

mHealth Strategy for Adult Primary Care Weight Management

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Abstract

Obesity contributes to higher healthcare costs and risk for disease. Obesity management is labor and resource intensive in the primary care setting, requiring patient education, reeducation, and frequent clinician assessment for comorbidities. Mobile health (mHealth) applications allow behavioral modification, though evidence suggests few applications (apps) on e-commerce platforms are grounded in theory or sustainable lifestyle change. Smartphone technologies are widely available, accepted by the public, and can encourage equitable care delivery. This quality improvement (QI) project created an online system for primary care providers (PCP) to offer adult females seeking clinically assisted weight management at a women's primary care clinic. The PCP performed the initial patient evaluation for weight management and offered the system's brochure with detailed instructions for viewing the system's quick response codes (QR codes) linked to online materials via a personal smartphone or tablet. A post-intervention questionnaire was thematically coded and assessed by context analysis to determine the impacts of a mHealth program on streamlining care delivery. The program had modest utilization but was received favorably by the provider, staff, and patients.

Keywords: mobile application; weight management; streamline; primary care; Chronic Care Model; obesity

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Obesity results from the accumulation of excessive adipose tissue and poses significant increases in morbidity and mortality (World Health Organization, n.d.), resulting from increased risk of cardiovascular disease, stroke, Type 2 diabetes, asthma, hypertension, multiple cancers, and chronic disease (Cawley et al., 2021; Coughlin et al., 2015; Hales et al., 2020). Adult obesity is determined by screening an individual for body composition, and their body mass index (BMI) is calculated using their height compared to weight (Centers for Disease Control and Prevention (CDC), 2021a). BMI is calculated by dividing body weight in kilograms by the height in meters squared (CDC, 2021b). Health care providers use BMI calculations with dietary history, levels of physical activity, and family history to determine individual health status and risk for disease (CDC, 2021b). Overweight BMI levels are 25.0 to < 30 kg/m² (CDC, 2021a). A BMI of 30 or greater is diagnostic of obesity and is divided into three subclassifications (CDC, 2021a). Class 1 obesity is a BMI from 30 to < 35 kg/m² (CDC, 2021a). Class 2 obesity is a BMI from 35 to < 40 kg/m² (CDC, 2021a). A 40 kg/m² or greater BMI is Class 3 obesity, or severe obesity (CDC, 2021a). By 2016, 1.9 billion adults worldwide were overweight, and 650 million met the criteria for obesity (WHO, n.d.). Obesity prevalence in the United States was 42.4% by 2018 (Hales et al., 2020). Obesity increases the financial burden on the health care system, taxpayers, the community, and the individual, with costs rising proportionately with higher BMI levels (Cawley et al., 2021; Hong et al., 2019; Li et al., 2015; Wang et al., 2011).

Adults with obesity have higher medical costs than normal weight individuals, with medical care expenditures increasing 3-fold with each obesity subcategory (Cawley et al., 2021; Su et al., 2015). Direct medical costs for obesity management are six times higher than overweight expenses, but variations are relative to levels of health care utilization, availability of treatment, service costs, and prevalence of obesity within the context of the health care system (Cawley et al., 2021; Su et al., 2015). Aggregate expenses associated with overweight and obesity care doubled between 2001 and 2016, increasing from \$124 billion annually to over \$260 billion (Cawley et al., 2021; Agency for Healthcare Research and Quality (AHRQ), 2019). Patient out-of-pocket costs related to obesity were \$20 billion in 2016 (Cawley

et al., 2021; AHRQ, 2019). Patients that are overweight or obese incurred higher expenditures in all medical categories, including ambulatory care, prescription drugs, public and private health insurance expenses, and inpatient services (Cawley et al., 2021, AHRQ, 2019).

Patients frequently seek help for obesity management in the primary care setting (Rozenblum et al., 2019). Deficient insurance coverage coupled with limited treatment availability, including weight loss surgeries and pharmacological management, leaves patients shouldering most out-of-pocket care expenses (Chaudhari et al., 2013; Sharpe et al., 2017). Weight management therapies can be costly with low efficacy while overlooking the behavioral complexities that contribute to obesity (McKinsey Government Report, 2014; Sharpe et al., 2017). Clinical modalities must acknowledge individual motivational practices, biological factors, and demographical aspects that contribute to eating behaviors (Lench et al., 2011; Sharpe et al., 2017). High dietary, pharmacological, and behavioral treatment failure rates occur (Ogden et al., 2007). Maintenance of lost weight proves problematic long-term (Ogden et al., 2007), but small amounts of weight loss can result in considerable health benefits (Ogden et al., 2007; Rozenblum et al., 2019). Rates of successful weight loss vary significantly, with many regaining some of their weight within a year and most returning to baseline weight in three to five years (Dansinger et al., 2007; Katan, 2009; Sharpe et al., 2017).

Theoretical Framework

Acute conditions, such as illness or infection, can be managed by face-to-face clinical instruction and a short-term treatment plan provided by the clinician (Barlow, 2007). Weight management cannot be addressed in short-term treatment (Barlow, 2007). Traditional approaches do not address the complexities of obesity or the associated sequela of comorbidities, which requires continued patient education and reinstruction of self-management (Barlow, 2007). The Chronic Care Model (CCM), formulated by Wagner, can be used to synthesize evidence-based changes into disease management and quality improvement (Jacobson & Gance-Cleveland, 2010; Wagner, 1998). The CCM as a framework for this QI project incorporates the perspectives of patient self-management and complexities of obesity care through clinical-based weight loss supervision as these systems exist within the context of the medical system, the

patient's environment, social milieu, and care delivery methods (Dietz et al., 2015). Care delivery must reflect supportive changes that foster patient self-management and disease prevention as principal outcomes (Dietz et al., 2007; Dietz et al., 2015). The development of a supportive, collaborative patient-provider relationship encourages collaborative communication and may facilitate healthier behaviors (Jacobson & Gance-Cleveland, 2010). Clinicians must promote patient-centered care and help patients identify the motivation needed for changing unhealthy behaviors (Barlow, 2007). The CCM framework encourages quality improvement through enhanced clinical decision support and promotion of patient-centered self-management in the context of the care delivery system and available community resources (Barlow, 2007; Cygan et al., 2018; Jacobson & Gance-Cleveland, 2010). Development of the materials within "The Healthy Living Series" was a straightforward method for treating obesity and briefly addressed its associated chronic diseases, bridging possible gaps in care (Dietz et al., 2015).

Review of Literature

PCPs are uniquely positioned to treat obesity at the community and individual level by tackling broader aspects of determinants of health through approaches that address physical, mental, and socioeconomic factors impacting comprehensive health (Canuto et al., 2020; Rozenblum et al., 2019). Prevention is the primary treatment for overweight and obesity (Garvey et al., 2016). Once a patient has gained weight, the provider should seek secondary prevention through screening for obesity and instituting treatment goals that slow the progression of further weight gain, encourage weight loss, and prevent complications and comorbidities (Garvey et al., 2016). Tertiary preventative approaches for obese patients include weight loss through intensive lifestyle and behavioral modifications plus weight loss medications, surgical considerations, and weight loss therapies to prevent the progression of disease and comorbidities (Garvey et al., 2016).

Smartphone technologies encourage equitable care through a multitude of applications available across e-commerce platforms though few are grounded in theory or sustain long-term behavioral change, resulting in PCP reluctance to recommend mobile health apps (Coughlin et al., 2015). Participants may benefit from the mHealth app's interactive processes, goal setting, and health awareness leading to

improved physical activity (Casey et al., 2014; Fanning et al., 2012; Walsh et al., 2016). Smartphone apps can be low-cost alternatives to labor and resource-intensive PCP-guided weight management counseling (Coughlin et al., 2015). Digital technology provides effective health behavioral transformation through easily accessible guidance, support, and dissemination of information (Alkhaldi et al., 2015). Mobile device applications tailored to specific populations may facilitate lifestyle changes that contribute to health benefits (Recio-Rodriguez et al., 2016).

The technology of quick response codes (QR codes) has existed since 1994 (Denso Wave Incorporated, n.d.; Hung et al., 2020). The ongoing coronavirus pandemic in 2020-2022 pushed QR codes into mainstream usage as restaurants and businesses sought touch-free solutions to distribute menus and informational materials (Kelleher, 2020). QR codes are easily linked to portable document format (PDF) files, website uniform resource locators (URL), and pay-for-purchase platforms (PayPal, Google Pay, Apple Pay, Samsung Pay) and scanned for access using a personal mobile device's built-in camera (Kelleher, 2020). QR code formats are accessible on multiple mobile operating systems (OS), including Android-enabled platforms and Apple iOS (Kelleher, 2020).

Despite the increase in smartphone ownership and volume of weight management trackers readily accessible on app stores (Android, Google Play, Apple's App Store), PCPs have yet to embrace mobile technology for weight management because of concerns that few apps are tested for their quality of health promotion or contain evidence-based features (Coughlin et al., 2015). Common weight control apps focus on healthy eating goals, self-management with reward feedback, and weight, dietary, caloric, and macronutrient tracking, though few are based on health behavior theories (Azar et al., 2013; Coughlin et al., 2015; Wearing et al., 2014). Novel mobile health (mHealth) apps on electronic devices offer opportunities to facilitate healthier patient self-management behaviors in setting goals by using positive feedback mechanisms of rewards and encourage more provider engagement with ordered health interventions (Rabin & Bock, 2011; Walsh et al., 2016). Prior studies have demonstrated the facilitation of positive behavioral change in participants through a mHealth app's interactive processes, goal setting, and health awareness, leading to improve physical activity (Casey et al., 2014; Fanning et al., 2012;

Walsh et al., 2016). In weight management, mHealth apps are low-cost alternatives to labor and resource-intensive face-to-face weight loss programs (Coughlin et al., 2015). Patients preferred mobile phone health apps that increased their weight management awareness and food intake (Coughlin et al., 2015). More significant weight loss and self-regulated adherence were demonstrated with the use of technology-supported mobile health (mHealth) applications (app) over self-guided weight loss and traditional in-person weight counseling alone (Spring et al., 2017). A significant increase in physical activity occurred in young adults using mobile phone apps for goal tracking, counting steps, and self-monitoring (Walsh et al., 2016). Exercise behaviors were positively influenced by participation in a mHealth app (Casey et al., 2014). Participants conveyed positive attitudes toward using online weight management programs (Rozenblum et al., 2019). Participants lost more weight when given intervention-specific weight-loss counseling, text messaging, interactive calls, and provider monitoring over broad weight treatment in a primary care-based weight program (McVay et al., 2019).

Purpose of the Project

A novel QI system-based project was developed as an online program for primary care providers to streamline the initial consultation with adult females pursuing clinician-assisted weight management in the primary care setting. The *Healthy Living Series* utilized evidence-based guidance in easy-to-follow video formats and encouraged equitable care that was accessible at the patient's convenience via the internet-based streaming platform, YouTube. The project's online materials were personalized toward its intended audience. The information contained in the program was predominately gender-neutral, though the program's visuals tended toward the women's health perspective.

Material and Methods

This project was approved by the Institutional Review Board (IRB) at Lenoir-Rhyne University in Hickory, North Carolina, through expedited review. Informed consent was not required for this QI project. HIPAA standards were followed to ensure that any confidential health information was protected.

This 16-week quality improvement (QI) project was designed by a Doctor of Nursing (DNP) student and implemented by a family nurse practitioner (FNP) in a rural primary women's health clinic in

western North Carolina. The stakeholders of the clinic include the provider, three medical assistants, and one office receptionist, whom all interface with the patients. As requested, the provider and medical assistants performing direct patient care and management were offered access to the program's creator's YouTube account for data monitoring.

This pilot program begins the weight conversation without being a burden on the provider. *The Healthy Living Series* incorporates information from community resources, including evidence-based literature and guidelines from the CDC, American Psychological Association (APA), Healthy People 2020, US Department of Agriculture's *MyPlate* (USDA), US Department of Health and Human Resources Dietary Guidelines (DGA), and obesity specialists from the New England Journal of Medicine and Journal of the American Medical Association in easy-to-follow instructions for healthy eating, increasing physical activity, and stress management. Viewing times of the videos run approximately three to four minutes each, or 11 minutes total. QR codes were generated that direct patients to YouTube-hosted URL addresses of the videos. The PCP and staff were trained on the program's objectives and use of the program. A written copy of these instructions was left at the clinic for reference. Brochures with the QR codes were professionally printed and distributed by the participating clinic's PCP and staff to female patients seeking clinical weight management. Costs of the materials were covered by the primary investigator (PI) and provided to the clinic at no charge. Recipients of the brochures did not incur additional costs over their provider service fees to participate in this novel program. Only costs to brochure recipients pertained to their existing personal mobile device cellular or internet provider fees, as applicable, when accessing the internet outside of the clinic's WiFi coverage. This program did not address data regarding recipient fees or cellular providers.

For project consideration, usability and sustainability focused on a patient-facing design. Brochure distribution occurred for 16 weeks. YouTube Analytics tracked the viewership of the videos. Views were monitored, assessed for participation in the program, and compared to counts of distributed brochures. Reeducation of staff on the usage of the program was given periodically to improve recipient

utilization. At program completion, brochures were counted by the PI and returned to the clinic for continued use of the program.

Measures and Data Analysis

The clinic uses third-party electronic medical records (EMR), which cannot be altered for the use of the project. The PI did not have access to patient charts during the program. A paper-based spreadsheet was created to document the dates the brochures were distributed and the patient's age receiving the brochure. The program's criteria did not assess race, ethnicity, and socioeconomic status. The clinic staff maintained the spreadsheets in the clinic during program implementation in a discrete folder. The spreadsheets were reviewed periodically and collected at program completion by the PI. The brochure count was gathered and compared to the spreadsheet count. Discrepancies in brochure count and data collection were corrected through record review with the clinic's receptionist. The post-intervention surveys were distributed after program implementation. Answers to the questionnaire were coded for thematic analysis (*Table 2*). YouTube Analytics tracked video views, viewer retention times, the average duration of views, and percentages of the videos viewed. The spreadsheets and post-intervention surveys will be kept for three years by the PI. YouTube Analytics will continue to gather new views since the program remains in use by the clinic.

Results

Quantitative Data

The clinical staff distributed twenty-eight program brochures. Recipients were all female with a maximum age of 64, the median age of 48, and minimum age of 32 (Figure 1). October saw the most variation in age (Figure 2). The "Healthy Living Series" channel had 13 total unique views during the program's implementation. The highest YouTube viewership occurred in November, with nine total views. October was second in viewership with two total views. December and January had one view each, respectively. Per YouTube's policies, a meaningful view is a minimum of 30 seconds or longer. Only non-repeat or unique views were addressed (Table 1).

The introductory video "Healthy Eating" received five total views with an average duration of one minute and nine seconds, and 25.8% of the video was viewed (Table 1). Audience retention view duration averaged one minute, 18 seconds, and decreased to 46% at the 30-second mark, with five unique viewers on five separate days watching beyond 30 seconds. Audience retention decreased again at two minutes, nine seconds into the video. Relative audience retention peaked at one minute, 18 seconds. The second video in the series, "Mind Over Food Matters," received four total views with an average duration of one minute, one second, and 25.2% of the video viewed (Table 1). Audience retention view duration averaged one minute, six seconds, and decreased to 18.2% at 30 seconds, with four unique viewers on four separate days watching beyond 30 seconds. Viewer retention remained between 18-27% until two minutes and 33 seconds into the video when it increased to 36%. Relative audience retention peaked at two minutes, 35 seconds. The final video, "Let's Get Moving!" garnered four total views with an average duration of viewership of one minute, one second, and 25.2% video viewed (Table 1). Audience retention view duration decreased to 42% at 30 seconds, with four unique viewers on four separate days watching beyond 30 seconds. The average view duration was 50 seconds, with 29.9% of the video viewed. Relative audience retention peaked at one minute and 55 seconds. Eight viewers used Android devices. Five viewers used Apple IOS devices.

Qualitative Data

After the program, a voluntary five-question survey was distributed to the participating clinician and clinic staff that utilized the program (Table 2). Answers were analyzed and scored thematically. Returned responses included the clinic's *primary care provider* (1), *one nurse practitioner student* (2), *two medical assistants* (CMA, 3; MA, 4), and *one receptionist* (5). Experience with primary care weight counseling varied from expertise to novice level knowledge, with the PCP having the most experience and the receptionist having the least with direct patient counseling (Table 2). A dichotomous theme was evident when asked about what the providers and staff enjoy least about weight management. The staff focused on drawbacks of the system regarding the process of weight counseling, while the PCP and NP student expressed empathy for patients experiencing discouragement and marginalization.

“...seeing patients get discouraged when they don't see what they perceive to be fast enough results in spite of counseling.” (1)

“...some patients may feel as though they are being marginalized or that the diet counseling is only being provided because of their weight.” (2)

“People don't want to listen. They think the medication should drop the pounds!” (3)

“...when people show up without an appointment.” (5)

All participants responded positively regarding the "Healthy Living Series" program for its ease of use, visual presentation of information, and novel approach to knowledge and resource dissemination. As for program improvements, the PCP expressed concern about low recipient utilization. Recipients had reported to the staff and provider viewing the program's materials; however, data from YouTube Analytics do not support recipient claims. The NP student suggested implementation during wellness visits. One MA (4) found the program “a little time consuming,” and the other (3) wanted stricter rules and patient requirements of record keeping before acquiring prescriptions for weight loss medications. All participants stated that the program was well received within the clinic and by recipients.

Discussion

The stigma of obesity requires a care delivery model that incorporates clinical and community systems into health equity (Dietz et al., 2015). All recipients received the same patient-centered resources to encourage equitable care that is safe, effective, efficient, and timely according to AHRQ's (2018) six domains of quality assessment. Behavioral changes are required to maintain desired improvements in dietary habits and physical activity levels, which are byproducts of the individual's decision making, provider involvement, and patient social milieu that allows for healthier choices (Dietz et al., 2015). Providers should examine their biases toward obesity and address patients appropriately to reduce the appearance of stigmas that can negatively impact care delivery quality (Dietz et al., 2015). The provider should inquire about available community resources the patient can utilize safely, food insecurities, and

address any health disparities and inequities that could decrease the patient's likelihood of successful weight control and self-management (Dietz et al., 2015). Without resources for healthy food and safe spaces for physical activity, it is unlikely that the patient can succeed with desired or sustainable weight loss (Dietz et al., 2015).

Free weight loss management interventions may increase widespread participation in weight programs (Ahern et al., 2016). The use of smartphone technology as a tool to disseminate health information within the clinical setting has the potential to ameliorate barriers to care for general and at-risk populations (Coughlin et al., 2015). The benefits of smartphone and mHealth integration continue to gain acceptance in the health care community (Recio-Rodriguez et al., 2016), but further research is needed to examine the effectiveness of smartphone interventions (Coughlin et al., 2015). This project noted the modest supportive data and low utilization for mHealth platforms and similar prior studies.

Conclusion

The prevalence of obesity and its associated comorbidities continue to rise globally in the US. Overweight and obese individuals have higher health care costs and resource utilization throughout their lifetime. Patients often turn to primary care providers for weight-loss interventions. This study demonstrated low treatment adherence considering its small population size. Other mHealth application studies have described modest benefits for weight management. Further development of this and other mHealth tools should focus on patient engagement and audience retention to increase efficacy within patient populations and provide more significant benefits in the primary care setting.

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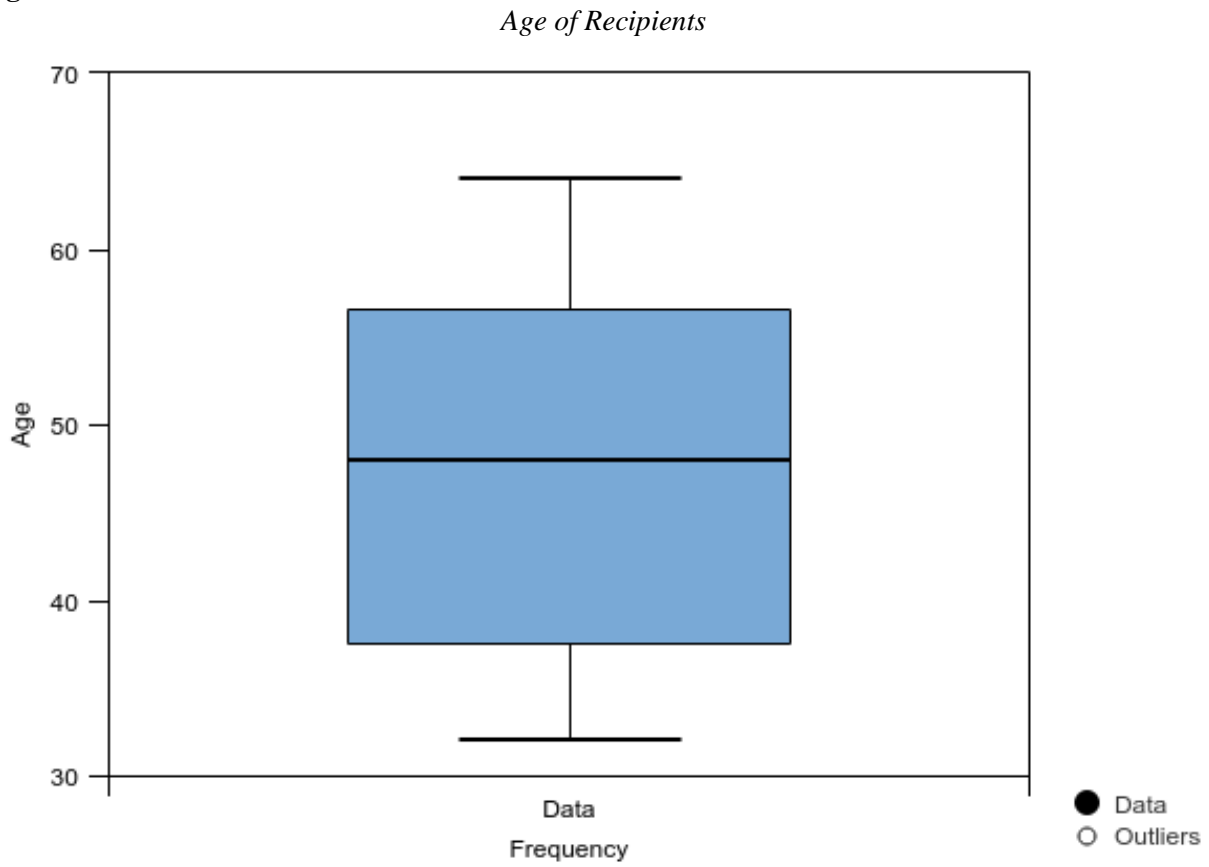
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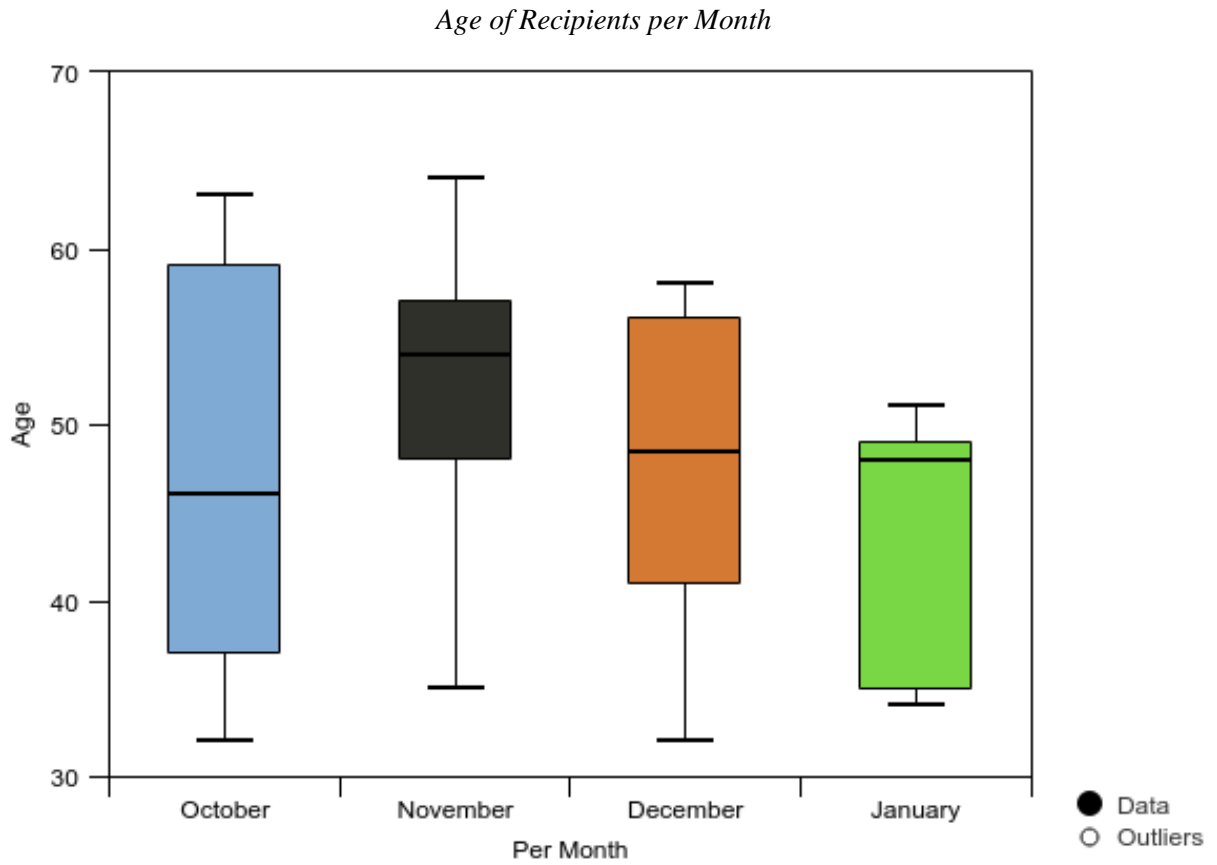
Figure 1



Source: Intellectus Statistics.

Note: Age of recipients, all were females with a maximum age of 64, median age of 48, and minimum age of 32.

Figure 2



Source: Intellectus Statistics.

Note: Age of recipients, by month.

Table 1: Views

| Video | Unique Viewers | Average View Duration | Percent Viewed | Audience Retention at 30 secs | Relative Retention Peak (time) |
|------------------------|-----------------------|------------------------------|-----------------------|--------------------------------------|---------------------------------------|
| Healthy Eating | 5 | 1:09 | 25.8% | 46% | 1:18 |
| Mind Over Food Matters | 4 | 1:01 | 25.2% | 18.2% | 2:35 |
| Let's Get Moving! | 4 | 0:50 | 29.9% | 42% | 1:55 |
| Total | 13 | 1:00(av.) | 26.97%(av.) | 35.4%(av.) | 1:56(av.) |

Source: YouTube Analytics

Note: Unique views, categorized in average view duration, percentage of the video viewed, audience retention at the 30 seconds mark, and relative retention peak time.

Table 2: Frequency of Themes

| | | <i>n=5</i> | <i>Participant #</i> |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------|----------------------|
| Q1 | <i>Provide details about your experiences providing clinic-based weight counseling.</i> | | |
| | Expertise | 1 | 1 |
| | Basic Experience | 3 | 2, 3, 4 |
| | Novice | 1 | 5 |
| Q2 | <i>Tell me what you like least about providing in-person weight counseling.</i> | | |
| | Negative Process | 2 | 3, 5 |
| | Empathy | 2 | 1, 2 |
| | Neutral | 1 | 4 |
| Q3 | <i>Can you tell me what you enjoyed about this project?</i> | | |
| | Ease of Use | 1 | 1 |
| | Visual Presentation | 1 | 1 |
| | Resource Utilization | 3 | 1, 2, 5 |
| | Recipient Success | 1 | 4 |
| | Working with PI | 1 | 3 |
| Q4 | <i>What are aspects about the project you would change or do differently?</i> | | |
| | Low Recipient Utilization | 1 | 1 |
| | Timing of Implementation | 1 | 2 |
| | Time Consuming | 1 | 4 |
| | Stricter Criteria | 1 | 3 |
| | Satisfaction with Current Program | 1 | 5 |
| Q5 | <i>Describe how the project was received in the clinic.</i> | | |
| | Well Received | 5 | 1, 2, 3, 5 |
| | Low Recipient Participation | 1 | 4 |
| Distributed 1/31/22, responses for thematic synthesis obtained by 2/24/22 | | | |

Note: Post-Intervention survey questions with answers coded for thematic analysis.