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MEASURING FOOD CONSUMPTION WITHIN A FOODRX PROGRAM

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A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

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Abstract

This pilot study set out to assess food consumption measures within the Charleston FoodRx program. Assessments made through this investigation aim to improve the Charleston program as well as provide suggestions for future programs. Charleston FoodRx provides enrolled households with fruits and vegetables in a supply intended to last for two weeks. These goals combine social and pharmaceutical science, by addressing barriers in food environment and insecurity, nutritional health, and preventative treatment. Though the idea behind FoodRx has existed prior to recent pilot programs, research behind FoodRx and its possible integration within the healthcare system lack published and replicable research for program design and sustainability. One such potential facilitator of efficacy in FoodRx is a measurement tool for food consumption within participant households. The development of an instrument for measuring food consumption could help create a system of operations within FoodRx to maximize effectiveness of intervention and aid in recreating FoodRx in other locations.

This study focuses on the implementation of food measurement tools within the FoodRx program and recommendations deduced from the findings. First is the unreliability of a food journal within FoodRx. The 24-hour recall was more effective in measuring food consumption for various factors. From the data collected on consumption, significant patterns are seen. Findings from this study offer some insight and recommendations for the operationalization of FoodRx. Further research could expand on findings from measurement data to demonstrate the applicability of FoodRx within healthcare.

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Introduction

The Charleston FoodRx program is a pilot study in Tallahatchie County, Mississippi. The focus of the FoodRx program entails an interdisciplinary approach to community health. Here, understandings of sociology and pharmacy intersect to form a health intervention which utilizes food as medicine. The program also addresses food insecurity within Charleston. In 2016, Tallahatchie County measured an obesity rate of 44% (County Health Rankings). Further, an estimated 29.5% of Charleston residents fall below the poverty level (ACS 2019 5 Year Estimate). The FoodRx adopts a method for addressing health risks related to these factors in a holistic, sustainable strategy for improving health of participants.

Participants interested in entering the FoodRx program are screened for food insecurity factors in order to determine eligibility. Through grant funding, orders for fresh produce are delivered to Charleston every two weeks. Food is distributed to the households enrolled in the program at no cost. Because the program is currently operating under grant funding, produce distribution is free for participants. However, to remain a sustainable program, participants in the future will be able to pay a low cost to continue receiving the produce needed for the health interventions.

The premise of the Charleston FoodRx program was adapted from previous pilot studies which had similar goals. Though the Charleston program was developed specifically for the community of interest, other programs with corresponding goals for health can be looked at for the validity in the programs mission and implementation. These include a program in Chicago which administered vouchers for discounts on food products with proven benefits in tackling chronic illnesses experienced by participants, such as diabetes (Goddu 2015). Another Food as Medicine program rather used community resources such as cooking classes and nutrition

education in presenting food as a form of medicine for participants with chronic illness (Nara 2019). Like these, the Charleston FoodRx program centers community based resources for implementing its health intervention. Upon entry to the program, participants are instructed to perform a routine blood test as well as determine their current bodily measurements. These are used as a reference point throughout the program to determine outcomes and efficacy of FoodRx.

FoodRx programs are relatively new and still in the beginning stages of implementation. As FoodRx grows, the need for a tool of measurement of household food consumption also grows. Measuring food consumption shows to be a vital resource in assessing nutrition, poverty, and general wellbeing in any population (Zezza 2017). Given the unique quality of the FoodRx program, a distinct tool for measuring food consumption within a FoodRx program was determined to be an area of special focus for the program. A tool for measuring food consumption would be essential for maximizing efficacy of the program in fund allocation, ability of replication, and in evaluation of the program. Because it would solely measure the consumption of the food distributed by the program, the necessity for a distinct tool is evident. This research discusses the process of creating and implementing an instrument for measuring food consumption within a FoodRx program, and the implications of this data.

Literature Review

The literature on FoodRx programs is limited. The evidence existing of FoodRx programs does show, however, the ways in which presenting food as medicine can be implemented to successfully create interventions for health outcomes. Findings range across fields of nutrition and sociology, from those related to community resilience to illness resistance (Nara 2019). Further, the literature suggests that FoodRx programs combined with other health literacy and nutritional education are especially effective in preventing and reducing chronic

illness and reports of illness for participants (Ogunmodede 2020). Emerging evidence about FoodRx points not only to the growing confidence in their efficacy for community health efforts, but also toward the need for more research about the best ways to implement and analyze data from the FoodRx programs.

While the efficacy of programs implementing food as medicine have been documented, tools of analysis related to food consumption for the programs have been less discussed. A widely used instrument for measuring food consumption in a FoodRx program has yet to be established. Further, considerations toward the household as the unit of analysis versus the individual are discussed. The literature reviewed here demonstrates understandings of food consumption by which different tools were chosen within the research process to formulate a tool for measuring food consumption within a FoodRx program. Literature reviewed also discusses the distinctiveness of FoodRx programs in their intersections of nutrition, culture, and society; and how these anomalous factors influence the need for a specific tool for food consumption measures for FoodRx programs.

Survey tools represent the standard methodology for household food consumption measures. There are three highly established methods of measuring food consumption trusted and implemented within the field of food consumption research. These include the 24 hour recall, food diary, and food frequency questionnaire methods (Crowe 2018). Each method demonstrates benefits for determining novel findings within research of food measures, but each cannot be implemented ubiquitously across research in food measures. The food frequency questionnaire (FFQ) proves to be effective in analyzing long term eating habits with a survey averaging between 80 to 120 questions (Johnson 2002, National Institute of Health Dietary Assessment Primer 2020). While the FFQ is effective in measuring long-term patterns of eating

habits at the individual level and is therefore highly useful in some food interventions, the FFQ survey methods could not be applied to the Charleston FoodRx program, as the food distribution occurs in two week intervals and alternates in produce variety. Further, the exhaustive nature of the FFQ in its extensive list of questions could be predicted to be burdensome on household participants, who would need to administer the survey to each member of the family. Due to these issues, the FFQ was determined to be incompatible with the consumption measure tool for the Charleston FoodRx program and could be considered incompatible for FoodRx programs at a larger level.

Food diaries and 24 hour recalls are the two other common methods for consumption measures, both of which were used within this program. The basic foundation for a food diary asks participants to fill out a survey of their food consumption throughout a designated reference period (Zezza 2017). Food diaries are beneficial in measuring food consumption across different situations as evidenced their low cost and relative convenience for diverse households. Drawbacks for the food diary include barriers related to illiteracy as well as risks of “survey exhaustion”, wherein repeated entries in the diary become burdensome for families (Beegle 2012). Based on the literature, the food diary method was determined a viable option to adapt for implementation into a measure of food consumption within the FoodRx program. This is due to the diary method’s ability to measure consumption at the household level as well as in a two-week reference period.

Last to be reviewed in the methods of food consumption measures applicable for the FoodRx program is the 24 hour recall. Largely, the 24 hour recall consists of an administrator asking the participant questions regarding the food consumption of the previous 24 hours. Benefits of the 24 hour recall method include its low cost and reliability when administered

under recommended guidelines. 24 hour recalls can be conducted in person or via phone calls with equal results in reporting, and the recall method is more accessible for low-income participants as it does not require reading or writing (Johnson 2002). Accessibility represents an essential factor within the FoodRx program, as all participants are admitted on the basis of their experience with food insecurity. Food insecurity affects low income and minority populations at disproportionate rates (Wolfsone and Leung 2020). The nature of the short recall period also demonstrates benefits for measuring food consumption in accuracy and low burden. Shorter recall periods, such as the 24 hour recall, have shown to be more resistant to memory loss in remembering food consumption (Zezza 2017). The 24 hour recall has also shown to be effective in determining relationships between food consumption and health outcomes, as well as lowered bias in self-reporting compared to diary methods (NIH 2020). Using the literature reviewed here, the 24 hour recall demonstrates that it is an appropriate measure in understanding food consumption of the FoodRx participants. This is related to the ability for the 24 hour recall to encapsulate the consumption of the household, the accuracy of reporting within a short reference period, and the accessibility of the recall for low-income households.

Methods

The investigation in implementing a tool to measure food consumption began by formulating and administering both food diaries and 24 hour recalls. This program grew in enrolled members throughout this study, which is reflected in the results. The study began with 16 households enrolled. The second and third sets of data were collected when the program had 23 enrolled households

To determine which method of measuring food consumption yielded higher responses, food diaries and 24 hour recalls were distributed to equal numbers of households enrolled in the program for the first two dates of data collection. On the first date, this totaled 8 households receiving food journals and 8 households administered recalls. For the second reference period, 11 households received food journals and 11 were administered recalls. Due to low reliability in food journal returns, the food journals were not administered on the third date for data collection. Instead, a group of randomly selected households were chosen in the third set to participate only in the 24-hour recall. The number of households chosen was 11, to attempt to keep the second and third reference periods constant in collection numbers.

Because of the nature of the FoodRx program, the food diaries used were developed specifically to be applicable for measuring food provided in the pickups. However, the format of the diaries followed guidelines from the National Institute of Health's profile in the Dietary Assessment Primer on considerations when implementing a food diary instrument. Food diaries were printed into physical copies and given to half of the households enrolled in the program. Participants given the food diaries were instructed to complete the diary and return the diary at the following food distribution. This reference period consisted of two weeks, with four entries over the span of the period. Food diaries contained tables including the food provided by the program, where participants hand wrote the amount of remaining produce corresponding to the date. Because the diary needed to measure the household consumption, participants answered how much of each food provided by the FoodRx program was remaining at the time of entry. For foods unable to be measured in whole amounts (i.e. peas, greens, berries), participants estimated how much of each food was remaining. These estimates were coded in the analysis of food

journals to translate to serving sizes. Participants who received journals also received periodic reminders over the reference period via text messages to both fill out and return journals at the following food distribution date. To limit burden on participants, the food journals only inquired about the amount of food remaining.

Figure 1: Food Journal Distribution and Return Rates, Dates 1 & 2.

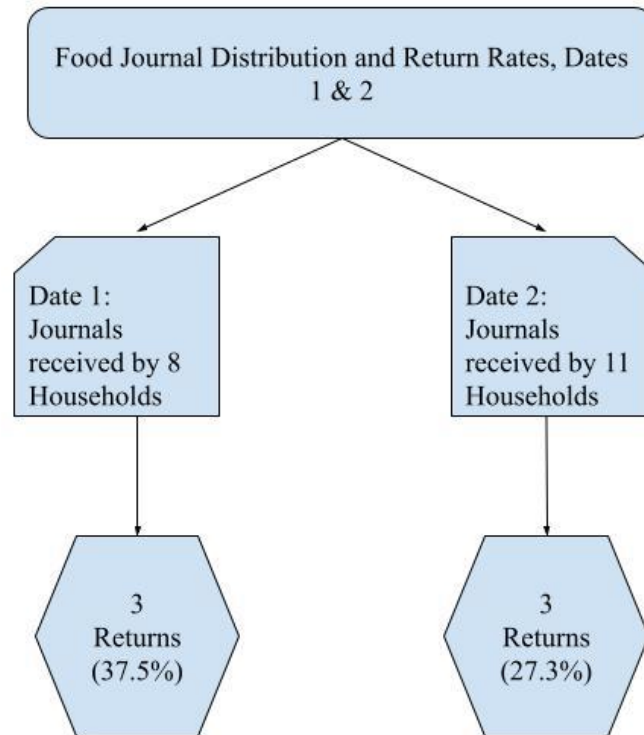


Figure 1 demonstrates the distribution of journals over the two weeks, as well as their return rates. On both the first and second date of returns, three households brought completed journals back to the distribution site. This gave a total of six returned journals for the data collection (37.5% response rate at week 1 and 27.3% response rate at week 2).

Journals entries of fruit and vegetable estimates were converted from remaining quantities into serving amounts. The average servings remaining for both fruits and vegetables was calculated for all households at week 1 and week 2, for both reference periods.

Figure 2: 24 Hour Recall Distributions and Response Rates, Dates 1, 2, & 3

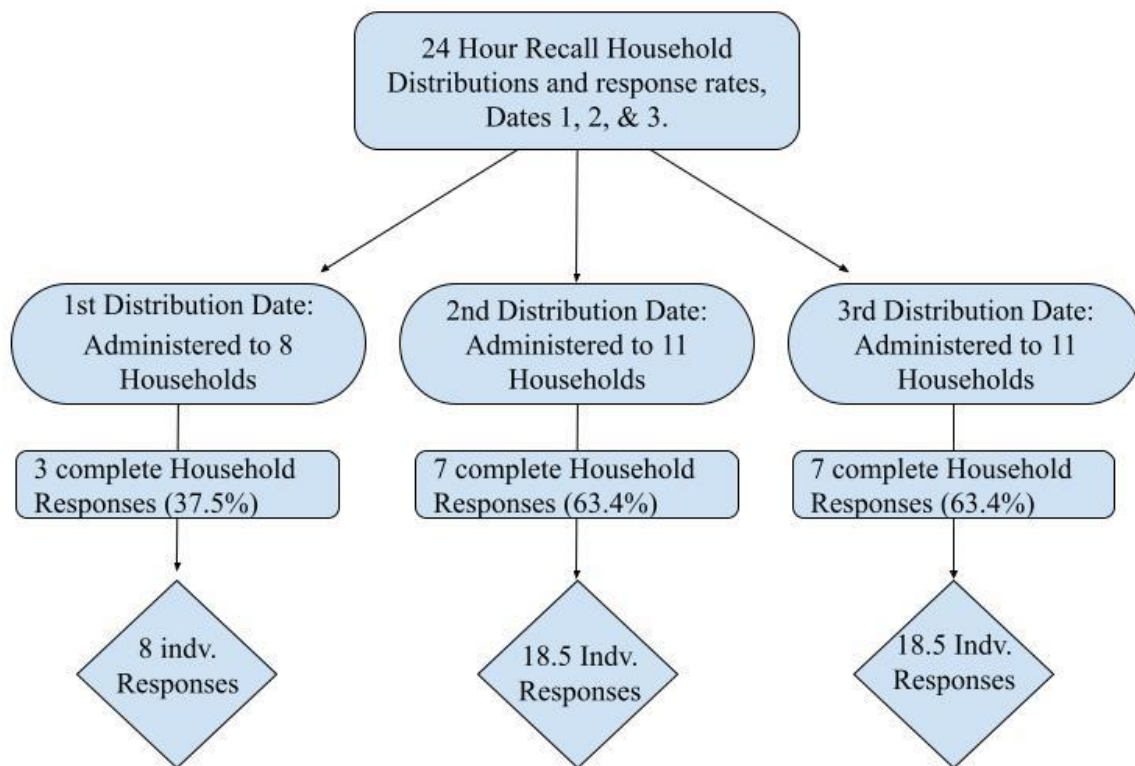


Figure 2 demonstrates the methods by which the 24-hour recalls were administered and their response rates. For each household, the number of individuals was calculated to determine serving size allotment per household. For Distribution 1, there were 3 complete recall responses. Complete recalls are considered 2 calls in contact with the household within the reference period. Within these three households, 8 total individuals are accounted for in the food allotment. The

same is true for date 2 and 3, with 18.5 individuals distributed throughout the 7 households reporting.

The 24-hour recall questionnaires were developed for the FoodRx program following guidelines from the National Institute of Health profile from the Dietary Assessment Primer. These considerations included the use of multiple recalls per person to assess habitual eating patterns in the household. Also following the NIH guidelines, recalls took place on both weekend days as well as weekdays, to account for nuance in eating patterns across various times.

Half of the participants completed phone administered 24 hour recall interviews. Phone interviews were conducted on Sundays, Mondays, or Tuesdays from 4-5:30 during the reference period, in order to allow for the most convenient time for participants. The 24 hour recall consisted of a survey method which aimed to determine how much of each food distributed to the participants was consumed in the previous 24 hour period. The recalls conducted with the FoodRx participants differed from the traditional 24 recall method, as they only sought to measure how much of the food provided by the program was consumed. Typically, the 24 hour recall consists of food consumption measures at the individual level, whereas the 24 hour recall conducted within this study investigated food consumption at the household level. Participants were instructed to indicate how much of each food was consumed within the household as a whole within the previous 24 hours. The interview consisted of naming each item and having participants recall how much of each was consumed. To limit burden on participants and center data collection specifically on program efficacy, recall questions only included consumption amounts of the food provided by the program.

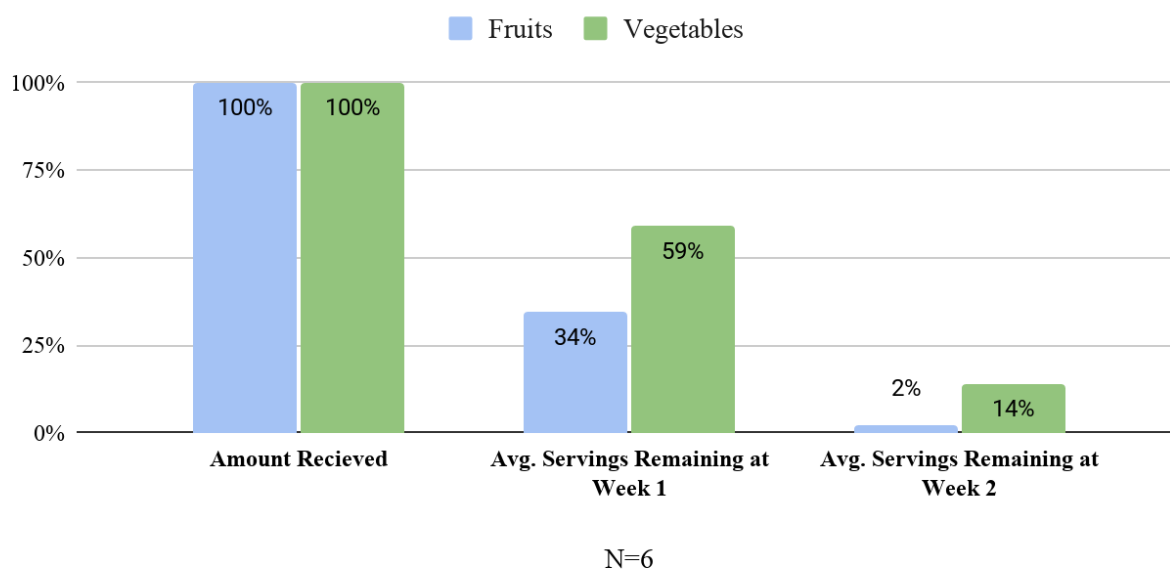
The first set of recalls yielded 3 households with complete recall data (N=8). Both the second and third sets of recalls yielded 7 households with complete recall data (N=18.5). These

sets of recalls each took place over periods of two weeks within a food distribution period, with one call each week. Quantities of food consumption reported by participants were coded from their responses into serving sizes. The average serving size per person of both fruits and vegetables was calculated for each date of distribution. For both the first and second recalls, the average servings consumed per person was calculated. For households with children, the allotment of food per child equaled 0.5% of the allotment for an adult. The sample size reflects children as 0.5 of an individual.

Results and Analysis

Figure 3: Food Journal Food Consumption, Average Household Percentage of Servings Remaining at 1 and 2 Weeks.

Food Journal Food Consumption, Average Household Percentage of Servings Remaining at 1 and 2 Weeks



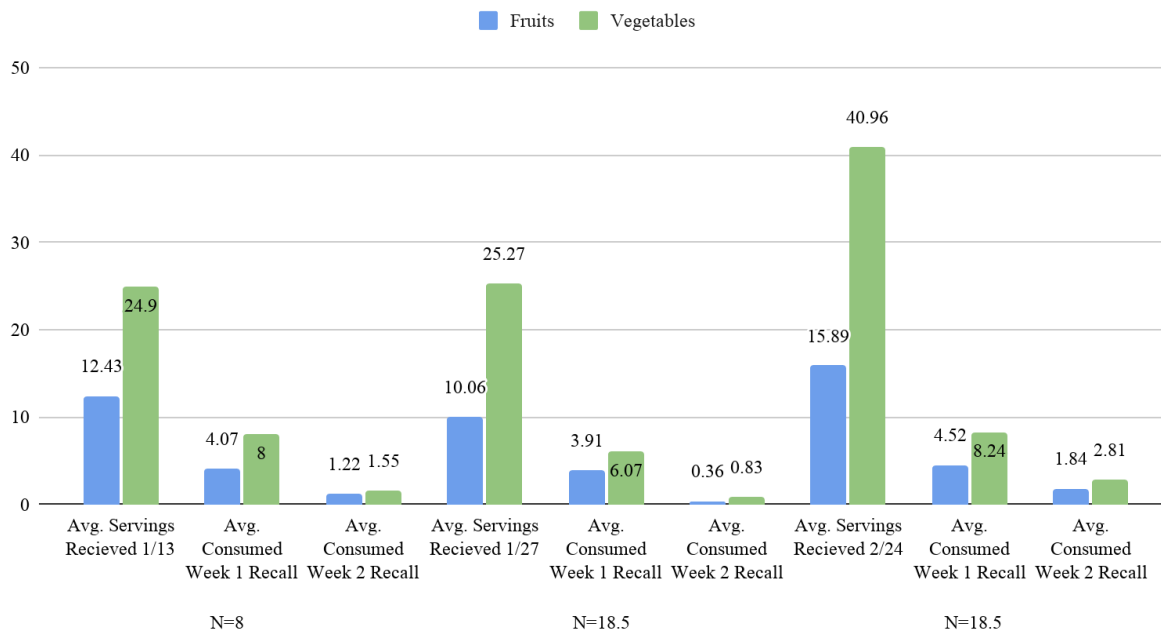
Data from household food journals are reflected in Figure 3. The journal distribution period took place over one month, with two reference periods of two weeks each. Sample size of returned journals totaled six household recordings. From the eight households provided with journals, three journals were returned on both the first date and second date for returns. This return rate equaled 37.5% at distribution 1 and 27.3% at distribution 2. Here, low reliability is evident with the journals. Despite reminders and attempts to limit burden on participants with minimal entries (4 per journal over 2 weeks) and food quantities given in estimates, the food journals showed to be a challenging method for measuring food consumption. This may also indicate that journal return rates do not increase over time, as the return rate declined over two separate reference periods.

The data from Figure 3 are limited; however, it offers some insight into food consumption patterns over the course of the two week reference period between food distributions. Here, consumption appears to sustain over the course of the two weeks. Though the average percentage of fruit remaining is lower than the 50% threshold at the week 1 mark (34% remaining), remaining vegetable servings appear to spread evenly throughout the period, with 59% and 14% average servings remaining per person, respectively.

Figure 4 represents the data collected from 24-hour recalls which took place over 2 months, with three reference periods of two weeks each. The figure shows the average quantity of servings provided per person at the food distribution, followed by the average quantity of servings consumed per person at the week 1 and week 2 mark. Recalls from the first reference period yielded 3 complete household responses (contact twice over the reference period), for a total sample size of 8. Recalls from both the second and third reference periods yielded 7 complete household responses, for a total sample size of 18.5.

Figure 4: 24-Hour Recall Food Consumption, Average Servings Per Person

24-Hour Recall Food Consumption, Average Servings Per Person



Shown in Figure 4, higher consumption is recorded within the first week of the reference period over all 3 periods. The recalls from week 1 of all three reference periods show an average of about 25% of the vegetables being consumed within just one day. Fruit consumption within the 24 hour recall period in combined week 1 values shows about 30.1% of allotted fruit servings being consumed within one day. Meanwhile, combined consumption of vegetables at week 2 shows an average serving consumption of only 5.3% in one day, and combined fruit consumption at about 8.7% of total serving consumption within one day. These stark drop offs in consumption between week 1 and week 2 indicate higher consumption within the first week of acquiring food items. This data show that consumption rates in participant households are not similar to a rate which would provide a sustainable, evenly dispersed consumption of fruits and vegetables over the two week period. A rate of 7.15% of servings consumed per person per day would allow households to provide fruits and vegetables to all members of the household at least once a day

for two weeks. These numbers reflect that high consumption within week 1 causes consumption to fall below the sustainable amount in week 2. Because of errors in self reporting, these numbers may not accurately represent exact values of household consumption or consumption at the individual level. However, trends of higher consumption within the first week can be understood as accurate based on the margin of difference between the two weeks within all 3 reference periods.

Discussion

Based on the data collected from both food journals and 24-hour recalls, some assumptions can be made in their applications in a FoodRx program. Though previous literature shows that food journals are effective methods of measuring food consumption, their application within this program was unsuccessful. Low reliability in returns of journals was evident, with less than one third of journals being returned at the instructed dates. Further, inconsistencies and blank responses found in some journals indicate that journals within a FoodRx program may not be as effective as other methods for measuring consumption. Based on the existing literature, high return rates were not an expectation due to the probability of exhaustion and low reliability (Beegle 2012). Journals were included based on the recommendation that different methods be principally implemented within an intervention to determine better performance (NIH).

24-hour recalls for measuring food consumption within the FoodRx program were more successful than food journals, though the data provided by participants may not be representative of consumption patterns for all households within this or other FoodRx programs. Unlike the food journals which required four separate entry dates, 24-hour recalls only occurred twice over the reference periods. Higher response rates were seen in the 24-hour recalls, with an average of

about 6 households between the three reference periods, compared to only 3 household returns with the food journals. Benefits of the 24-hour recall within the FoodRx program include the limited quantity of foods to be remembered by participants (only recalling what was consumed from the provided fruits and vegetables of the program), and the low effort in recalling serving sizes. Further, recall rates show an increase and retention rate over time. This may indicate that recall success may improve over time within a FoodRx program, as participants become more familiar with researchers in the program.

Challenges in both journals and recall methods can be addressed and improved upon in the context of a FoodRx program. For food journals with low return rates, the data collected in this investigation could offer some recommendations for challenges to returns. One significant challenge in food journals returns is the instructed time of collection. Participants who received journals were instructed to return the journals at the following food distribution, two weeks following the date that journals were given. Food distributions in the FoodRx program occur in the late afternoon, from 4-6:00 p.m. on Wednesdays. This indicates that participants are likely coming from work or other obligations to the distributions, rather than coming from home where the journal would predictably stay between weeks. The challenge in food journals is that in this case, participants would be required to remember to bring their food journal with them earlier in the day, likely before they leave for work, in order to have it returned at the designated time. This is an understandable barrier in return rates of journals. Participants may also have childcare and other responsibilities that prevents them from prioritizing the food journal. A solution which may help increase return rates of food journals in a FoodRx program would be the implementation of an online component of journal entries. Online food recording methods have shown to be accurate, easy, and effective ways for researchers to measure food consumption in other health

intervention programs (Hutchesson 2015). An online food record would allow FoodRx participants to complete their entries on their smartphones or computers, thus eliminating the need for journals to be returned physically. Participants could also easily estimate their remaining food quantities by choosing representative pictorial or numerical amounts for each fruit or vegetable. While this method could potentially increase return rates for participants with access to smartphones, computers, as well as internet access, the barriers to these resources must also be addressed as challenges for an online food journal system.

It should also be mentioned that the FoodRx program serves a majority of African American participants. Along with being a majority African American population, Charleston is also a largely rural, low-income area with barriers to a variety of health and social resources. The combination of these demographic and geographic factors present unique challenges on the population served by the FoodRx program, which should be addressed when attempting to implement an instrument for measuring food consumption. Research shows that many African-Americans lack trust in many medical and health professionals as a result of lived experiences within the healthcare system, and low-income populations disproportionately display hesitancy in reporting health conditions to professionals (Wolff 2003). Further, self efficacy in health related reporting and interventions appears to be a challenge for implementing programs designed to address community health. African Americans show lower rates of self efficacy than whites in nutritional health abilities (Pawlak 2009), which is significant within the context of this program. Self efficacy is a self rated metric, but indicates individual beliefs of ability in achieving a goal. Therefore, self efficacy in reporting food consumption within the FoodRx program may represent a barrier in food consumption measures.

There are a few suggestions to mitigate these culturally significant barriers to reporting on food consumption. A primary suggestion for improving response rate is with building relationships with participants to increase trust and minimize feelings of intrusion from researchers. Research shows that FoodRx programs benefit from efforts to form positive relationships between researchers and participants (Swartz 2018). Because the research period occurred in the midst of Covid-19, efforts to minimize contact between participants and program facilitators may have prevented relationships from forming between the groups. However, in future research, relationship building may take place with face to face interactions between the program and participants. This would include more in-depth explanations on how to fill out the food journals to build participants' confidence in reporting. Further, self efficacy in fruit and vegetable consumption can be addressed through potential teaching and educational experiences provided by the program. Research shows that educational experiences for healthy eating and nutrition aid in improving rates of self efficacy among low-income households (Overcash 2018). Periodic events to interact with participants and increase food preparation knowledge could show benefits for improving self efficacy in reporting food consumption measures.

From the data collected in this study of the Charleston FoodRx program, food consumption patterns were demonstrated from the methods of measuring food consumption. In both journal and recall methods, food consumption is significantly higher within the first week of acquiring fruits and vegetables from the program. As discussed in the results, this presents a challenge for the goals of the program, which aims to provide a sustainable supply of fruits and vegetables for the participants over the entire 2 week period between distributions. If households are consuming most of their provided food within the first week, as is displayed in the data from Figure 4, the food supply provided by the program cannot evenly disperse over the duration of

the two weeks. This may lead households to decrease their consumption of fruits and vegetables over the second week. Implications for the lack of sustainability of food distribution could include an increase after the first week in consumption of high fat, low nutrient foods readily available to food insecure households rather than fruit and vegetable supply.

Considerations for the FoodRx program for increasing longevity of food supply provided at distribution dates vary. One suggestion may be in increasing frozen food quantities in an effort to allow participants to consume food at even rates over the course of the two week period without fear of food waste from perishable produce. Frozen foods may be perceived as more difficult to prepare, but may prove as more sustainable in evening out food consumption. Another consideration is with participant food preferences. Households are able to indicate which fruits and vegetables, if any, they dislike or cannot eat due to dietary reasons (i.e. seed intolerance, allergies). This could have implications for consumption rates for households which do not receive certain produce in terms of essential nutrients needed by individuals in the household. In this case, households that do not receive specific products from a food distribution should be supplemented with produce that offers similar nutritional value, as to mitigate potential losses in consumption rates.

Conclusion

The Charleston FoodRx is a pilot study, and the findings from this study are not representative of all households within the program or of FoodRx programs in general. The data collected were sourced from a small portion of the current total household enrollment, and consumption data were measured over a short period of time. However, this data indicates specific trends which can be extrapolated more in future studies. The investigation on the tools used to measure food consumption also provides useful insights into potential future

implementations of food consumption measures. Data from this study show that food journals were unreliable measures with inconsistent participant provided responses. In future applications, though, FoodRx programs may implement an online or web-based tool for food journal methods. This could increase response rates and address challenges which prevent journal returns. Online based measures may be inaccessible for all populations, though, due to economic, rural, and age-related barriers for online based surveys.

The 24-hour recall proved more successful as a tool for measuring food consumption within this FoodRx program. Because of low effort from participants and calling at convenient times, participants responded more to the recall method. Because of higher rates of response, the recall method could be a better metric for measuring food consumption over a longer period of time. Potential lack of data on consumption is known immediately with recalls, as the researcher can instantly indicate whether the participant was reached via phone call. With journals, especially paper-printed journals, researchers have a two week potential loss period between distributions. This leads to the indication that paper-based food records are more unreliable metrics than 24-hour recalls.

Research on FoodRx programs is emergent in the field of community health and nutrition. Combining social science with pharmaceutical practice, these programs have the potential to become integrated into insurance practices and the healthcare system at large. This study provides a limited view into measuring food consumption within the FoodRx program, but with this data, further research could be conducted to demonstrate the usefulness of FoodRx programs for their implementation into healthcare. Providing preventative medicine in the form of food to communities lacking essential resources to health could prove to be a monumental change in the way healthcare operates.

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