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Microgreens Nutrition Outreach: A Novel Tool for Community-Wide Dietary Disease Prevention

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Cover Page Footnote

The Drexel University College of Medicine IRB reviewed and approved this work under the Health Outreach Project (HOP) IRB.

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Microgreens Nutrition Outreach: A Novel Tool for Community-Wide Dietary Disease Prevention

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ABSTRACT

PURPOSE: To investigate how microgreens educational programming impacts the relationship between nutrition attitudes and healthy eating habits.

METHODS: A three-part workshop in Philadelphia, PA that consisted of a pre-survey, presentation, and microgreens kit assembly session was held. A post-survey was distributed electronically 1 week after the event.

RESULTS: 9 participants voluntarily attended the workshop and completed the pre-survey, and one-third of the participants submitted post-survey feedback. Participants were middle-aged, Black women from the Allegheny West neighborhood of Philadelphia, a predominantly (97.5%) Black neighborhood. The survey showed microgreens were well-received and suited for urban communities with little space and cold weather. Microgreens garnered interest in trying new vegetables and growing fresh foods.

CONCLUSIONS: Microgreens outreach serves as a novel, low-cost, sustainable tool that can effectively educate about nutrition and encourage healthy dietary habits.

INTRODUCTION

Incorporating fresh fruits and vegetables into a diet can be difficult for a variety of reasons, including affordability, access, or the perceived time it takes to prepare them for consumption.¹ The 2021 Chronic Disease Burden Report published by the Pennsylvania Department of Health reported that 9 out of 10 adults in Pennsylvania do not consume the recommended daily intake of at least five servings of fruits and vegetables, and the average consumption has decreased from 2011 to 2019.² This information is concerning when paired with data revealing that 1 in 3 adults and 1 in 5 high school students live with obesity, as well as the knowledge that diabetes is the seventh leading cause of death in Pennsylvania.³ For diabetes alone, Black residents in Philadelphia have the highest age-adjusted diabetes mortality rate from 2010 to 2019 with Hispanics, Whites, and Asians/Pacific Islanders following behind, respectively.³ Philadelphia county has multiple zones classified as food deserts. The 2019 Neighborhood Food Retail in Philadelphia report revealed that approximately 1 million Philadelphians have more than 20 stores with low-produce supply within walking distance from their residence.⁴ Additionally, lower income neighborhoods have a higher quantity of low-produce supply stores.³ Most Americans do not reach dietary recommendations, and lower-income individuals are at greater risk of consuming unhealthy diets.⁵ Barriers such as finance, time, transportation, and differing cultural norms and eating

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habits all impact the nutrition intake readily accessible for low-income communities.⁶ There are many initiatives to try to combat these systemic issues both on the government and community level as efforts increase to incorporate early-childhood nutrition education and more community gardens in cities.^{7,8} In this study, we investigated how microgreens can be used as a cost-efficient resource to introduce healthy eating habits to a community. Microgreens are young, edible plants that are harvested generally within one week of being planted. They are known to be nutritionally dense with more vitamins and antioxidants than full-grown plants.^{9,10} There are many different types of crops that can be utilized for this type of growth, such as bean sprouts or sunflower seeds. Microgreens are also able to be cultivated regardless of season, access to land, or greenhouse space.¹¹ With this type of flexibility in growing medium, microgreen utilization is ideal for urban locations, such as Philadelphia, where the proportion of unhealthy food options to healthy food options is skewed. A previous study acted as a pilot for proof of concept with medical students at Drexel University College of Medicine.¹² This study applies the knowledge gained from the pilot study to a community of adult participants in the Philadelphia area. We hypothesize that teaching individuals how to grow their own food with microgreens helps facilitate a connection between fresh food intake with healthy habits and increases overall nutrition awareness.

METHODS

Microgreens Outreach Kit Assembly

The assembly of the microgreens kits used at our current outreach events was adapted from the method established at the pilot event hosted at Drexel University College of Medicine.¹² At this event, we recognized the need for a streamlined process using the following materials: Tupperware containers, sunflower seeds, soil, and plastic containers to hold water. Although most seeds can be used, we opted for sunflower seeds due to their low cost and accessibility. The finalized protocol of the assembly process has been adapted and is documented (*Supplemental Figure 1*).

Survey Development

A pre- and post-survey (*Figures 2 and 3*) was created with questions in English language that aimed to gauge the current nutrition-related beliefs and lifestyle choices of workshop participants. The Google Forms platform was employed for several reasons; the familiarity that both workshop volunteers and participants have with the platform, the ease at which we could link our survey via QR code for par-

ticipants to access using their personal device, and the ability to quickly access and analyze the results without additional software.

The pre-survey was completed by participants at the beginning of the workshop and accessed via a QR code using a mobile device. It consisted of 13 closed and open-ended questions, with answers displayed in *Figure 2*. The survey also gathered demographic information such as age and self-reported gender, along with personal contact information such as email address and phone number. Initially, 1 week after the workshop, the post-survey was shared via email, however, due to a low number of responses, phone calls were also made a week later. The post-survey consisted of 14 closed and open-ended questions. Post survey phone calls gave participants the opportunity to freely discuss their attitudes towards microgreens and nutrition perceptions after the growth process (*Figure 3*).

Adult Education Workshop

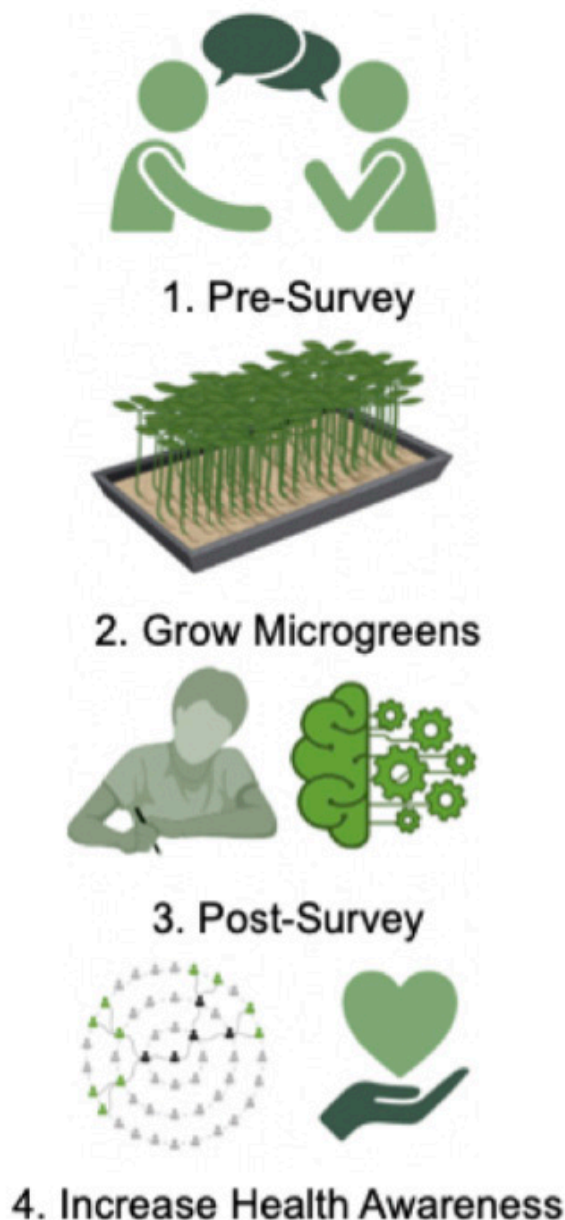
The adult education workshop consisted of a pre-survey, a brief presentation, and time dedicated to microgreens kit assembly. Upon pre-survey completion, a presentation in English language using Microsoft PowerPoint was delivered regarding the topics of chronic diseases and microgreens (*Supplemental Figure 2*). Drexel student volunteers assisted to guide the participants through the kit assembly process (*Supplemental Figure 3*) and facilitated open discussions about nutrition, health, and access to fresh produce. Printed take-home growing guides (*Supplemental Figure 4*) were provided at the conclusion of the event. The guide contained images, descriptions of the growth process, and answers to common questions and concerns. 1 week after the event, a microgreens online PDF recipe book created by Old Ranch Farm (*Supplemental Figure 5*) and Google Form post surveys were sent out by email to gauge success of the event. Post-survey calls were conducted 2 weeks after the event to gather more qualitative data about the participants perceptions and thoughts.

Cost per participant

The microgreens kits offered were significantly less expensive than commercially available kits. Microgreens grow kits for purchase on Amazon range between \$23-39 per kit. By purchasing items in bulk and using alternatives like Tupperware containers instead of designated pots, the total cost of the event serving 9 participants and 6 volunteers totaled out to be \$17.38. This meant that each microgreens kit cost \$1.09 and provided each participant with 2-3 servings of microgreens.

RESULTS

A. Experimental Design



B. Cohort Characteristics

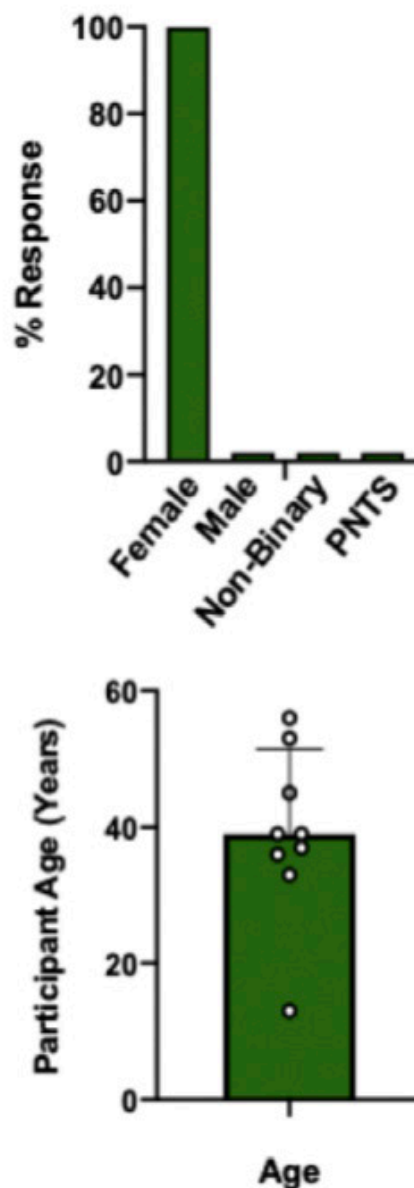


Figure 1. Experimental Design and Participant Cohort Demographics. A) experimental design overviewed B) Cohort Characteristics of Gender Identify (PNTS = prefer not to say), participant age presented in years.

A diagram of the experimental design (Fig 1A) depicts the overall goal of the microgreens outreach event. Nine participants reported living in Ridge Ave, Allegheny Ave, and Huntington Park neighborhoods, identified as female, spoke English as their primary language, and reported ages ranging between 13 to 56 years of age (Fig 1B).

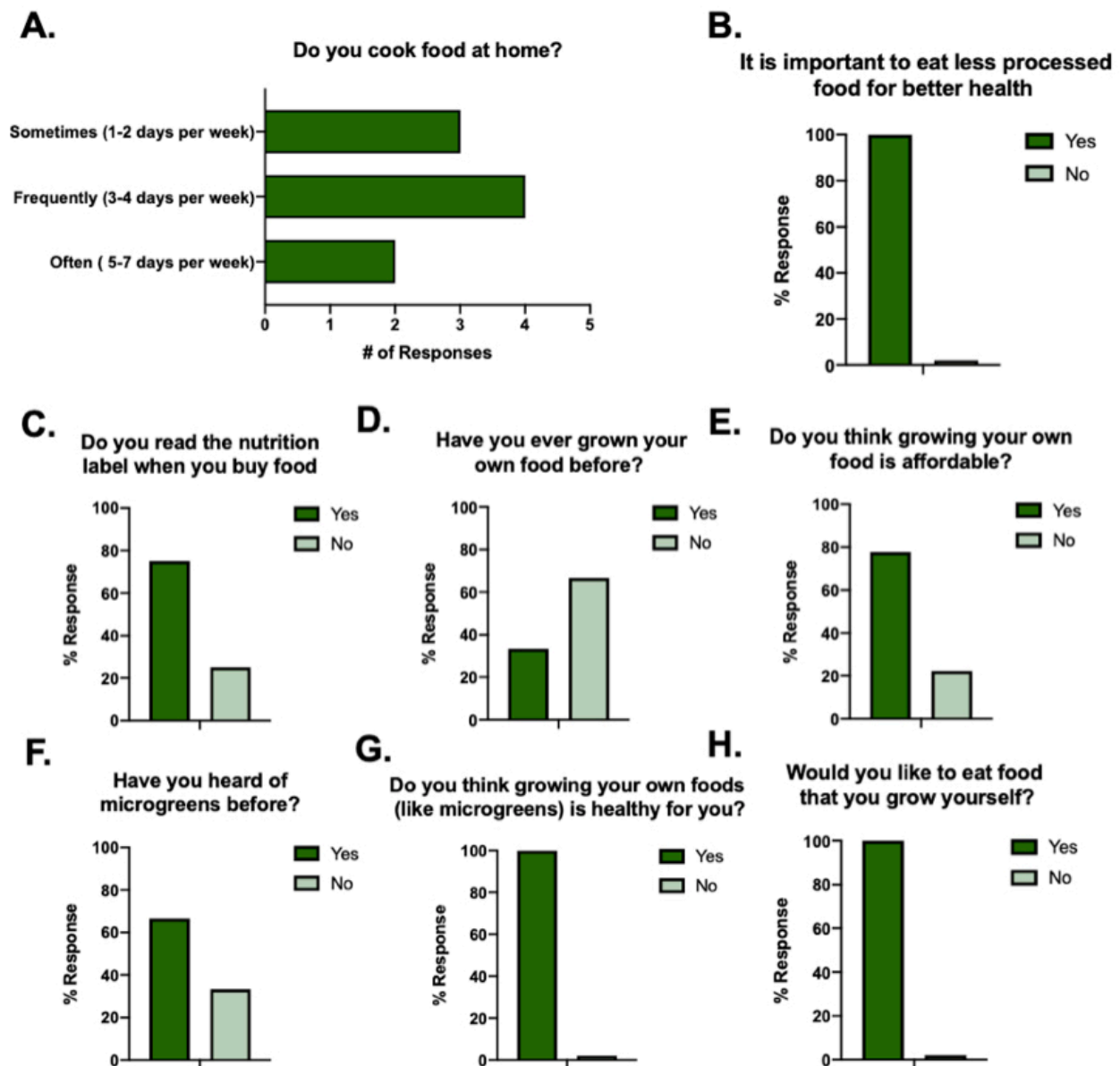


Figure 2. Pre-survey data from deidentified community participants. A-H) Data collected in the pre-participation survey characterized attitude, awareness, and interest in microgreens growth as well as nutrition.

Participants reported they prepared food at home to varying degrees, ranging from sometimes (1-2 days per week) to often (5-7 days per week) (Fig 2A). However, most participants reported an interest in nutrition and healthy eating, with the vast majority of responses agreeing with the importance of eating less processed food and reading a nutrition label when buying food (Fig 2B-C). The majority of the cohort reported they believed growing food on one's own is affordable although over 60% of respondents reported they had not grown their own food previously (Fig 2D-E). Interestingly, 100% of the participants indicated they wanted to eat food they grow themselves, and over 60% of participants reported they had heard of microgreens before attending the outreach event (Fig 2F-G). Lastly, 100% reported they thought microgreens are healthy (Fig 2H).

Figure 3. Post-survey interview excerpts from de-identified community members regarding attitudes towards microgreens after growing them. The three survey respondents are color-coded with green (respondent A), blue (respondent B) and black (respondent C) box outlines.

Attitude Towards Microgreens

<p>Enjoyed the micro aspect of microgreens and how quick and easy it was.</p> <p>Liked that microgreens could be added to almost any recipe, such as seasoning mix for meat or in sandwiches</p> <p>Growth is not limited to winter. Good for communities where there is no space for people to grow things large scale</p>	<p>Growing microgreens was easy and there were no issues.</p> <p>Did not end up harvesting and eating the microgreens, but interested in growing again and adding to dishes such as chicken and sandwiches</p> <p>Interested in learning more about all the different types of seeds that can be used to grow microgreens</p>	<p>Easy to assemble and grow the microgreens, and they grew perfectly</p> <p>Although she didn't harvest her microgreens this time, she is interested in growing them again and incorporating into her cooking</p> <p>Growing the microgreens was very rewarding, and she is interested in growing herbs in the future</p>
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Over 30% of the participants responded to the post-survey phone calls. All respondents found the microgreens were easy to grow, and none ran into any issues while growing them (Figure 3). All three respondents expressed interest in incorporating microgreens into their cooking, although only respondent A was able to do so with the microgreen kit assembled during the workshop. Respondents also expressed interest in growing microgreens again using the extra kits provided at the workshop and indicated that they found the experience rewarding. Respondent A stated that microgreens were very suitable for communities like her own where there is not an abundant amount of space for residents to grow plants on a large scale.

Attitude Towards Healthy Eating and Growing Food After Growing Microgreens

Figure 4. Post-survey interview excerpts from de-identified community members regarding attitudes toward healthy eating and growing food after growing microgreens. Color-coding for three respondents remains consistent with Figure 3.

<p>Encouraged her to try out other types of greens</p> <p>Using fresh herbs encouraged her to use other fresh foods in her cooking</p> <p>Excited to explore what other greens she can grow herself, such as herbs and spices</p> <p>Growing her own greens helped give her confidence that it is easy to grow healthy food</p>	<p>Watching it (microgreens) grow and eating her own fresh food is nice</p> <p>Interested in buying more greens at the supermarket and adding more fresh fruit and vegetables to diet</p> <p>Wants to try using pumpkin seeds for microgreens and try growing peppers</p>	<p>Already eating healthy and buying a lot of fruit and vegetables, so growing microgreens did not shift her attitude towards healthy eating</p> <p>Would like to learn more about growing food in general, such as avocados, chickpeas, beans, and nuts</p>
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The experience of growing microgreens also had an impact on the respondents' attitudes towards healthy eating and growing their own food (Figure 4). Respondent C reported she was already incorporating a lot of fruits and vegetables in her diet. Respondents A and B however indicated that growing their own microgreens encouraged them to try out different types of greens and add more fresh fruit and vegetables to their diet. All three respondents were interested in growing their own food outside of microgreens. Respondent A specifically indicated that the experience of growing microgreens increased her confidence in her ability to grow healthy food.

DISCUSSION

The aim of community microgreens outreach is to demonstrate this approach as a novel and alternative method to food and nutrition education. Microgreens serve as a low-cost, sustainable, and community-driven approach to combat chronic diseases and give individuals a sense of ownership over their food-making decisions. Previous outreach revealed that while participants recognized what a healthy diet was, they faced obstacles in implementing healthy lifestyle choices.^{13,14} Barriers included finances, time, and transportation. However, activities such as gardening were seen to be facilitators for healthier eating and lifestyle.^{15,16} Nutrition outreach in the form of community gardens and farmers-market education positively impacts nutrition awareness and encourages healthy-eating behaviors.^{16,17} Microgreens kits can offer a similar benefit and serve as a unique tool for nutrition outreach as participants found them well-suited for non-ideal growing conditions, easily utilized in urban communities, and are not by limited space and cold winters like community gardens.

Previous studies among low-income women show that nutrition programming should be focused on limited, achievable steps that fit within low-cost, cultural, and accessibility constraints.¹³ A specific qualitative study conducted in Philadelphia, among low-income African American women, showed that despite good-intentions many participants had misconceptions about nutrition that lead to unhealthy eating habits.¹⁸ These studies highlight a few of the barriers with nutrition programming and the necessity to provide culture-informed, accessible education that addresses nutrition misconceptions.

Food choice is an expression of an individual's values, identity, and lifestyle.¹⁹ Socio-cultural factors that influence dietary habits include the impact of cultural capital, social stratification, and social inequalities. In addition, one's social environment, foodscape, financial constraints, and personal taste could create undue pressure leading a consumer to make a food choice that is generally unhealthy.²⁰ Thus, a major focus of our community outreach program was to determine if microgreens had flavors that were accepted by the participants. Those who ate microgreens found it to be an easy method to grow healthy food. However, some participants did not consume their microgreens, reflecting cultural factors that may influence microgreen consumption such as low utilization of different vegetables in African American households.²¹ Potential strategies to encourage consumption of microgreens include expanding the provided recipe

sheet, and offering external resources for more recipe options incorporated to foods routinely eaten among participant communities.

There are limitations to this study. For one, some of the participants at this event attended a previous microgreens event held at St. James Episcopal School in 2021. Previous exposure to the microgreens growing process may have influenced pre- and post-survey responses about nutrition. Furthermore, while feedback to the microgreens growth process was overall positive, the sample size was small and low response rates limited the ability of researchers to demonstrate the success of microgreens educational programming. Potential reasons for low response rates include survey fatigue, competing demands, and no incentives for response. Relying on survey answers also inherently limited conclusions due to response bias. All of the participants were Black women from the Ridge Ave, Allegheny Ave, and Huntington Park (RAH) neighborhoods. Finally, our surveys did not collect information on what long term health outcomes result from nutrition education outreach programs.

Future studies should repeat this approach with a larger sample size of participants with different backgrounds. Increased enrollment can be achieved through more community advertisements and compiling data from different education workshops conducted across the city. Techniques to optimize follow up in future workshops include pre-notifying participants about the post-survey, multiple follow-up reminder emails, and incentivizing responses with raffle prizes. A larger and more diverse sample size will help the researchers to adequately address the sustainability and positive health outcomes that result from utilizing microgreens long term and eliminate potential confounding factors. A crossover study could be conducted comparing pre-survey and post-survey answers from a control and microgreens treatment group. A logistic regression of the binary survey answers could then assess if microgreens significantly change nutrition attitudes.

CONCLUSION

Obesity and chronic diseases disproportionately affect lower-income Philadelphian communities and resultantly burden our healthcare system. Microgreens are a unique tool as they are a low-cost, transportable, and highly nutritious food source that is positively accepted in the community. Feedback from microgreens outreach events shows that microgreens are easy to grow, are suitable for communities with little space and cold winters, and gar-

ner interest in trying new vegetables and growing healthy foods. We aim to further use this method by adapting the nutrition presentation for different demographics in the Philadelphia area, and hope to expand our programming through microgreens cooking classes to further demonstrate how microgreens can be incorporated in an everyday diet.

The Drexel University College of Medicine IRB reviewed and approved this work under the Health Outreach Project (HOP) IRB.

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SUPPLEMENTAL FIGURES

Supplemental Figure 1: Microgreens Kit Assembly Protocol

2022 Protocol Microgreens Planting Sessions

Setup two stations: with at least two people at each station:

Soil Station (first-time instructors should start here)

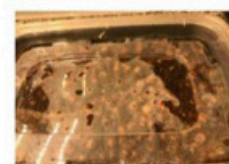
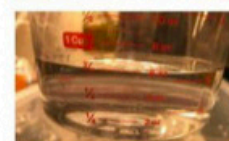
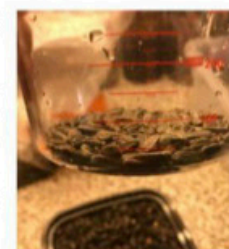
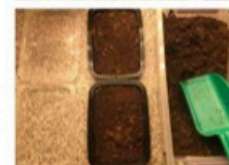
Seeds/Water Station (more senior folks should lead this part)

Soil Station:

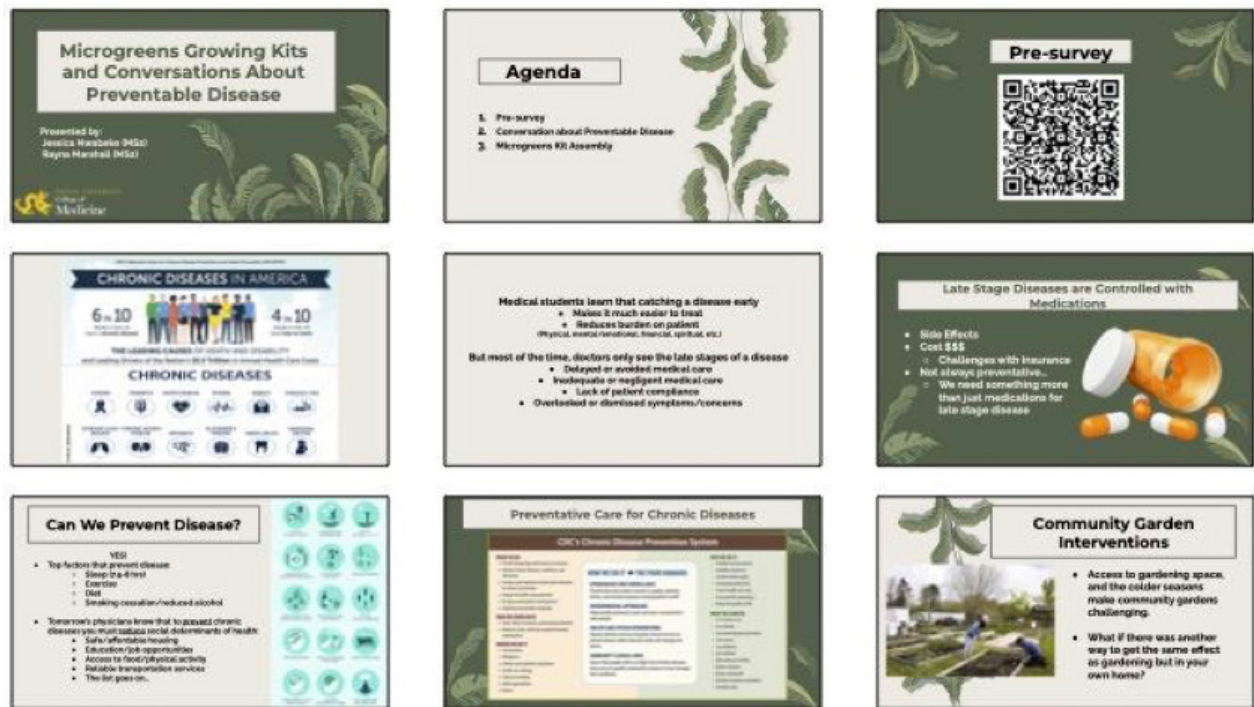
- Prepare:** Fill two plastic tubs with soil and hand-shovels
- Instruct/help:** Participants will use hand shovels to add soil to the grow kits until the soil presses against the plastic lid when it is flipped upside down and placed on top of the growing kit
- Explain** this amount of soil ensures that when the seeds are germinating during the first 48 hours, they feel pressure from the weighed-down lid and the seeds grow roots down

Seed/Water Station:

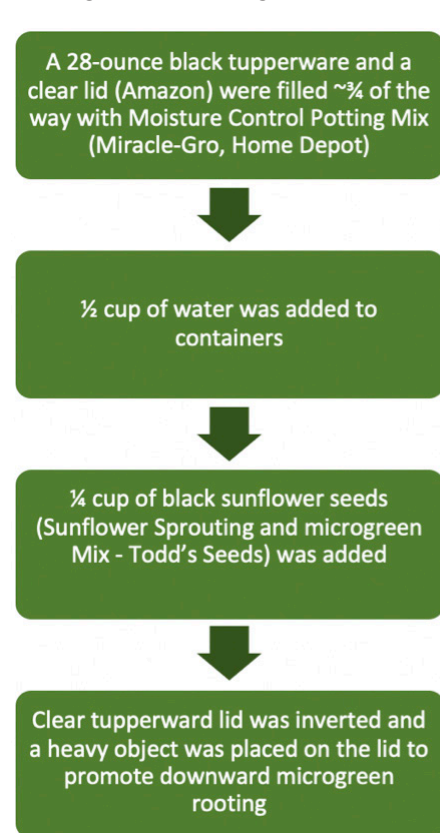
- Prepare:** Set out four measuring cups, and fill two plastic tubs half-way with tap/hose water
- Instruct/Help:** Measure between 50 and 100 mL of seeds (either sunflower or pea) using the measuring cups. Dip the second measuring cup into the tub of water and measure $\frac{3}{4}$ cup of water. Add the water to the seeds and stir with a finger or slosh-around for 10-20 seconds
- Explain:** The seeds need to be added to water first to help them germinate, but because we keep the soaking time brief, this reduces the risk of mold. On the note of mold, after the first 48 hours, the seed's rootlets can appear to look like mold. But it is not mold. If you really suspect mold, then exposing it to the light and fresh air should kill it off quickly as well.
- Instruct/Help:** Add seed+water mixture to the soil, trying to keep the distribution of seeds even across the tray, check to see that the lid pressed on the soil
- Explain:** The seeds need to be covered with a weight placed on top in a dark place for 2 days. After that, take off the lid and place the grow-kit in direct sunlight or near a light source for the next 3-4 days. After that, the microgreens can be harvested, washed, and used in recipes. To store them for later, simply place the grow-kit in the fridge (this prolongs the microgreens for at least 1 week)
- Provide:** Growing tips hand out paper and recipes



Supplemental Figure 2: Microgreens Nutrition Outreach Event PowerPoint



Supplemental Figure 3: Microgreens Growing Process



Supplemental Figure 4: Microgreens Home Care Guide Sheet

Supplemental Figure 5: Microgreens Recipe Book

