A Multifaceted Therapeutic Recreation Intervention Plan: Analyzing and Managing the Impact of COVID-19 on Mental Health Among Long Term Care Residents

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Introduction

- COVID-19 pandemic made a profound mark worldwide, but the global population of older adults was impacted significantly, conceptualizing it as "gero-pandemic" (Wister & Speechley, 2020).

% of COVID-19 Deaths as of April 2021

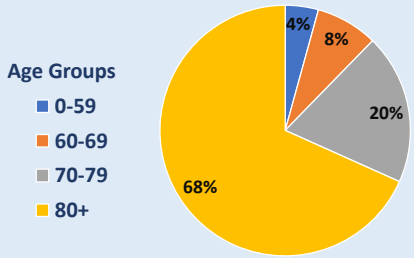
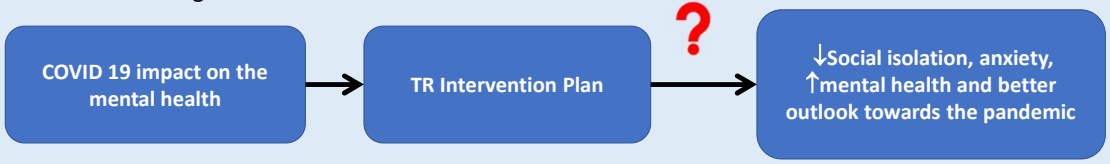


Fig 1. Representation of the Data by Government of Canada computes higher % of COVID-19 deaths among the population 60 years and above (Government of Canada, 2021).

- Mental health among *Long term care (LTC) residents* can be accounted as one of the most crucial aspects impacted during the pandemic and can be analyzed by considering *the variables such as mood, anxiety, social isolation, depression, fear of disease contraction*.
- *Therapeutic Recreation (TR)* focuses on the implementation of the recreational activities as an interventional plan which *promotes greater well-being*.

Purpose and Study Aim

- This study aims to analyze and combat the impacts of COVID-19 on the mental health among LTC residents through TR intervention.



- The study will evaluate and address the question, if therapeutic recreation can help play an essential role in managing the effects on mental health during pandemic amongst a vulnerable population.

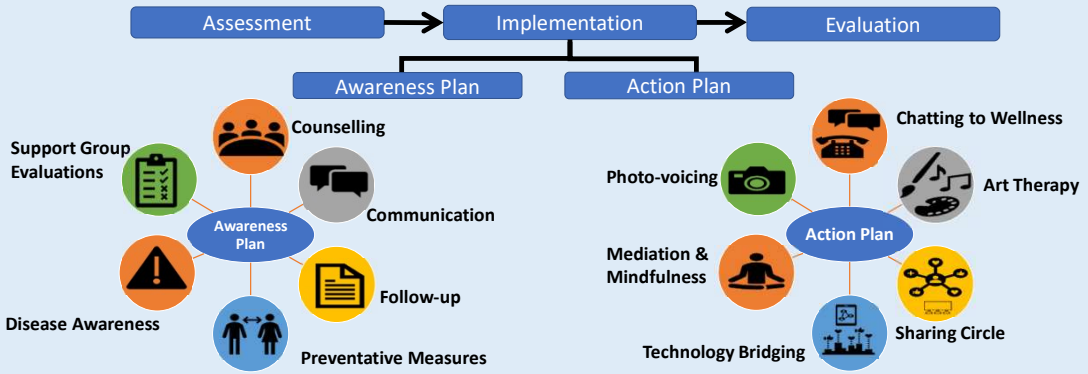
Proposed Methodology

This TR intervention Plan comprises of a mixed method approach, executed in three phases among 30 LTC residents over the span of 6 months, conducted by certified TR professionals.

Phase 1- *Assessment* through interviews, MDS-RAI scale (Drummond et al., 2015), Generalized Anxiety Disorder and Geriatric Depression Scale (Snyder et al., 2000), results will be recorded for each participant.

Phase 2- *Implementation* is distinguished in ***awareness plan*** (positive aging, counselling, support groups, and disease awareness and prevention) and ***action plan*** (*two-way exchange model* which includes volunteers from university level, trained by the TR professionals to engage in TR activities). This phase aims to mitigate and address the impacts of COVID-19 through education and therapeutic recreation.

Phase 3- Participants will be reassessed using the scales used in Phase-1, results will be *evaluated* by comparing the pre and post intervention changes in the variables.



Expected Results

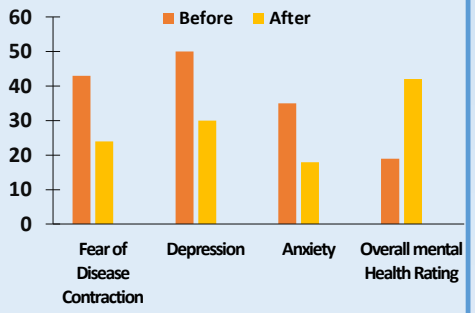
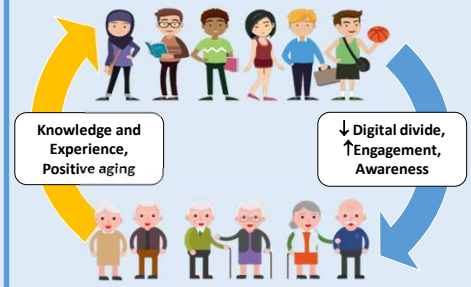


Fig 4. Results from the qualitative analysis represent a (%) decrease in variables like depression and increase in overall mental wellbeing after TR intervention.

Significance and Community Engagement



A *two-way exchange model* can help create awareness towards TR interventions by bringing two populations together through bridging the gap and creating opportunities. This will promote healthy aging and awareness towards role of TR intervention plans in geriatric research.

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A Non-Antibiotic Approach to Treat the Outbreak of *Vibrio cholera* in Syrian Refugee Camps in Lebanon

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Introduction

In the last year, Lebanon declared an emergency state for the cholera outbreak, mostly in Syrian refugee camps. An increase in population density in refugee settlements can result in an overburden of water supply and sanitation systems, influencing the intensity of cholera. Syrian refugees, who flee their homes because of the war that has been going on for almost 12 years, struggle to access clean water and have inadequate sewage systems. On the other hand, in Lebanon, a fragile.

Figure 1. A Syrian refugee child walks in muddy contaminated water in one of the camps. This image is taken from https://www.jpost.com/middle-east/article-720247

The virulence factors of *Vibrio cholerae* include toxin-co-regulated pilus, cholera toxin, and motility. The main symptoms are acute watery diarrhea, vomiting, and leg cramps. Cholera is treatable and preventable, but can lead to quick death by dehydration if untreated. Current treatments for cholera involve oral/intravenous rehydration, which is often combined with antibiotics to shorten the duration and survival of *V. cholerae* in the stool. However, resistance has been seen in most antibiotics over time, which limits the treatment options. Therefore, we want to analyze the options that can be affordable for refugees as well as options that reduce antibiotic resistance. Also, we question how a treatment can make cholera patients less susceptible to other intestinal bacteria. Conjugated linoleic acid is a new therapy that reduces cholera toxin production by inhibiting *V. cholerae* ToxT Activity (Withey et al., 2015). In addition, the motility of *V. cholera* can be inhibited by ZAC-3 antibody that arrest the motility and reduces the ability of *V. cholera* to colonize the intestinal epithelium (Levinson et al., 2016).

Hypothesis

A conjugated form of linoleic acid with engineered probiotic *Lactococcus lactis* could potentially treat cholera. Engineering ZAC-3 antibodies displayed on the probiotic surface reduce the virulent activity of cholera through probiotic-pathogen binding.

Methodology

Genetically engineered antibodies are introduced in the *L. lactis* by application of modern recombination DNA or gene mutation technology to reconstruct gene fragments and obtain specific antibodies through cell transfection by electroporation and culture in vitro. To have our probiotics express the ZAC-3 antibody, we construct the ZAC-3 plasmid. For plasmid design, peptides will be included for secretion to the growth medium, while AcmA3b was included for surface anchoring of the expressed ZAC-3 to *L. lactis*. The sequence of ZAC-3 was surrounded by two restriction sites. The aim of such a design is, through the digestion of restriction enzymes, to obtain the ZAC-3 sequence in the *L. lactis* plasmid. The engineered probiotic will be provided as a freeze-dried powder and will be supplemented with linoleic acid.

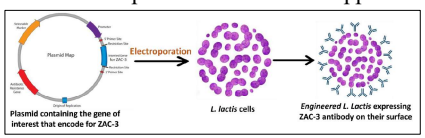

Figure 2: The engineering process by cloning target parts into plasmids and transforming it into *L.lactis* cells.

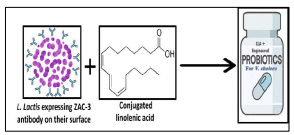

Figure 3: The final product that includes CLA and the engineered probiotic.

Expected Results

Our approach is expected to produce a dietary supplement that does not require additional treatment or strict dosages to consume as antibiotics do. It is consumed in a flexible manner, and it will not make their digestive tract vulnerable to other bacteria. Additionally, it does not require the authorization of a physician or to go to a health center to receive treatment because our body is used to *L. lactis* to participate in digestion. Moreover, as explained, the probiotic effectiveness is high, especially because it reduces the risk of developing antibiotic resistance and exposure to other potential infections. Finally, the total cost needed to engineer *L.lactis* is reasonable, as demonstrated in table 1. So, the probiotic is cheap enough for Health Organizations to provide it as part of their food donations.

Table 1. This table analyzes the estimated cost to produce 100,000 capsules of engineered probiotics supplemented with CLA prescribed for cholera patients. It costs about $0.753 per one capsule.

Cost Break Down							
Equipment		Consumables		Manufacturing		General	
Molecular Biology Equipment	$6,000	Molecular Biology Reagent	$7,300	Bioreactor Equipment	$9,000	Business and Product Liability Insurance	$5,000
Engineering Equipment	$8,000	Engineering Materials	$9,000	Prototyping	$30,000	Advertising and Marketing	$1,000
Total (75,300 Canadian Dollars)							

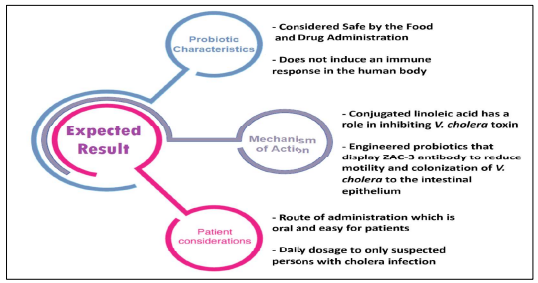

Figure 4. The expected results regarding the probiotic characteristics, mechanism of action and patient considerations of the newly engineered dietary probiotic supplements.

Significance of Research

Innovations of this dietary supplement probiotic not only offer a solution that preserves the potency of antibiotics and microbial composition of the gut microbiome, but also illuminates targeted approaches to treat related other bacterial infections. This product can ultimately reduce and help with the stress and challenges faced by families during crises and war. This project aligns with the United Nations Sustainability Goals: (Good Health and Well-being goal) and (Industry, Innovation, and Infrastructure goal).

Community Engagement

Our target audience is Health Organizations (such as the United Nations and Works Agency for Palestine Refugees in the Near East) as they currently are the main providers of food, water, and medical supplies for refugees. We will show them the effectiveness of our treatment in terms of price, safety, access, and effectiveness. To reach them, we created an Instagram page that explains our product.

The given QR code is linked to the Instagram page. By posting this QR code everywhere and mounting them on the walls of street, health centers, we could help in spreading our innovation to reach health organizations and increase people's awareness of our product.

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Barriers and Strategies for Diagnosis of Human Papillomavirus Infection in Indigenous Communities in Manitoba

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Introduction

Cervical cancer is the second most common cancer in people with a uterus worldwide, with Human papillomavirus infection being a major risk factor (Walboomers et al., 1999; Daling, 1996). HPV infection rates are approximately 50% higher in Indigenous communities compared to non-Indigenous communities in Canada (Jiang et al., 2013). The rates of cervical cancer are approximately 2-4 times higher among the Indigenous population in Manitoba. This is accompanied by lower rates of Papanicolaou (Pap) smears used to detect cervical cancer (Young et al., 2000). Due to the effects of colonization, rates of HPV vaccination and Pap testing are lower in Indigenous communities, thus a trauma-informed approach is needed to improve testing rates (Henderson et al., 2017). It has been shown that the vulnerable nature of Pap tests compel those with a uterus in Ontario to prefer self-collected HPV testing (Racey and Gesink, 2016). Collecting first-void urine samples is less invasive, and sensitivity is comparable to Pap tests in detecting HPV (Leeman et al., 2017). To increase HPV prevention and screening, collaboration and dialogue with Indigenous communities must be established (Henderson et al., 2017).

Hypothesis

Implementing non-invasive urine self-testing for HPV will affect rates of HPV detection in Indigenous communities in Manitoba.

Proposed Methodology

Clinic Set-up

Urine self-testing clinics would be established in 50 Indigenous communities. As a control, traditional HPV testing clinics using Pap smears would be established in 50 other Indigenous communities with similar demographics. Clinics will be operated for 6 months, and rates of HPV detection recorded.

Sample Collection

Residents will be provided with the Colli-Pee™ urine collection device as in Leeman et al., 2017. Participants will be instructed to collect the urine sample during the first void of the morning and bring the sample to the clinic on the same day, where they will be held at -80°C. At the end of each month, the samples will be shipped to Winnipeg, where they'll undergo HPV DNA testing.

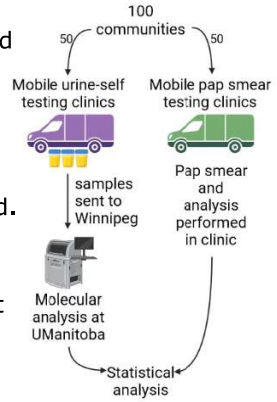

Figure 1. Proposed methodology of clinic set-up, sample collection and urine analysis. Created with BioRender.

Urinalysis

Urine sample analysis will be carried out as outlined by Leeman et al., 2017. Statistical analysis to determine whether there is significant evidence that the urine self-testing clinics are more effective than the traditional Pap smear clinics.

Expected Results

The urine self-testing clinics are expected to increase the rates of HPV detection within Indigenous communities. Privacy and the non-invasive nature provides added convenience for the test. By developing this test in collaboration with Indigenous communities, test rates will hopefully increase.

Significance

Cervical cancer rates in Indigenous communities in Canada are unacceptable, being significantly higher than the general population (Young et al., 2000). Widespread adoption of urine self-testing kits in these communities could drastically improve early-stage HPV detection rates. These cases can then be treated appropriately, thus decreasing the prevalence of cervical cancer. This is just one possible step towards reconciliation between Indigenous communities and the Canadian healthcare system.

Community Engagement

Lack of awareness and access are the two major reasons for individuals not being up-to-date on their cervical cancer screening (Suk et al., 2022). The focus of our knowledge translation will be to inform people above the age of 20 on the benefits, simplicity, convenience, and recommended frequency of urine-based HPV screening. It is no secret that social media is becoming the easiest and most effective way to reach a large number of people. As of September 2021, TikTok has passed 1 billion active users globally and Facebook 3.5 billion (Bursztynsky, 2021). The success of campaigns such as the ALS Ice Bucket challenge, which raised over 100 million dollars by 2014 (Phing et al., 2014), has shown that this approach can be extremely effective. Thus, we propose using social media platforms to communicate our findings.

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Comparing Post-COVID-19 Pandemic Stress in Manitobans Living With HIV Before and After Attending a Group Mindfulness-Based Stress Reduction Program

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INTRODUCTION

- Stress is defined as a physiological response to the relationship an individual perceives between themselves and their situation or environment (Firdaus, 2014; Lopez-Matos *et al.*, 2022).
- The 2019 coronavirus disease (COVID-19) is associated with an increase in stress and anxiety levels in the general population (Yıldırım & Solmaz, 2022).
- Long term stress can lead to development of mental illness, and a decrease in immune function (Firdaus, 2014).
- Individuals living with human immunodeficiency virus (HIV) report higher rates of stress, mental health problems, and substance abuse (Lopez-Matos *et al.*, 2022).
- There is a link between stress and treatment adherence, and subsequently disease progression in individuals living with HIV (ILWH) (Weinstein & Li, 2016).
- In Manitoba, 42.7% of newly-diagnosed females and 32.3% of newly-diagnosed males entered into HIV care with a pre-existing mental health condition in the past 5 years (Manitoba HIV Program, 2022).
- Mindfulness-Based Stress Reduction (MBSR) programs have been shown to decrease stress and increase healthy mindfulness-based coping mechanisms in a variety of populations through exercises that increase bodily awareness, self-acceptance, and emotional regulation (Carmody *et al.,* 2008; Lwi *et al.*, 2022; Martins, 2014).

Hypothesis: It is hypothesized that attending a free eight-week mindfulness-based stress reduction group program will lead to a decrease in post-COVID-19 pandemic perceived stress symptoms among people living with HIV.

POPULATION

- 40 individuals referred to study via primary care provider.
  - 20 ILWH
  - 20 Individuals living without HIV (ILWOH)
    - Positive control group.
- **Sampling Methodology:** Stratified random sampling.
- **Participant Recruitment:** participating community health centers responsible for recruitment of individuals fulfilling the following inclusion criteria:
  - HIV Care Clinics: Individuals living with HIV
  - General Care Clinics: Individuals living without HIV
- **Note:** Transportation offered to participants to reduce accessibility barriers and increase participant retention.

MEASURES

Surveys:

- Demographics Questionnaire (DQ)
  - age, gender, occupation, housing, history of substance abuse, participation in group therapy
- Stress Survey (SS) - adapted from Perceived Stress Survey (Cohen *et al.*, 1983).
  - Focuses on perceived stress participants faced in the past month.
  - 14 questions with a rating scale of 1-5 for a total score out of 70.

Mindfulness-Based Stress Reduction Program:

- Begin each 45-minute session with 15-minute discussion about stress and mental health.
- Introduce and try as a group new mindfulness techniques each week (Gallego *et al.*, 2014).
  - Technique 1: Body Scan
  - Technique 2: Mindful Breathing, Complete Attention
  - Technique 3: Three-Minute Breathing Space
  - Technique 4: Sitting Meditation Exercises
  - Technique 5: Mindful Seeing
  - Technique 6: Five Senses Exercise
  - Technique 7: Acceptance of Thoughts and Feelings
  - Technique 8: Yoga Exercises (Sun Salutation Flow)
- Individuals encouraged to continue using these practices daily, but not required for remaining in program.

ETHICS

- Ensure complete confidentiality for each participant.
  - Only collecting demographic information for study.
  - Will not disclose any personal identifiers or health information.
- All participants will provide written informed consent prior to participation.
- This proposal assumes approval from Research Ethics Board and Winnipeg Regional Health Authority (WRHA)

PROPOSED METHODOLOGY

Experimental between-subjects research design chosen.

Hypothesis created.

Contact 4 Winnipeg-based community health clinics:
- 2 specializing in care for ILWH.
- 2 specializing in community health.

Establish inclusion criteria and sampling with health clinics.

Randomly select 40 participants and separate into groups:
Group 1: 20 ILWH
Group 2: 20 ILWOH

Obtain written informed consent and confidentiality agreement from participants.

Administer DQ to gain patient demographics.

Explain details of study to participants, including definition of MBSR.

Have participants complete SS.

Implement MBSR program sessions once per week for 8 weeks separately to two groups.

Have participants complete SS once sessions are complete.

Analyze collected data and compare results of ILWH with ILWOH.

Test hypothesis.

EXPECTED RESULTS

- A decrease in mean SS scores over course of program for both ILWH and ILWOH.
- Paired-Samples t-test shows significant difference between pre- and post-program SS scores.
- On-average, differences in pre-program scores are higher than post-program scores for both groups, suggesting program decreases stress in participants regardless of HIV status.
- Confirm hypothesis that attending an eight-week mindfulness-based stress reduction program will lead to a decrease in post-COVID-19 pandemic stress symptoms among people living with human immunodeficiency virus.

SIGNIFICANT IMPACT

- Study has promise of creating a generalizable MBSR program that decreases post-pandemic stress among ILWH.
- While results are expected to be more significant in ILWH, MBSR program could be generalizable to general public.
- MBSR program could be implemented into different community health clinics in Manitoba and beyond.
- Administration via group decreases stress on clinicians.

COMMUNITY ENGAGEMENT

- Assuming findings agree with hypothesis, study shows promise that group MBSR programs could decrease stress significantly in ILWH and ILWOH.
- Target audience is ILWH that are experiencing post-pandemic stress; however, this program could be generalizable to individuals at community health clinics.
- Partnership with Nine Circles Community Health Centre to implement group MBSR program:
  - Clinic in Winnipeg specializing in care for ILWH.
  - Clinic responsible for providing space for free voluntary group therapy program.
  - Coordinators would provide scheduling and administration of program.
- Decrease transportation barriers and increase accessibility through partnership with Winnipeg Transit and Handitransit.
  - Provides valuable information about patient enrollment in programs with increased accessibility.
- Partnership with Government of Manitoba and WRHA for assistance with funding, and increased capacity upon program success.

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Yemen Malnutrition Crisis: Detection of Bacterial Pneumonia Infections in Cases of Child Malnutrition

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Introduction

Yemen is experiencing the largest food security emergency in the world with approximately 1.8 million children suffering from acute protein-calorie malnutrition (PCM) (Dureab *et al*., 2019). As explained by Rodríguez *et al*. (2011), there is a correlation between PCM and opportunistic respiratory infections in children less than five years old. PCM prevents the initiation of an adequate host immune response by rendering many immune mechanisms defective, including T-cell function, cytokine production, and alveolar macrophage function (Rodriguez *et al*., 2011). Bacterial acute respiratory infections (ARI) run rampant in Yemen (Dureab *et al*., 2019). Badulla *et al.* (2020) found that in a 2015 study, 84.2% of hospital prescriptions in Aden, Yemen contained antibiotics (ABXs). A lack of proper screening leads to indiscriminate prescribing of broad-spectrum ABXs and accelerates the development of antibiotic-resistance (ABR) in bacterial strains (Badulla *et al*., 2020). Focusing on *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Staphylococcus aureus*, the purpose of this study is to develop a selective and cost-effective microfluidic sedimentation-based immunoassay (MSI) test to identify the major causative agents of bacterial pneumonia in Yemeni children under five years of age (Schuchat & Dowell, 2004).

Hypothesis

Using the MSI, we will identify the major culprits of bacterial pneumonia in malnourished Yemeni children. Over time, we expect the percentage of narrow-spectrum ABX prescriptions to increase as the percentage of broad-spectrum ABX prescriptions decreases.

Proposed Methodology

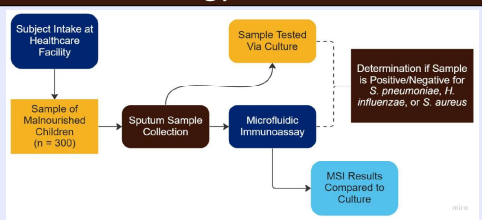

Figure 1: Flow chart outlining the experimental procedure. Flowchart made using Miro.

- Comparative diagnostic accuracy study consisting of three-hundred sputum samples from malnourished Yemeni children, anticipating that some will present with ARI, at Yemen Red Crescent Society (YRCS) supported healthcare facilities (Bujang & Adnan, 2016; Canadian Red Cross [CRC], n.d.). ARI status will be determined via pulse oximetry testing as suggested by National Heart, Lung, and Blood Institute (2022).
- Conserved antigens targeted by the immunoassay are:
  - *H. influenzae* outer membrane protein P6 (Nelson *et al.*, 1991)
  - Staphylococcal protein A (Lachia *et al*., 1979)
  - Capsular polysaccharide of *S. pneumoniae* (Ehara *et al.*, 2008)

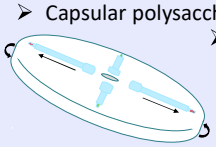

Figure 2: Theoretical MSI disk model. Capture beads separate antigen-antibody complexes at the end of the channels through centrifugation.

- Design of the MSI is based upon the underlying theory and methodology proposed by Phaneuf *et al*. (2016), Schaff and Sommer (2011), and industry standards as reviewed by Shi *et al*. (2021). Our adaptation will account for use of sputum samples, and the targeting of ARI-associated antigens.
- Separation and selectivity of the device is determined by sedimentation rates of capture beads induced by a centrifugal force (Schaff & Sommer, 2011).
- Results will be compared to the established technique of bacterial culture-based identification as a control.
- Two confusion matrices will be generated to analyze data by calculating the specificity and sensitivity metrics of the associated diagnostic methods. This will confirm the efficacy of MSI in relation to culturing techniques.

Expected Results

- We expect that the MSI will selectively identify the presence or absence of either *S. pneumoniae*, *H. influenzae*, or *S. aureus* when compared to culture results from the same samples.
- When pneumonia is detected by oximetry testing and the culture is positive in the acutely malnourished children, we expect to see a positive MSI test as well.
- When pneumonia is not detected by oximetry testing and the culture is negative in the acutely malnourished children, we expect to see a negative MSI test.
- Over time, we expect broad-spectrum ABX prescriptions to decrease, while narrow-spectrum ABX prescriptions increase, once the device has been made more accessible to Yemeni healthcare professionals.

True Positive: Positive MSI/ Positive Culture	**False Positive:** Positive MSI/ Negative Culture
False Negative: Negative MSI/ Positive Culture	**True Negative:** Negative MSI/ Negative Culture

Figure 3: Confusion matrix showing possible outcomes of each test (n=300). If our methodology is successful, we expect the results of tests on patients presenting with ARI to fall within the true positive group, and those of tests on patients presenting without ARI to fall within the true negative group. Figure made using Miro.

Significance of Research

This MSI offers cost-effective, selective, and field deployable testing (Phaneuf *et al*., 2016). Its utilization will improve screening in the malnourished, under-five population of Yemen and reduce the development of ABR. MSI offers an affordable solution to the resource-poor Yemen without sacrificing the sensitivity of standard clinical diagnostics (Phaneuf *et al*., 2016). With the use of portable batteries and solar panel charging, this device can revolutionize the way that screening is done in developing countries.

Knowledge Translation

The experimental results will be shared with biomedical corporations to facilitate the mass production of microfluidic tests. We will also present to the YRCS which runs health clinics all over the nation (CRC, n.d.). We will create presentations in collaboration with the YRCS for Yemeni healthcare professionals to educate the families of children suffering from PCM and ARI about the importance of microfluidic testing to combat ABR. If this test is accepted by a company and the YRCS, parents will be encouraged to bring their children to healthcare locations that offer this screening method and help decrease the prevalence of ABR in Yemen.

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