


Topical probiotics for reducing infections by multidrug resistant bacteria

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Probiotic Delivery Device



Overview

- Background
- Motivation
- Problem Statement
- Design Specifications
- Design Alternatives
- Design Matrix
- Final Design
- Future Work

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Background

- o **Probiotics**
 "Live microorganisms, which, when administered in adequate amounts, confer a health benefit on the host." – WHO

To offset side effects caused by antibiotics by restoring balances

To stop or suppress the growth of harmful microorganisms

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Background

- o **Probiotics**
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Lactobacillus rhamnosus GG (LGG)

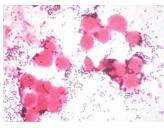
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Background



- o **LGG**
 - o Antibiotic-associated diarrhea
 - o Allergies
 - o Respiratory infection
 - o Tooth decay
 - o Nasal colonization of potentially pathogenic bacteria (*Staphylococcus aureus*)

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Motivation



- o MRSA
- o Longer hospital stays
- o Economic burden > \$14 billion in 2003





- o 30% of people have colonies in their nasal cavities
- o LGG can produce peptides to inhibit growth of Staph

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Problem Statement

- Research the efficiency of the probiotic LGG applying in the interior nasal passage in preventing *Staph a.* infections
- Trade name: Culturelle



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Problem Statement

Need:

- A **delivery device** of LGG into nasal cavity is needed for clinical trials
- A **solution** in which suspend and deliver the bacteria needs to be found.

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Design Specifications

- Delivery Device must:
 - Accurately deliver 1 billion LGG organisms
 - Keep bacteria viable for up to 2 weeks
 - Repeatability of delivered dose
 - Prevent far insertion in nasal passage
 - Be able to be refrigerated
 - Be opaque

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Design Specifications

- Solution must:
 - Be biocompatible
 - Allow bacteria to live up to 2 weeks
 - Survives in nose for min. of 1 day
 - Prevent overgrowing

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Design Alternatives

- Dry Powder Nasal Spray
- Liquid Nasal Spray
- Gel with Blister Pack Applicator

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Design I

Dry Powder Nasal Spray


- Powder form of LGG
 - Powder with LGG lands directly on interior nasal surface
- Storage conditions known
 - Stored for 2 weeks
- May cause sneezing



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Design II Liquid Nasal Spray

- Liquid form of LGG
 - LGG powder + 0.9% saline solution
 - Positive results from preliminary testing
- Opaque bottle
- Shorter spray nozzle is needed



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Design III Gel with Blister Pack Applicator

- Applied close to edge of nostril
- Aliquoted into blister pill packs
- Nasal gels already in use for antibiotics
- Must be a survivable environment for bacteria




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Design Matrix

	Dry Powder Nasal Spray	Liquid Nasal Spray	Gel & Blister Pack
Preference (5)	3	4	5
Distance (5)	3	3	5
Ease of Use (5)	3	4	4
Bacteria Viability (5)	5	4	3
Consistent Delivery (5)	4	5	4
Total Score (25)	18	20	21

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Final Design

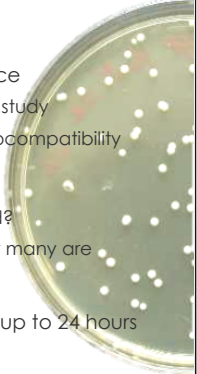


- **Gel with Blister Pack Applicator**
 - Client's preference
 - Highest popularity from survey
 - Appropriate delivery distance
 - Further testing is needed

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Future Work


- Survivability in media of choice
 - 3 day followed by week long study
 - Salts or glucose added for biocompatibility
- Delivery of 1 billion cells
 - How much product is applied?
 - Swab nose to determine how many are applied
- Bacteria must live in nose for up to 24 hours



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Acknowledgment

- **Client** Dr. Nasia Safdar
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Questions

