EZ DRAW

A New Generation of Pediatric Blood Collection Tubes

Kira Grossman, Leen Madiah, Kevin Tran, Matteo Simamora

VANDERBILT School of Engineering

VANDERBILT UNIVERSITY MEDICAL CENTER

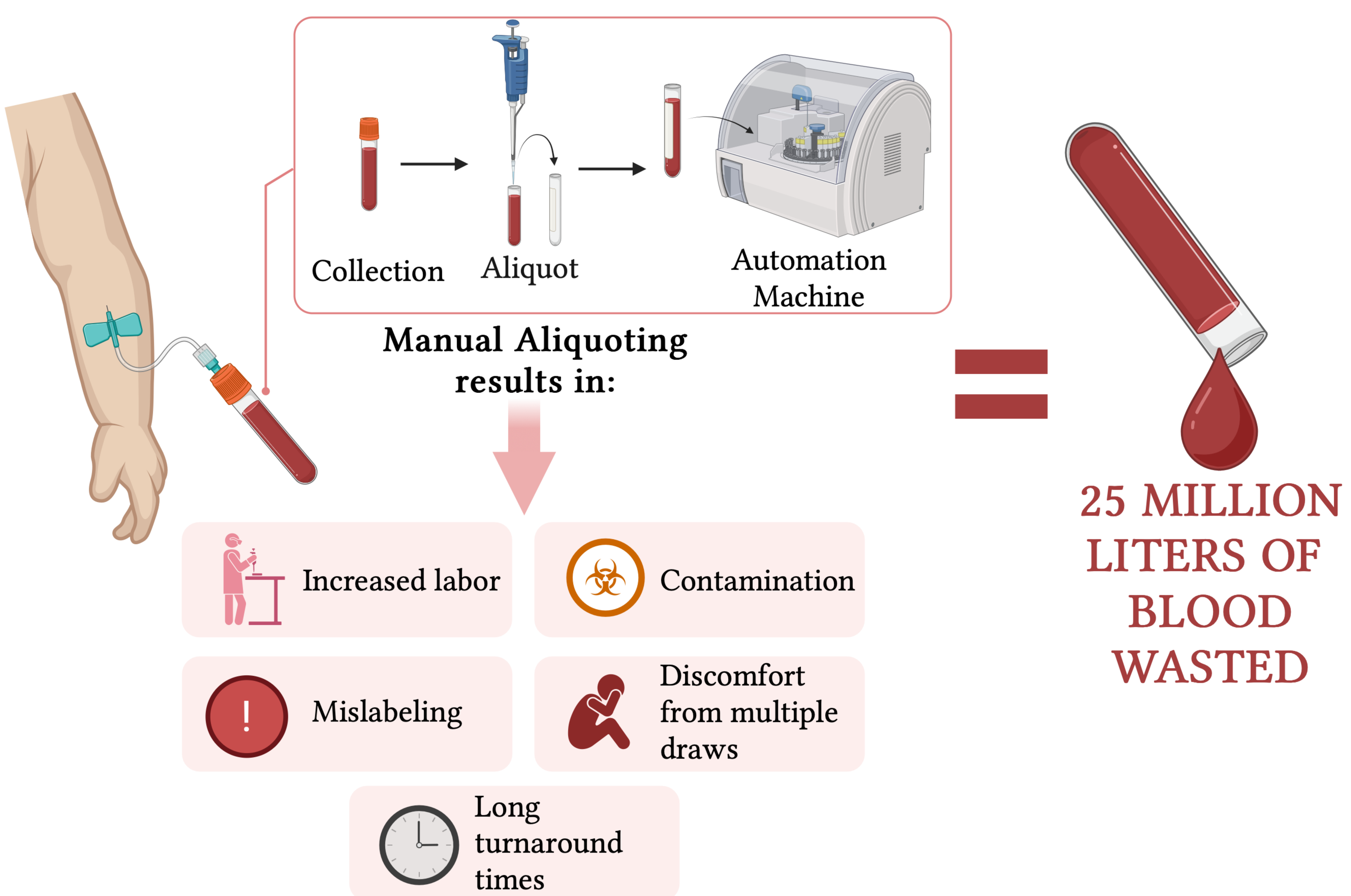
OVERVIEW

PROBLEM

- Pediatric blood collection is **challenging** due to small veins, low volume needs, and high sensitivity to discomfort.
- Current pediatric tubes are **incompatible** with automated lab analyzers.

Current Blood Collection and Analysis Pathway

Current pediatric tubes do NOT fit directly into automation machines



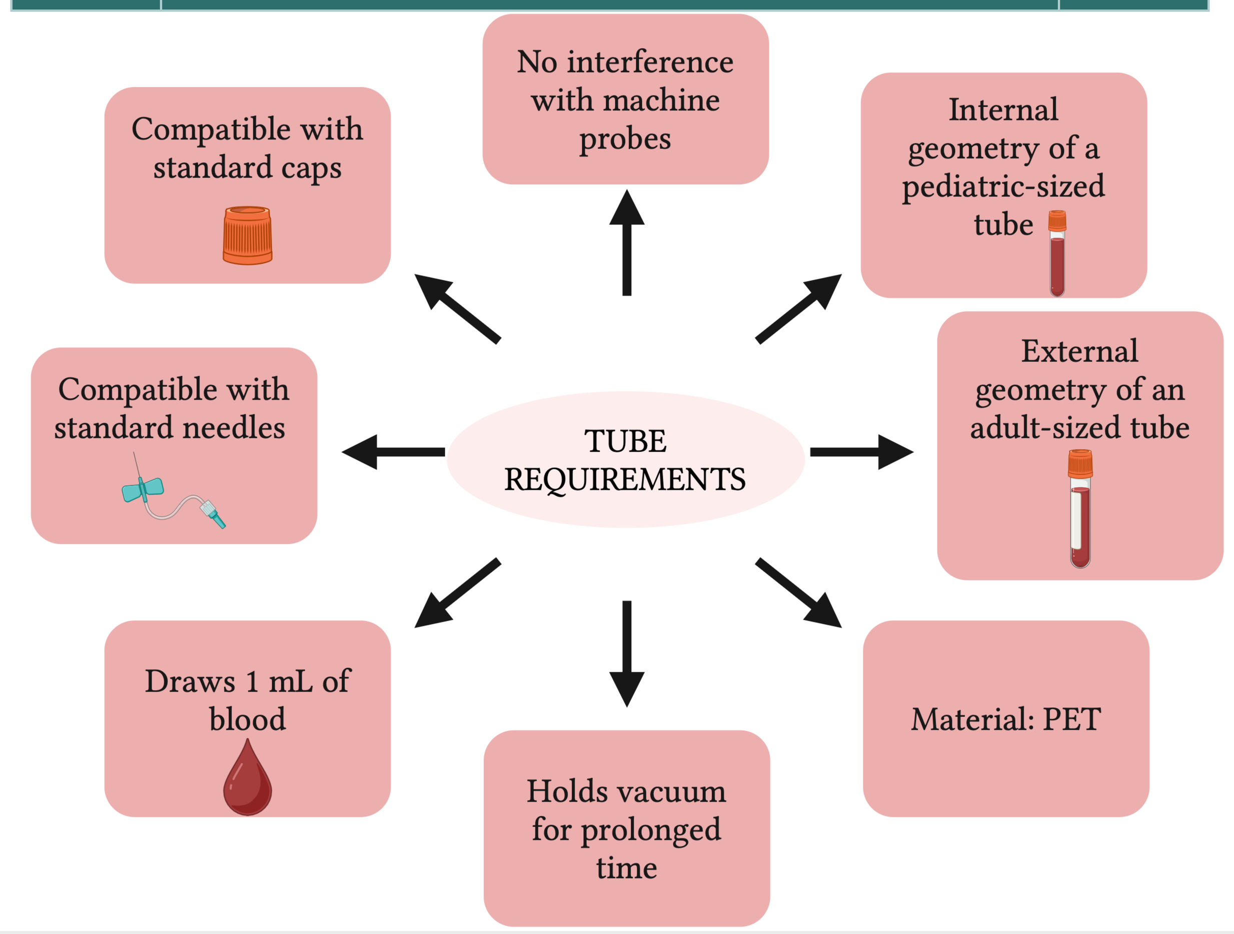
SIGNIFICANCE

- Improving the existing blood collection pathway enhances care quality, reduces the number of blood draws, and minimizes redundant work for lab staff.
- No other pediatric blood collection tubes on the market incorporate a vacuum system—an essential feature for consistent blood draw volume and reduced patient discomfort.

OUR GOALS

1. Design a dual geometry tube
2. Fits in existing hospital systems, reducing manual steps & errors
3. Minimizes patient discomfort
4. Compliant with all standards

DESIGN PROCESS



ITERATIONS

- Filament 3D printing was initially used for prototyping
- Injection molding and vacuum forming were later explored

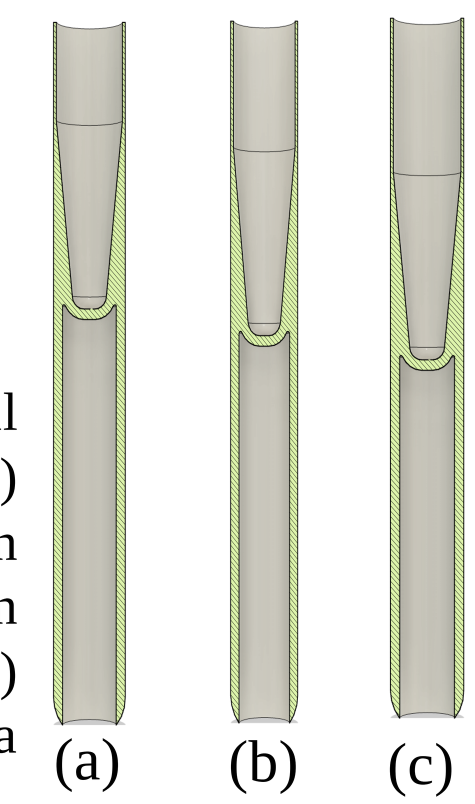


Figure 1. Design iterations of the EZ Draw tube. All iterations had an outer geometry of an adult tube. (a) Initial design with an inner geometry smaller than an existing pediatric tube. (b) Second design with an inner geometry that matches a pediatric tube. (c) Third design with an inner geometry larger than a pediatric tube for testing purposes.

FINAL DESIGN

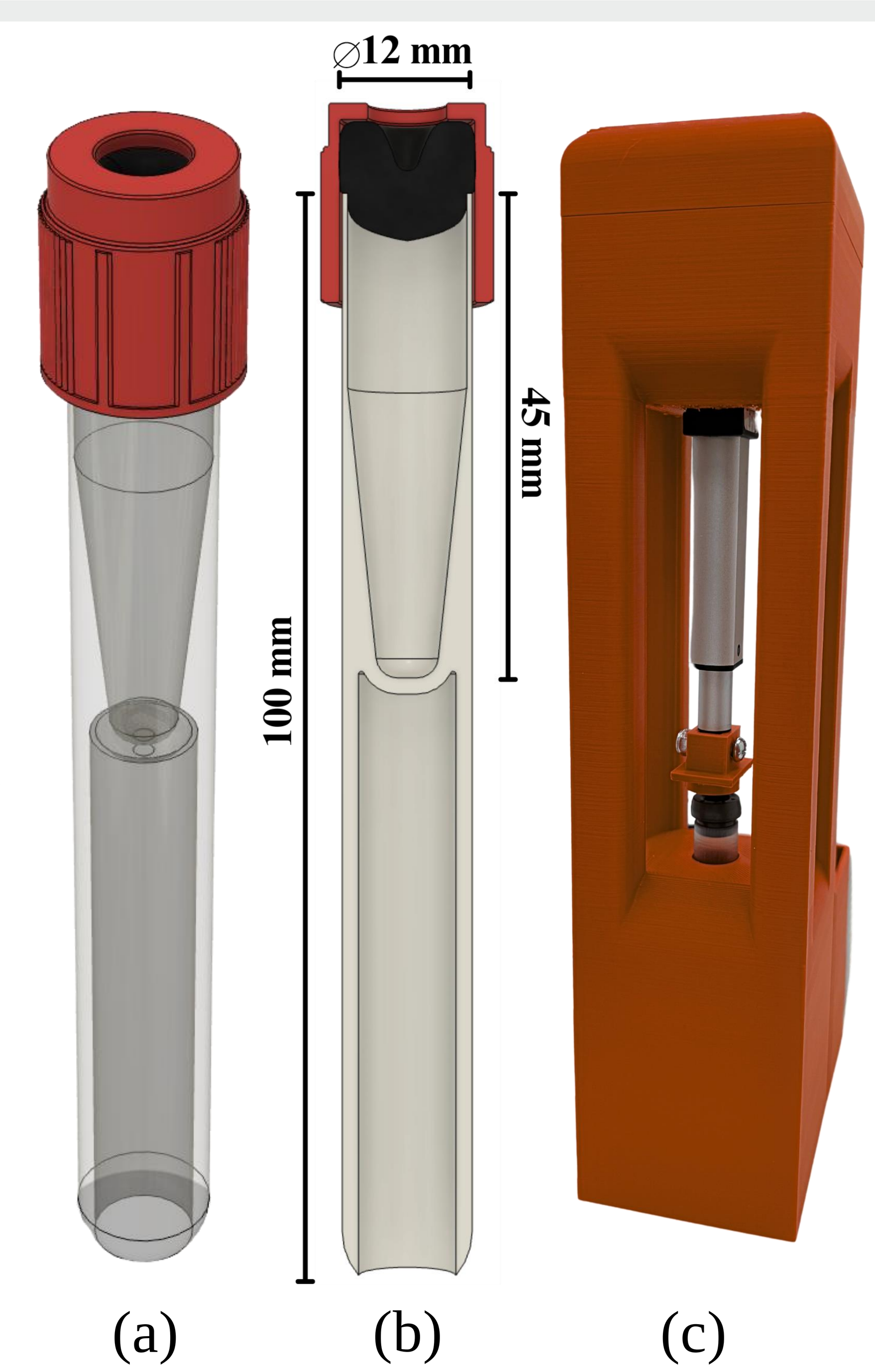


Figure 2. (a) The final design, EZ Draw, was selected to be resin-printed for its ability to consistently draw 1 mL of blood while remaining cost-effective and feasible within available resources.
(b) A cross-sectional view of EZ Draw.
(c) EZ Draw was successfully vacuumized using our custom-built vacuum system and meets all design criteria for pediatric blood collection tubes. However, due to resource limitations, the final prototype is made from resin rather than medical-grade PET.

TEST RESULTS

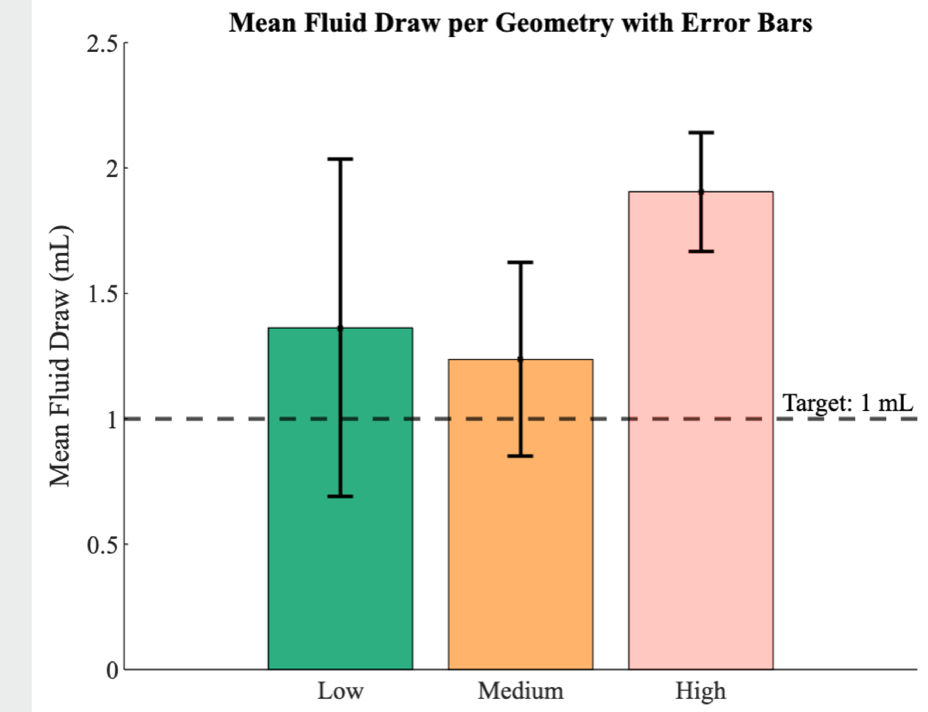


Figure 3. Mean fluid volumes for Low, Medium, and High geometries. The dashed line indicates the 1 mL target volume. The Medium geometry produced the most accurate and consistent draw near the target, guiding our selection of this design for further testing against the clinical gold standard.

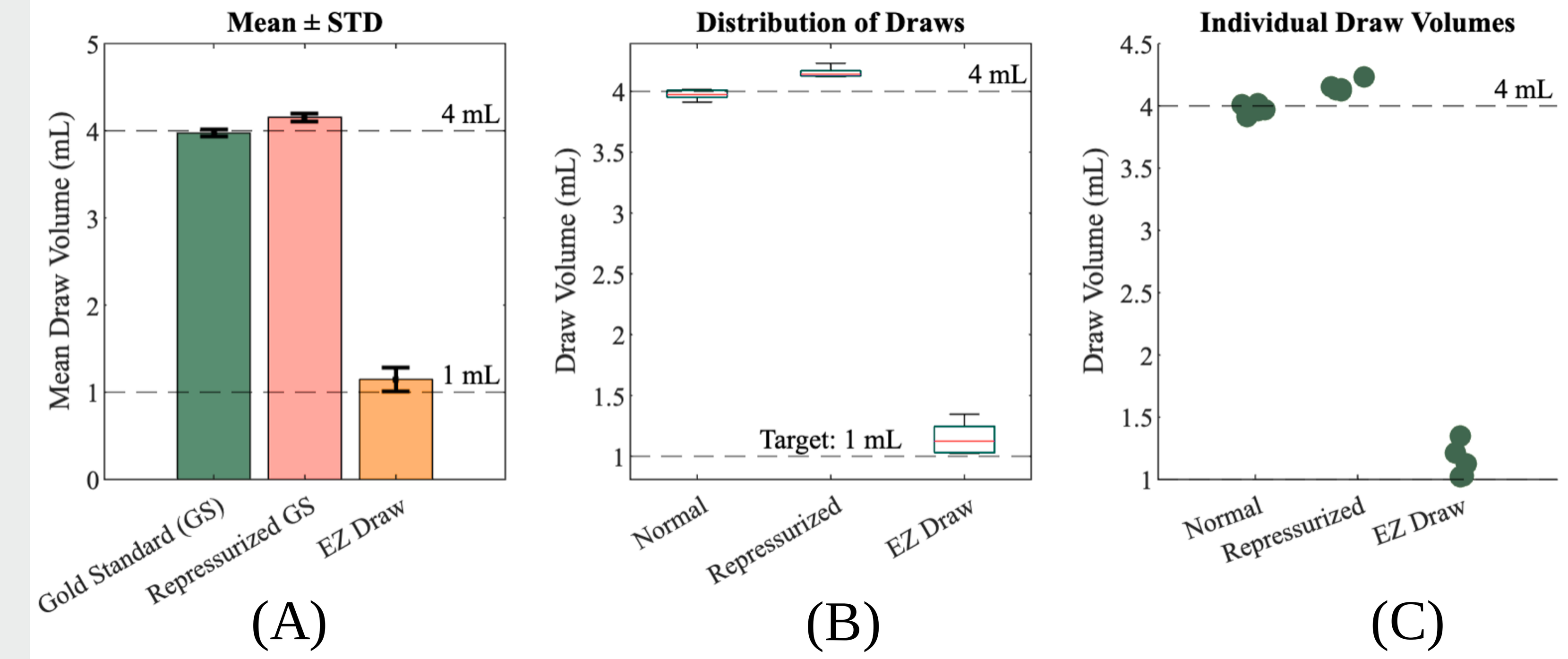


Figure 4. Comparison of fluid draw volumes across three tube conditions. The Gold Standard (GS) and Repressurized GS drew consistent volumes near 4 mL (SD = 0.0416 and 0.0438, respectively), while our Medium Design achieved a lower volume near the 1 mL target (mean = 1.15 mL, SD = 0.1346). Panel A shows group means ± standard deviation, Panel B displays distributions, and Panel C presents individual draws. Our design meets reduced volume goals with acceptable variability, supporting its use for small-volume applications.

NEXT STEPS

1. **Manufacturing** — Explore injection molding with PET to enable cost-effective, scalable production.
2. **Finalize Testing** — Conduct clinical testing and gather feedback from healthcare professionals and pediatric patients.
3. **Refine Design** — Incorporate testing outcomes and user feedback to optimize functionality.
4. **Regulatory Process** — Begin steps toward regulatory approval, such as FDA certification.

ACKNOWLEDGEMENTS

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