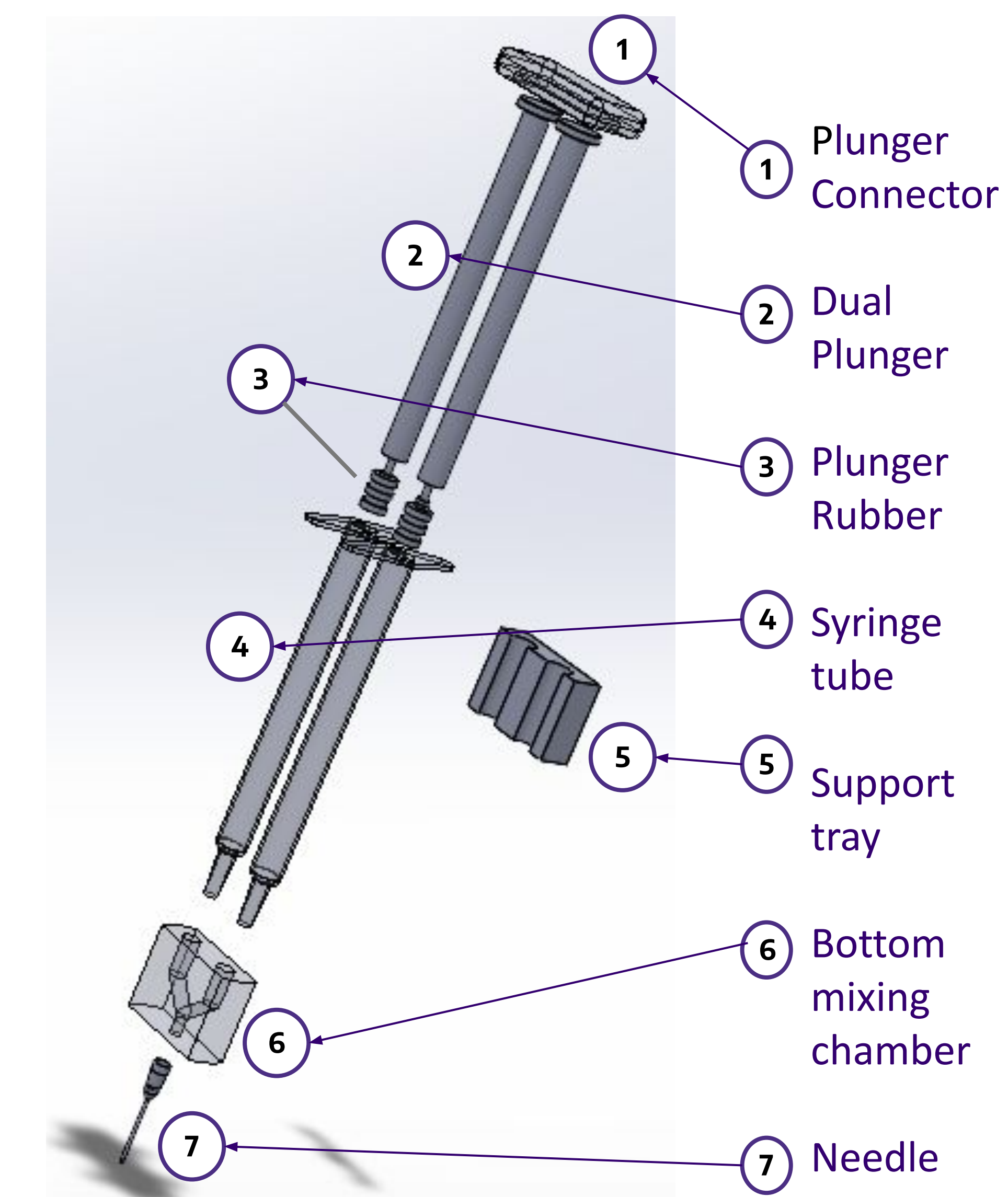


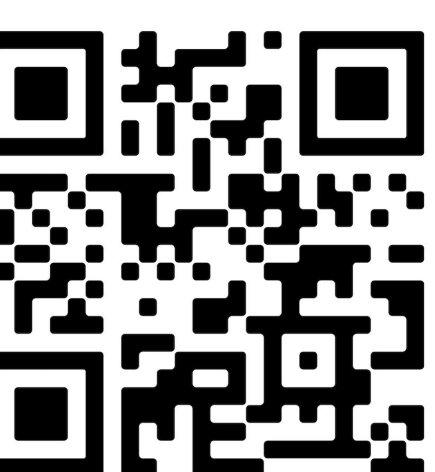
Figure 6. SOLIDWORKS model of parts involved

### NEXT STEPS/FUTURE WORKS

- **Future Issues to Address**
  - Sterilization during manufacturing
  - Functionalizing design for variable syringe diameters and lengths
  - Improving instructions to increase clarity for user

### Acknowledgements

We would like to thank **Scott Knacksedt**, our clinical partner from **PATH**, for his time and resources he has provided for this project! We would also like to thank the EIH teaching staff and guest speakers for helping guide our project throughout the quarter.



References

