Senior Capstone:  
Stool Sample Collection and Preservation Device  
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**BACKGROUND**

- Between 60 and 70 million people suffer from gastrointestinal illnesses in the US annually.
- 5,724 registered hospitals in the US.
- Fecal matter is typically about 75% fluid and 25% solid material.
- Preservatives typically need to be added within six hours of defecation.
- Colorectal patients.
  - According to the American Cancer Society in 2014, there is an ESTIMATED:
    - 96,830 new cases of colon cancer
    - 40,000 new cases of rectal cancer
- According to the Center for Disease Control and Prevention (CDC):
  - 131,607 people in the United States were diagnosed with colorectal cancer, including 67,700 men and 63,907 women.
  - 52,045 people in the United States died from colorectal cancer, including 27,073 men and 24,972 women.

**CURRENT METHODS**

**Testing**
- Initial tests for color, occult blood, and consistency.
- Fecal Occult Blood Testing (FOBT) common form of initial testing for:
  - Allergies or inflammation
  - Bleeding of the GI tract
  - GI infection
  - Ulcers

**Preservation**
- Formalin Fixation:
  - First step in preservation and testing preparation
  - Solution containing approximately 40% formaldehyde
  - Intended to prevent autolysis and preserve biological tissue
  - Makes proteins and nucleic acids insoluble to stabilize them
  - Formalin is potential carcinogen

**USER NEEDS ASSESSMENT**

- Improve collection methods
- Improve transfer and preservation
- Mass Production
- Cost effective
- Exposure to irritating smells and fumes
- Potential for direct contact with toxic chemicals
- Market internationally

“For a user that is required to provide a stool sample for testing of gastrointestinal abnormalities, there is a need for a means to collect and preserve stool samples in a way that is safe, physically simplified, and emotionally facilitated”

**VALIDATION TESTING**

- **Blade Testing – Nathan**
  - Result: Triple blade system was most effective due to the fact that it produced the lowest maximum cutting force.
- **Geometry Testing – Scott**
  - Result: The optimal angle for the wall of the collection bowl is 45 degrees.
- **Containment Testing – Amelia**
  - Result: An aperture would be an effective closing mechanism for the collection cup if it would fit.
  - The lid on the collection bowl will prevent contact with stool.
- **Leakage Testing - Zak**
  - Result: The gasket is more effective at sealing the collection cup than an O-ring.

**ACKNOWLEDGEMENTS**

Dr. Heather Lai  
Barbara Presley  
National Institutes of Health  
SHB Medical

Dr. Michele Grimm  
Dr. John Santilucia  
Life Beyond Barriers  
BME Class of 2015

Dr. King-Huy Yang  
Professor Karen Apolloni

**RISK ANALYSIS AND VERIFICATION**