Developing the “Smart Toilet”: A Screening Tool for Health Monitoring

JACOB KEY¹,², JACKSON MCNABB¹,², SAMARTH MENTA¹,³, CLAIRE YIN¹,³
¹Duke University Center for Water, Sanitation, Hygiene and Infectious Disease, ²Duke University Pratt School of Engineering, ³Duke University Trinity College of Arts & Sciences

Are we flushing away our data?

- Feces is a strong indicator of gastrointestinal (GI) health
- Hospital acquired infections account for an estimated 99,000 deaths annually¹
- GI diseases cost the US $136 billion annually in healthcare expenditures²

How do we find what patients need?

Identify the most suitable market for the toilet.
- Long Term Care Facilities (LTCF) → patients are disproportionately impacted due to age

Research feces-related public health issues.
- Huge discrepancy between medical diagnosis and verbal description of feces by both patients and doctors

How are we solving the problem?

Engineer a sensor system for in situ analysis & sampling mechanism for feces extraction.

Sampling Mechanism:
Collect samples of immobilized feces for further biochemical analysis

Sensor Analytics:
Record physical and biochemical features with neural networks for intelligent fecal characterization

Biochemical Analysis:
Analyze feces for HAI’s, microbiome irregularities, and occult blood

What are our next steps?

1. Prototype higher fidelity engineering models
2. Apply machine learning for fecal characterization
3. Seek pre-submission meeting with FDA

Acknowledgments:
We thank our team leads (Drs. Katie Sellgren, Sonia Grego and Geoffrey Ginsburg) for their mentorship and guidance. We appreciate the faculty and researchers of the Duke Center for WaSH-AID for their support. We thank the Bass Connection and MEDx programs for funding this research.