Recruitment strategies for a post cessation weight management trial: A comparison of strategy cost-effectiveness and sample diversity

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ABSTRACT

Background: Effective recruitment of representative and diverse samples in research trials is important to the generalizability of findings and in describing access to behavioral interventions. The current study evaluated the effectiveness of local and national recruitment strategies for a smoking cessation and weight management-focused randomized controlled trial (Fit & Quit). The overall cost-effectiveness of recruitment strategies was also evaluated.

Methods: The study initially recruited participants locally in the Memphis, TN area and later transitioned to national recruitment, necessitated by the transition to remote assessment strategies due to the COVID-19 pandemic. The study evaluated effective recruitment strategies for randomized participants (n = 305) across gender, race, rurality, and recruitment method, as well as the cost-effectiveness of methods used during the recruitment period of this study.

Results: The most effective recruitment strategies were local postcards, local radio advertisements, word-of-mouth referrals, and national internet advertisements, which resulted in a combined 71.8% (n = 219) of the total randomized sample (n = 305). Radio advertisements were the best method for recruiting Black participants. Electronic recruitment strategies were the most effective method for non-urban participants. Additionally, gender, recruitment method, race, and rurality predicted randomization. Overall, electronic media methods were more cost-effective ($430.97 per participant) compared to traditional media methods ($931.43 per participant); however, traditional media methods resulted in a greater number of recruited and randomized participants.

Conclusion: Results provide information on effective and cost-effective local and national recruitment methods for recruiting underrepresented groups of participants in behavioral clinical intervention studies.

1. Background

The process of recruitment-to-randomization is crucial to human subjects research. Typically, researchers use various electronic, or online, (e.g., social media advertisements on platforms such as Twitter, Facebook, web promotions including the Google Adwords system, and emails) and traditional offline (e.g., flyers or posters, word of mouth, telephone calls, television advertisements, newspaper, radio, or magazine advertisements) recruitment methods for behavioral intervention trials [1,2]. Similarly, it is a common research reporting practice for researchers to briefly describe recruitment strategies used in the description of the sample. However, few studies examine the effectiveness of different strategies for recruiting research participants in addition to the cost-effectiveness associated with these strategies [1,3,4]. This information is vital for researchers recruiting for behavioral intervention studies to effectively reach a more diverse sample of prospective participants.

A few smoking cessation-related studies reported on the effectiveness of different types of recruitment strategies. One study [1] found that online advertisements (i.e., Google Adwords system) and offline materials (e.g., posters, business cards, newsletters) were effective in recruiting individuals that smoke, with these strategies averaging...
interest and responses from potential participants, eligibility criteria, were recruited through online strategies, such as social media advertisements, internet advertisements, and email listservs to business and health service directories. Most participants in this study were recruited through Facebook advertisements (84%), costing an estimated $42 per participant recruited. Other researchers successfully recruited participants through more traditional off-line methods; for example, King and colleagues recruited 49% of participants for a smoking cessation intervention through public transportation advertisements, 17% by traditional media advertisements (e.g., newspaper, TV, or radio), and 15% from word-of-mouth referrals, but cost-effectiveness was not reported in this study.

Recruitment strategies used for weight management interventions have also been explored. A recent study examining the effectiveness of recruitment strategies for young women to a weight management program found that participants preferred being informed of the study via word of mouth, advertising in locations where issues with weight are typically discussed (e.g., doctors’ offices, community health centers), and through online methods in comparison to newspaper and magazine advertising and flyers posted in public spaces. A similar study evaluating the effectiveness of recruitment strategies for young women to a weight management trial found that 36% of the participants were recruited via flyers posted on university campuses, 26% via advertisements on health service intranets, and 16% via advertisements in local and metropolitan newspapers, which together cost approximately $26 per participant. Griffin and colleagues found that the least cost-effective strategies involved paid advertising methods, including local newspaper advertisements, local health websites, and letters to local residents. Watson et al. explored traditional, web-based, and online survey panel recruitment methods. They found that the majority of participants were recruited through Facebook (49%), costing $40.51 per participant. The survey panel recruited 21% of participants and was least expensive ($13.95 per participant). Google advertisements were one of the most expensive methods used in this study ($34.71 per participant), yet recruited the fewest participants (3%). These results mirror those of other studies in which Facebook and Google advertisements were the most expensive and recruited the fewest people; notably, recruitment through all forms of electronic media incurred the lowest cost per participant ($26.76) compared to recruitment through all print media ($154.78). A systematic review of recruitment strategies for weight management programs concluded that although television and radio advertisements reach the most prospective participants, they are more costly and inefficient compared to mass-mailings which tend to cost less and recruit more participants. Further, they concluded that marketing strategies involving promotion and branding may be a promising approach, and monetary incentives for study participation tended to enhance recruitment. Together, these findings indicate that the best methods for recruiting participants efficiently and cost-effectively to weight management studies remain unclear.

Similarly, the process from recruitment-to-randomization can be complicated by the effectiveness of recruitment strategies in generating interest and responses from potential participants, eligibility criteria, and factors such as participant time availability, transportation to the study site, and access to technology or resources needed for engagement. In a weight management and smoking cessation behavioral intervention trial, age, race, and BMI predicted randomization and enrollment. Other demographic factors, such as education and age, have also been associated with randomization and participation in a weight management intervention trial. The loss of participants from recruitment-to-randomization in behavioral intervention trials also tends to differ by race; for example, in the Coday et al. study, Black individuals were more likely to be disqualified due to not meeting eligibility criteria during screening processes than White individuals.

Meeting requirements for eligibility, however, constitutes only one factor in the recruitment-to-randomization process and does not guarantee subsequent participation. Following screening procedures, participants may decline to participate due to lack of interest, lack of time, transportation barriers, or being unwilling or unable to participate in study activities. Therefore, in addition to researching effective recruitment strategies, it is important to monitor and research the flow of participants from recruitment to randomization.

To our knowledge, few studies have investigated recruitment strategies for combined weight management and smoking cessation interventions. Coday and colleagues examined traditional and online recruitment strategies for a randomized controlled trial that aimed to help young adults stop smoking while also managing weight. More participants were recruited using traditional methods compared to technology-based methods. Of the traditional methods used, TV advertisements and direct mail were the most commonly reported referral sources. A similar study evaluating the recruitment and randomization of individuals for a weight management and smoking cessation trial found that randomized participants were more likely to identify as women and to have increased health risks and cigarette use. However, the researchers did not report the associated costs for recruitment, emphasizing the need for further research and exploration.

The present study describes the recruitment methods and randomization process used in a behavioral intervention study focused on smoking cessation and weight management. Additionally, the study also aimed to explore the cost-effectiveness of recruitment strategies, with particular emphasis on populations that have not been frequently included in other post-cessation weight management interventions. In order to provide insight into which methods might be most effective and least costly.

2. Materials and methods

2.1. Design

The trial for which participants were recruited was the Fit & Quit study; this study is a randomized three-arm clinical trial designed to evaluate the efficacy of a weight management intervention in reducing the likelihood of smoking cessation-related weight gain. Participants were randomized to one of three conditions: (1) a weight stability group, (2) weight loss intervention group, and (3) self-guided intervention group. Following completion of the weight management intervention, participants across all three arms of the trial received 6 months of varenicline, a smoking cessation medication, in addition to a behavioral smoking cessation intervention. Following the smoking cessation intervention, participants in the weight stability and weight loss intervention groups received five monthly booster sessions, that integrated problem solving for weight management and smoking cessation. In total, participants were engaged with the intervention for 8 months and engaged in data collection for 12 months. The study protocol was approved by the University of Tennessee Health Science Center Institutional Review Board.

2.2. Participants

Individuals were required to be 18 years or older, have access to a telephone and email to engage in the study intervention activities, and agree to be randomized to study conditions and engage in study procedures (e.g., take varenicline, participate in group sessions). Smoking eligibility criteria included: individuals interested in quitting smoking within 30 days and those who reported smoking 5 or more cigarettes per day for one year or longer. Weight eligibility criteria were having a BMI of 22 kg/m² or greater (with an upper weight limit of 385 pounds due to the capacity of the electronic scale) and being able to engage in at least 10 min of exercise. Eligible participants who identified as women also submitted a negative pregnancy test and agreed to use contraception.
throughout the course of the study; individuals who were pregnant or had been pregnant in the past 6 months were ineligible. Additional exclusion criteria were: allergy or other medical contraindication to varenicline, inability to obtain medical clearance to participate in the study, and the presence of medical and psychiatric conditions that may make study participation unsafe or difficult. Participants were also excluded if they were engaged in another intervention for weight management or smoking cessation or lived in a household in which another person was also participating in the study, had weight loss surgery, lost 10 or more pounds in the past 6 months, or were taking medication that may impact weight. Prior to the COVID-19 pandemic and switching to a remote protocol, participants were also screened for zip code, to determine if they live within 45 min of one of the assessment locations and whether they had plans to move.

2.3. Recruitment strategies

Recruitment occurred November 2017 to February 2021. The focus of this study is on strategies used during the recruitment phase that led to successful randomization (n = 305). Recruitment methods included both traditional and electronic media advertisement. Study advertisement material was released periodically to fill waves. Traditional recruitment methods included radio, television, print, word-of-mouth (with minimal costs associated with recruitment materials) and community postings (e.g., billboards, bus shelters, postcards, community advertisements, brochures distributed to local clinics). Radio ads (see example scripts in the supplemental materials) were designed by the radio account executives and then modified by the study team for accuracy; these ads were recorded with the voice of either a man or a woman as well as either a white or a Black individual. Radio ads were placed on a variety of radio stations, including country, sports, rhythm and blues (R & B), and gospel. Electronic recruitment methods included university listserv announcements, social media posts and advertisement (i.e., from the study’s Facebook page, which was then shared by study team members on their personal Facebook pages), internet posts and advertisement (e.g., Google search and display advertisements), and ResearchMatch (https://www.researchmatch.org/), see examples in the supplemental materials). Images used in all of these ads were purposely chosen by the study team to represent both men and women as well as white and Black individuals, given the goals of recruiting a diverse sample. Recruitment methods also included advertisements and incentives through study materials (i.e., study website and refer-a-friend strategy, where participants had the option of referring up to 2 individuals for an opportunity to earn $50 for each randomized referral (this amount was increased from $10 in 2018)). Screenshots of the study website are available in the supplemental materials. Initially, both electronic and traditional recruitment strategies were developed by the research team and then were later coordinated by a marketing firm; ResearchMatch postings were maintained and coordinated by study personnel.

3. Screening and enrollment

During the initial contact, interested individuals contacted study personnel via email or phone and participated in a brief screening call to determine eligibility. Individuals identified as being eligible at initial contact were scheduled for a screening visit. Those identified as being ineligible at any stage of the recruitment process were provided with self-guided resources for weight management and smoking cessation. Screening and baseline visits occurred in-person prior to the pandemic and via phone during the pandemic. During screening visits, written informed consent was obtained, initial assessment measures were administered (e.g., demographics, a screening interview to determine fit with the program, as well as a series of self-report measures). Height and weight (measured pre-pandemic and based on electronic scale weights and self-reported height during the pandemic) were obtained. Instructions for obtaining medical clearance were also given. Additionally, participants received a 3-day diet and exercise journal to record diet and activity information. Participants then competed a baseline visit in which participants were asked to submit their diet and exercise journal, their medical clearance letter, and to provide a baseline weight. Following successful completion of the baseline visit, participants were randomized to one of three conditions and provided with materials according to their randomized condition.

4. Measures

During the phone screening process, potential participants indicated how they heard about the study. For the purpose of this study, participant responses were organized by method into 13 recruitment strategies that included traditional and internet advertisement methods (e.g., newspaper, postcard, brochure/flyer/billboard, television, radio, physician referral, word-of-mouth, refer-a-friend campaign, staff referral, university listserv, internet advertisements, study website, ResearchMatch registry). Participant demographics (i.e., race, ethnicity, gender) were also self-reported by participants during the initial screening visit. Rurality was based on self-reported zip-code data and categorized using Rural-Urban Commuting Areas (RUCA, 2010) codes, classifying RUCA codes 1–3 as urban and RUCA codes 4–10 as non-urban [16]. Both direct venue costs and indirect materials costs were recorded by study personnel. Costs in this study focus on direct costs associated with advertisement and promotional material (in USD).

5. Analysis

As the study is primarily descriptive and exploratory, analyses consisted of descriptive statistics and frequency-based calculations generated by recruitment method. Chi-square test for categorical data using a sample of randomized participants were performed to evaluate the equality of proportions between key participant variables of interest (e.g., race, gender, and location – rural vs. urban) and recruitment method. Descriptive statistics were used to evaluate effective recruitment strategies based on the number of participants randomized per recruitment method. Cost-effectiveness was evaluated on the basis of the total cost of each recruitment method per participant, as well as total recruitment cost per effectiveness of recruitment method (total number of participants recruited per method). Additionally, logistic regression models were applied to determine the predictive ability of key participant variables in predicting randomization using a sample of randomized participants (N = 305) and a sample of individuals found ineligible during a screening visit (N = 138). All associations were considered significant at the alpha level of 0.05 along with all other available evidence such as magnitude of associations, variability and confidence limits.

6. Results

A combined total of 2667 individuals were screened. Of these, some participants refused, discontinued, or were otherwise unable to be contacted prior to an initial phone screening (4.7%, n = 126). An additional 45.7% (n = 1220) were found to be ineligible for participation during an initial phone screening as well as during a screening visit (5.2%, n = 138). Additionally, some participants discontinued or refused participation at an initial screening visit (25.7%, n = 685), baseline visit (7.1%, n = 190), randomization visit (0.04%, n = 1), and at the end of the recruitment period (0.07%, n = 2). Of the total sample of individuals that were screened or contacted for participation, 11.4% (n = 305) were eligible and subsequently randomized for participation in the study.

Of the participants that were randomized (N = 305; see Table 1), a majority identified as women (67.9%; n = 207) and fewer identified as men (32.1%; n = 98). The majority identified as White (52.5%; n = 160)...
or Black (43%; n = 131); fewer identified as Asian (0.7%; n = 2) or another race group (3%; n = 9) and some participants declined to respond to the question about racial identification (1%; n = 3). Additionally, a majority of participants identified as non-Hispanic (98.4%; n = 300). Rurality was coded following criteria for RUCA codes and were considered urban metropolitan areas (89.5%; n = 273) and fewer participants reported residing in non-urban micropolitan (n = 14), small town (n = 13), and rural (n = 5) areas (total: 10.5%; n = 32).

6.1. Recruitment

Overall, the most effective recruitment strategies were local postcards, local radio advertisements, word-of-mouth referrals, and national internet advertisements; together, these methods resulted in the recruitment of a combined 71.8% (n = 219) of the total randomized sample. Results are presented according to population characteristics (i.e., race/ethnicity, gender, rurality) (see Table 2).

6.1.1. Recruitment by race/ethnicity

Due to the low number of individuals identifying as Hispanic or Latino(a) (n = 5), we did not examine the success of recruitment methods by ethnicity; however, descriptive results revealed that a majority of Hispanic participants (80%, n = 4) were recruited using electronic media methods (e.g., ResearchMatch registry and internet advertisement). In terms of race, results indicate a statistically significant relationship between race and recruitment method \( \chi^2(48, N = 305) = 130.75, p < 0.001 \). Specifically, among participants identifying as Black, radio advertisement was the most successful recruitment method (61.8%; n = 81). Radio advertisements on gospel and R&B stations were particularly effective at recruiting Black participants. Newspaper advertisement, brochures/flyers/billboards, physician referral, staff referral, email listserv, the study website, and ResearchMatch each recruited fewer than 5 Black participants. Among participants identifying as White, internet advertisement was the most successful recruitment method (32.5%, n = 52). The Fit & Quit refer-a-friend strategy, study website, and staff referral methods each recruited fewer than 5 White participants. Overall, traditional media methods were slightly more successful at recruiting White participants (54.4%, n = 87) compared to electronic media methods (45.6%, n = 73). Similarly, traditional media methods were more successful at recruiting Black participants (92.4%, n = 121) compared to electronic media methods.

| Table 1 | Demographic characteristics: Randomized participants. |
|---------|-------------------------------------------------------|
|         | Randomized (N = 305) | Ineligible (N = 138) |
| Gender n (%) |                       |                       |
| Men      | 98 (32.13)            | 55 (39.9)             |
| Women    | 207 (67.87)           | 79 (57.2)             |
| Missing  | 0                     | 4 (2.9)               |
| Hispanic/Latino n (%) |                     |                       |
| Non-Hispanic/Latino | 300 (98.36)          |                       |
| Hispanic/Latino | 5 (1.64)             |                       |
| Missing  | 0                     |                       |
| Race n (%) |                       |                       |
| White    | 160 (52.46)           | 44 (31.9)             |
| Black    | 131 (42.95)           | 85 (61.6)             |
| Asian    | 2 (0.66)              | 0                     |
| Other Race Groups | 9 (2.95)            | 3 (2.2)               |
| N/A      | 3 (0.98)              | 2 (1.4)               |
| Missing  | 0                     | 2 (1.4)               |
| Rurality n (%) |                     |                       |
| Metropolitan | 273 (89.51)         | 137 (99.3)            |
| Micropolitan | 14 (4.59)            | 1 (0.7)               |
| Small Town | 13 (4.26)            | 5 (1.64)              |
| Rural    | 5 (1.64)              | 273 (89.51)           |
| Urban    | 13 (4.26)             | 137 (99.3)            |
| Non-urban | 32 (10.49)           | 1 (0.7)               |

| Table 2 | Source of recruitment method to the Fit & Quit study, by gender, race, and rurality. |
|---------|-----------------------------------------------------------------------------------|
| Characteristics | Total | Gender | Race | Rurality |
|                       |       | Male   | Female | White | Black | Asian | Other | N/A  | Non-Urban | Total (N = 305) |
| Physician Referral Method | 48.4% | 41.5% | 41.5% | 41.5% | 41.5% | 41.5% | 41.5% | 41.5% | 41.5% | 41.5% | 41.5% |
| Internet ad | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% | 32.5% |
| Social Media | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% | 11.1% |
| Newspaper | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% | 5.1% |
| Postcard | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% |
| Mail | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% | 4.3% |
| Flyer/billboard | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% |
| TV | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% |
| Radio | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% |
| ResearchMatch | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% |
| UT/Delmar | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% |
| Quebec | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% |
| Word-of-mouth | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% |
| Friend referral | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% |
| Staff referral | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% |
| ResearchMatch & UT/Delmar | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% | 1.1% |

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There were few individuals identifying as Asian or other as well as some individuals that declined to report race; therefore, the success of recruitment strategies was not evaluated for these groups.

6.1.2. Recruitment by gender

Results revealed that there was not a significant relationship between recruitment methods and gender ($\chi^2(12, N = 305) = 8.36, p = 0.757$).

6.1.3. Recruitment by rurality

There was a significant relationship between recruitment methods and rurality ($\chi^2(12, N = 305) = 34.56, p < 0.001$). Among participants from urban areas, radio advertisement was the most successful recruitment method (38.5%, n = 105), followed by internet advertisement (15.8%, n = 43), postcards (8.8%, n = 24), and word-of-mouth (7.7%, n = 21). Among participants from non-urban areas, internet advertisement was the most successful recruitment method (53.1%, n = 17). Among participants from urban areas, traditional media strategies were overall more successful at recruiting a greater number of participants (75.1%, n = 205) compared to electronic media strategies (24.9%, n = 68); however, among participants from non-urban areas, electronic media methods were overall more successful (68.8%, n = 22) compared to traditional media methods (31.3%, n = 10).

6.1.4. Non-successful recruitment strategies

There were several strategies that did not result in the successful recruitment of participants. Recruitment events at local health fairs and health conferences, local magazine and newspaper articles written by the study principal investigator, as well as advertisements in certain local newspapers and radio stations did not directly result in recruited and randomized participants. Other strategies (e.g., a press release with the Chamber of Commerce; listings on smokefree.gov, and clinicaltrials.gov; advertisements placed in a bowling alley, movie theater) were also unsuccessful.

6.2. Predictors of randomization

A multivariable logistic regression analysis was used to evaluate the degree to which gender, race, rurality, and recruitment category (traditional media methods vs. electronic media methods) predicted randomization (yes/no). Demographic and recruitment data were available for individuals found ineligible during a screening visit (N = 138). The remaining non-randomized individuals (n = 2224) were either found ineligible or otherwise refused or discontinued further participation; demographic data were not reported for these individuals. Reasons for ineligibility included not meeting inclusion criteria for blood pressure and heart rate (44.2%, n = 61), BMI (10.8%, n = 15), and pregnancy (0.7%, n = 1), as well as exclusion criteria for depression (20.3%, n = 28) and suicidality (23.9%, n = 33). Due to insufficient power in some race categories (e.g., Asian, n = 2; Other, n = 12, and N/A, n = 5), the final sample (N = 418) for this analysis included only Black and White race categories. The results of this analysis suggest that men (OR = 0.567, 95% CI: 0.358–0.896, p = 0.015), individuals identifying as Black (OR = 0.526, 95% CI: 0.329–0.841, p = 0.007), and individuals recruited via traditional methods (OR = 0.479, 95% CI: 0.250–0.919; p = 0.027) had decreased odds of being randomized compared to their respective counterparts. Individuals residing in non-urban areas (OR = 8.758, 95% CI: 1.149–66.767, p = 0.036) had increased odds of being randomized.

6.3. Cost-effectiveness

The total cost of recruitment, including direct and indirect costs, was estimated at $242,125.05 USD. Direct costs included physical materials (e.g., postcards, rack card holders, pens, ribbons, and magnets) and costs incurred through content creation and promotion ($239,044.05 USD). Indirect costs, which included design, plan management, and website development, was estimated at $3,081.00 USD. In total, traditional media methods resulted in the recruitment and randomization of 215 participants (70.5%) and incurred costs of $200,257.25 (83.8% of direct costs), whereas electronic media methods resulted in the randomization of 90 participants (29.5%) and incurred costs of $3,878.00 (16.2% of direct costs). Overall, electronic media methods were more cost-effective ($430.97 per randomized participant) compared to traditional media methods ($931.43 per randomized participant).

Table 3 includes information about recruitment method effectiveness and cost-effectiveness, including the number of participants recruited using each method, the total approximate cost of each method, and the cost-effectiveness of each method (e.g., cost of method per participant). Individual recruitment methods ordered from most-to-least cost effective were refer-a-friend, word-of-mouth, physician referral, internet advertisement, newspaper, brochure/flyer/billboard, radio, TV, and postcard. Radio advertisements resulted in more recruited and randomized participants compared to other recruitment methods (36.7%, n = 112) and also incurred the most cost ($109,061.58; 45.6% of direct costs). Internet advertisement resulted in the second most successful recruitment method (19.7%, n = 60) and was found to be less expensive ($38,787.00; 16.2% of direct costs) and more cost effective than radio advertisements ($646.45 and $973.76 per participant, respectively). Local postcard advertisements (7.9%, n = 24) and word-of-mouth (7.5%, n = 23) were also successful in recruiting participants. However, local postcard advertisements were overall more expensive ($46,089.70; 19.3% of direct costs) than word-of-mouth ($1115.80; 0.5% of direct costs) and less cost-effective ($1920.40 vs $48.51 per participant, respectively), despite resulting in a nearly equal recruitment yield. The refer-a-friend system was the most cost-effective ($45.56 per participant) and least expensive ($410.00; 0.2% of direct costs) recruitment strategy; however, this method resulted in only 9

| Recruitment Method       | Specific Strategy | Randomized (N = 305), n (%) | Costs (USD) | Cost-effectiveness* |
|--------------------------|-------------------|-----------------------------|-------------|---------------------|
| Traditional Media        |                   |                             |             |                     |
| Local                    |                   | 8 (2.62)                    | $6076.50    | 759.56              |
| Newspapers Postcard      |                   | 24 (7.87)                   | $46089.70   | 1920.40             |
| Brochure/Flyer/Billboard |                   | 11 (3.61)                   | $8682.91    | 789.36              |
| TV: News                 |                   | 15 (4.92)                   | $27876.00   | 1858.40             |
| Radio                    |                   | 112 (36.72)                 | $190961.58  | 973.76              |
| Physician referral       |                   | 10 (3.28)                   | $944.76     | 94.45               |
| Word-of-mouth            |                   | 23 (7.54)                   | $1115.80    | 48.51               |
| Fit & Quit:              |                   | 9 (2.95)                    | $410.00     | 45.56               |
| refer-a-friend            |                   | 3 (0.98)                    | $0          | N/A                 |
| Staff referral            |                   | 215 (70.49)                 | $200257.25  | 931.43              |
| Electronic Media         |                   |                             |             |                     |
| University email listers  |                   | 7 (2.30)                    | $0          | N/A                 |
| Internet ad (Google, Craigslist, Centerwatch, Facebook) |     | 60 (19.67)                   | $38787.00   | 646.45              |
| Fit & Quit website       |                   | 6 (1.97)                    | $0          | N/A                 |
| Research                 |                   | 17 (5.57)                   | $0          | N/A                 |
| Match                    |                   | 90 (29.51)                  | $38787.00   | 430.97              |

Cost-effectiveness calculated as the total cost or monetary investment (USD) divided by the total number of participants recruited, or the estimated cost of recruitment per participant.
randomized participants. There were several methods that did not incur direct costs (i.e., staff referral, university listserv postings, accessing the Fit & Quit study website, and the ResearchMatch registry); these strategies resulted in a combined recruitment of 33 participants.

7. Discussion

The current study focused on the effectiveness of recruitment methods, strategies, and associated costs used in a combined smoking cessation and weight management behavioral intervention trial. We found that local postcards, local radio advertisements, word-of-mouth referrals, and national internet advertisements recruited the greatest number of participants in this study. Consistent with previous research on the cost-effectiveness of recruitment strategies for smoking cessation [1] and weight management trials [17], electronic media methods were more cost-effective compared to traditional media methods; however, traditional media methods resulted in a greater number of recruited and randomized participants. We also found some indication of strategies that may be more effective in recruiting populations that are typically underrepresented in clinical trials (e.g., individuals who identify as Black, those in rural areas) [18].

Specifically, we found that radio advertisement, particularly advertisements on gospel and R&B stations, was the most successful method for recruiting participants identifying as Black (61.8% of all Black participants were recruited using radio). Previous research similarly points to the effectiveness of targeted advertisement and promotional materials in recruiting people of color [18], and the results of this study add to the existing research suggesting that this is an effective strategy for recruitment of specific populations. However, similar to the study by Coday and colleagues [3], there was a larger proportion of individuals identifying as Black (n = 85, 61.6% of individuals that were not randomized at screening) that did not meet eligibility criteria for participation during a screening visit compared to individuals identifying as White (n = 44, 31.9% of individuals that were not randomized at screening). The consistency of this finding across similar investigations may point towards race-related barriers present between the recruitment phase to the randomization phase. Additionally, a majority of participants identified as non-Hispanic; therefore, this study was limited in its ability to evaluate effective recruitment strategies among Hispanic populations. In previous research, other forms of targeted recruitment revealed differences in recruitment sources among individuals identifying as Hispanic, among different levels of education and income, as well as among individuals identifying as Lesbian, Gay, Bisexual, Transgender, or other gender and sexual orientations (LGBTQ+) [8].

We also found that a majority of participants reported residing in urban metropolitan areas (89.5%; n = 273) and fewer participants reported residing in non-urban micropolitan, small town, and rural areas (10.5%; n = 32). Consideration for rurality, particularly in national trials, has gained less attention than race-based disparities. The results of this study demonstrated that, contrary to the common concerns about the digital divide [19], national internet advertisement, and electronic media methods in general, were more effective than other methods at recruiting from non-urban areas, including micropolitan, small town, and rural geographic areas.

In line with the SEAR (i.e., screening, eligibility, approach, and randomization) Framework proposed by Wilson and colleagues [20], this study also aimed to report on the process from recruitment to randomization to identify successful and cost-effective recruitment strategies that not only increase initial interest in studies but also lead to successful randomization and participation in clinical trials. This study was similar in the proportion of recruited participants that were randomized (11.4% in our study vs. 10.7% in Coday et al.) [3]. In addition, we found that individuals that were recruited, met eligibility criteria, and were subsequently randomized predominately identified as women (67.9%; n = 207), White (52.5%; n = 160), and were more likely to reside in urban metropolitan areas (89.5%; n = 273), similar to Coday et al. but with more race and gender diversity than other previous studies [3,13,14]. Further, we found that gender, race, recruitment method, and rurality were predictive of successful recruitment and randomization. Although previous research suggests that targeting recruitment media and advertisement materials towards specific populations may increase the success of different recruitment strategies for recruiting men [18,21], the results of this study revealed that there was not a relationship between gender and recruitment methods.

Notably, we found that per participant recruitment costs for this combined smoking cessation and weight management trial were substantially higher than recruitment costs reported in trials that targeted only one of these behaviors. Cost per person in these previous trials has usually ranged from $40–50 per participant [1,2], and thus much lower than many of the recruitment methods in the current study ($430–$931). It may be that it is more unusual to find participants interested in both of these behavioral goals simultaneously and thus recruitment efforts for this type of trial must reach more individuals to find these interested and motivated participants.

This study had several strengths. First, participants were diverse in terms of key demographic characteristics, including race and gender. Additionally, individuals outside of urban metropolitan areas were also recruited. The variety of both traditional and electronic recruitment methods was also a key strength in this study; related to this, recruitment strategies were implemented at both a local and national level and this likely contributed to diversity in rurality. Finally, this study was able to determine direct and indirect costs associated with individual recruitment strategies, which contributed to an estimation of overall cost-effectiveness and per participant costs per method.

The study, however, was not without limitations. First, the study recruited few individuals that identified as race or ethnic categories other than White, Black, or non-Hispanic. In addition, we chose to examine factors reported during the randomization visit (i.e., recruitment by gender, race, and rurality), although there could have been other demographic characteristics examined (e.g., socioeconomic status, age, level of education). Another limitation was that demographic information was not collected during initial phone screening visits and data for ineligible individuals were only available for screening visits. This limited our ability to evaluate the demographic characteristics and recruitment method across all phases of the recruitment-to-randomization process (e.g., phone screening, screening visit, randomization visit). In addition, given that the focus of the trial was not on different recruitment methodologies, these various strategies were often not introduced simultaneously nor used for the same length of time (particularly if initial response was not strong), consistent with the limitations of other trials examining recruitment strategies [22]. Future research should test various images and recruitment messages to determine which are most effective for individual-level recruitment materials. However, randomization to different recruitment materials is not always possible, such as with community-level strategies like television, newspaper, and radio ads as well as billboards. Further, the data presented in this paper reflect only the number of participants reached with each recruitment strategy, but for most of the strategies, it is not known how many people saw the recruitment strategy and did not respond. Additionally, some participants may have seen various recruitment strategies and may have only reported one strategy. In future research, it will be helpful to embed recruitment strategy evaluations within clinical trials similar to the Medical Research Council Systematic Techniques for Assisting Recruitment to Trials (START) project [23].

8. Conclusion

Overall, the results of this study demonstrate that locally distributed and promoted postcards, radio advertisements, word-of-mouth referrals, as well as nationally distributed and promoted internet advertisements were the most effective methods in terms of recruitment and
randomization. In combination, these methods resulted in the recruitment of 71.8% (n = 219) of the total randomized sample. The recruitment and subsequent participation of participants in this study from underrepresented and diverse populations is also important to the generalizability of clinical trials, particularly studies evaluating health behaviors that may disproportionally affect these subpopulations. Additionally, despite common concerns about the digital divide, electronic and internet-based recruitment methods aided in the recruitment and subsequent randomization of individuals from non-urban areas. Implementing national recruitment methods, aided by electronic and internet-based strategies, may increase the diversity of samples in behavioral clinical intervention trials. Finally, it will be important to systematically test recruitment strategies in future research in order to implement a more evidence-based approach to recruitment.

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Rebecca A. Krukowski: supervision, funding acquisition, writing – review and editing, conceptualization, investigation.

Declaration of competing interest
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data
Supplementary data to this article can be found online at https://doi.org/10.1016/j.jctct.2022.101037.

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