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Designing a smoking cessation intervention for the unique needs of homeless persons: a community-based randomized clinical trial

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Abstract

Background—Although smoking prevalence remains strikingly high in homeless populations (~70% and three times the US national average), smoking cessation studies usually exclude homeless persons. Novel evidence-based interventions are needed for this high-risk subpopulation of smokers.

Purpose—To describe the aims and design of a first-ever smoking cessation clinical trial in the homeless population. The study was a two-group randomized community-based trial that enrolled participants ($n = 430$) residing across eight homeless shelters and transitional housing units in Minnesota. The study objective was to test the efficacy of motivational interviewing (MI) for enhancing adherence to nicotine replacement therapy (NRT; nicotine patch) and smoking cessation outcomes.

Methods—Participants were randomized to one of the two groups: active (8 weeks of NRT + 6 sessions of MI) or control (NRT + standard care). Participants attended six in-person assessment sessions and eight retention visits at a location of their choice over 6 months. Nicotine patch in 2-

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week doses was administered at four visits over the first 8 weeks of the 26-week trial. The primary outcome was cotinine-verified 7-day point-prevalence abstinence at 6 months. Secondary outcomes included adherence to nicotine patch assessed through direct observation and patch counts. Other outcomes included the mediating and/or moderating effects of comorbid psychiatric and substance abuse disorders.

Results—Lessons learned from the community-based cessation randomized trial for improving recruitment and retention in a mobile and vulnerable population included: (1) the importance of engaging the perspectives of shelter leadership by forming and convening a Community Advisory Board; (2) locating the study at the shelters for more visibility and easier access for participants; (3) minimizing exclusion criteria to allow enrollment of participants with stable psychiatric comorbid conditions; (4) delaying the baseline visit from the eligibility visit by a week to protect against attrition; and (5) regular and persistent calls to remind participants of upcoming appointments using cell phones and shelter-specific channels of communication.

Limitations—The study's limitations include generalizability due to the sample drawn from a single Midwestern city in the United States. Since inclusion criteria encompassed willingness to use NRT patch, all participants were motivated and were ready to quit smoking at the time of enrollment in the study. Findings from the self-select group will be generalizable only to those motivated and ready to quit smoking. High incentives may limit the degree to which the intervention is replicable.

Conclusions—Lessons learned reflect the need to engage communities in the design and implementation of community-based clinical trials with vulnerable populations.

Introduction

Tobacco-related illness causes over 400,000 deaths annually in the United States and cigarette smoking is implicated in one-third of all cancer deaths [1]. In contrast to declines in cigarette smoking in the general population, smoking rates and related morbidity and mortality remain high among poor and underserved populations. One such group is the estimated three million people who experience homelessness during a given year in the United States [2]. Due to the national economic recession, high rates of mortgage foreclosures and unemployment, the homeless population has increased sharply. In Minnesota, from 2006 to 2009, the homeless population increased by 25% [3]. Nationally from 2008 to 2009, demand for homeless services increased by 26%, the largest jump since 1991 [2].

For the homeless population, cigarette smoking prevalence has remained strikingly high; at 70%, it is three times the national average [4,5]. For the homeless, the probability of living to 75 years is 32% in men and 60% in women; mortality rates are between 3.5 and 5.9 times greater when compared with the general population [6–8]. Tobacco-related illnesses, that is, heart disease and cancer, are two of the three leading causes of death among homeless persons [9–11]. Because smoking cessation research has usually excluded persons without a regular place of residence, we lack evidence about how to assist homeless smokers with quitting.

On a broad scale, there are several overlapping barriers to tobacco cessation for the homeless population. These include the high prevalence of psychosocial stress, high rates of tobacco use among staff and homeless persons in the organizations serving homeless persons, and psychiatric morbidity as well as co-substance use and dependencies. Further, inadequate access to health care and lack of funds to pay for nicotine replacement therapy (NRT) and other tobacco cessation medications present further barriers [12,13]. Daily challenges to smoking cessation include accessing treatments [14] and competing demands on the need to quit such as ongoing negotiations for access to food, clothing, and shelter [15]. Despite these challenges, there is evidence that homeless smokers want to quit [16] and will enroll in smoking cessation trials [17–19]. Successful smoking cessation under such circumstances can be challenging; we need novel interventions and research approaches to reach this highly affected yet rarely studied subpopulation of tobacco users.

To fill this gap in evidence-based smoking cessation interventions in homeless populations, we conducted ‘Power to Quit’ (PTQ), a community-based, randomized, controlled smoking cessation trial designed to assess the efficacy of 21-mg NRT patches used for 8 weeks and motivational interviewing (MI) counseling among homeless smokers. The multidisciplinary team included researchers from medicine, public health, and sociobehavioral sciences who worked collaboratively with ‘community mobilizers’, that is, research assistants on the study team who were either homeless at the time of the study or had recently experienced homelessness. The randomized clinical trial (RCT) was based in eight homeless shelters and transitional housing units. It was the first adequately powered study funded by the National Institute of Health to test the efficacy of NRT in combination with counseling for smoking cessation among homeless persons [20]. Evidence supports the efficacy of MI for tobacco cessation [21–23]. A number of studies have documented the efficacy of behavioral interventions for smoking cessation. Current treatment guidelines recommend the use of counseling for smoking cessation [24]. A recent systematic meta-analysis of cessation trials comparing MI with control found an odds ratio of 1.45 (95% confidence interval (CI) 1.10–1.96) [23]. In addition to its efficacy, MI is well suited to the homeless population due to their extensive experience with counseling and the intervention’s low cost and portable nature.

Methods

Overview of study design

The primary aim of this two-group community-based, randomized controlled trial was to assess the efficacy of adherence-focused MI to help homeless smokers quit smoking. Once eligibility was determined, participants were randomized to either the intervention arm (NRT + MI) or to the control arm (NRT + standard care (SC)). At baseline, participants in both groups received a 2-week supply of 21-mg NRT patches [25], selected based on preferences expressed in preliminary studies [15,18]. For the initial 8 weeks of the study, participants in both arms received an additional 2-week supply of nicotine patch every 2 weeks. They were instructed on how to use the patch daily; any concerns were addressed by research staff. In addition, participants randomized to the intervention arm received six MI counseling sessions, 15–20 min in length, while participants randomized to the SC arm

received one brief session (10–15 min long) of advice-oriented counseling to quit smoking. The brief directive advice was designed to simulate a typical clinical encounter. The design did not include a placebo arm due to ethical concerns as well as the communal living situation of homeless people (i.e., the possibility of participants in different study arms sharing patches could lead to contamination of study groups). The *primary outcome* was biochemically verified smoking cessation assessed at 6 months postrandomization. Participants who did not return for the 6-month assessment were classified as treatment failures. The *secondary outcome* was adherence to NRT. Additional aims included identifying the potential moderating effects of substance abuse, psychiatric comorbidities, and other demographic and smoking behavior variables on intervention efficacy.

Participants

A total of 430 participants enrolled in the study (Figure 1). Recruitment occurred over 15 months, from May 2009 to August 2010. Final follow-up was completed in April 2011. Participants were randomized to either the active (MI; $n = 216$) or control (SC; $n = 214$) arms. Eligibility criteria included confirmation that the potential participant was homeless [26], a current cigarette smoker, aged 18 years or older, willing to use a nicotine patch for 8 weeks and participate in counseling sessions, and willing to complete 15 total appointments (6 during NRT treatment, 8 retention contacts, and a final exit interview survey) over the 26-week study period.

Participants were determined to be homeless based on the Stewart B. McKinney Act, passed by the US Congress in 1987 in which homelessness was defined as ‘any individual who lacks a fixed, regular and adequate nighttime residence’; or ‘one whose primary nighttime residence is a supervised publicly or privately operated shelter designed to provide temporary living accommodations, transitional housing, or other supportive housing program or a public or private place not meant for human habitation (e.g., on the streets or in abandoned buildings, tents, or automobiles)’ [4,9,26]. Participants were also considered homeless if they had been staying with friends or family for three months or less.

To be considered a current smoker, a participant had to have smoked at least 100 cigarettes in the entire lifetime and reported smoking at least one cigarette every day over the past 7 days. To confirm smoking status, participants were asked to exhale into a carbon monoxide (CO) monitor. Individuals with CO scores above 5 parts per million (ppm), a criterion based on recommendations by the Society for Research on Nicotine and Tobacco (SRNT) [27–29], were confirmed to be smokers (Figure 2).

Additional eligibility criteria included willingness to use the nicotine patch, had lived in the Twin Cities (Minneapolis/St. Paul metropolitan area, MN) for at least 6 months, and planned to stay in the TC for the next 6 months; and for women, not currently pregnant and willing to use birth control. Exclusion criteria included use of another tobacco cessation aid (e.g., patch, gum) in the previous 30 days, cognitive impairment, suicidal ideation in the last 14 days, a major medical condition (heart attack or stroke) within the prior month, or scoring greater than 5 on items assessing psychotic symptoms from the Mini International Neuropsychiatric Interview (M.I.N.I.) [30]. The M.I.N.I. scale includes seven items such as

the following: ‘In the past 30 days, have you believed that people were spying on you, or that someone was plotting against you, or trying to hurt you?’; ‘In the past 30 days, have you believed that someone was reading your mind or could hear your thoughts, or that you could actually read someone else’s mind or hear what another person was thinking?’; and ‘Do you ever hear things other people couldn’t hear, such as voices?’

A Community Advisory Board (CAB) with 13 members was convened in the first year of the project and subsequently met once or twice each year during the 4-year project. An integral part of implementing the study, the CAB was composed of program directors and managers from shelters and social service agencies with a predominantly homeless clientele. The CAB reviewed and approved the study design and assisted in the conceptualization of the project name and logo. They provided insights on the context of homelessness and potential barriers to participation; further, they strategized methods for enhancing study retention. Their perspective was important for retaining a study sample from this highly mobile and vulnerable population.

Participants were recruited from eight homeless emergency shelters and transitional housing units in the Twin Cities (see Table 1). Strategies for recruiting participants included conducting health fairs, staff informational sessions, and posted flyers. Staff visited shelters at meal times to announce the study. The project logo, designed by a local artist previously homeless and from the community, was displayed on all the study promotional materials. Further, recruitment occurred *via* word of mouth, that is, participants telling acquaintances about the study. Shelters were compensated financially for the time required to conduct recruitment activities.

Setting

All counseling and retention visits were conducted at the participating homeless shelters and transitional housing units. Appointments were scheduled with participants in keeping with shelter and transitional housing space needs. The research team was composed of a project coordinator, two full-time and one part-time MI counselors, four part-time SC counselors, and two full-time community mobilizers. Those team members employed as community mobilizers had recent experience with homelessness (either personal or by way of family members). Their role was to recruit, enroll, and survey participants. The research team was located in offices in close proximity to one of the main study shelters. Baseline surveys, lasting between an hour and an hour and a half, were administered by community mobilizers in communal spaces within the shelters such as a cafeteria or waiting rooms. The data collectors ensured that there was adequate distance from other shelter staff and clients to maintain confidentiality. All counseling sessions were conducted in private rooms with doors to ensure participant privacy, to encourage counselor–participant rapport, and to facilitate high-quality audio recording. Intended to maintain participants in the study, retention visits were brief and simply included updating the participant’s contact information and providing incentives.

To minimize attrition, staff made daily reminder calls to participants during the week prior to appointments, both pending and missed, until the window for completing appointments

closed. Calls were placed from the project office and made either to each participant's cell phone or to the shelter identified as the most recent nighttime residence in participant's file. Staff also gave participants appointment reminder slips at the time of setting the appointment. If participants missed the baseline appointment visit window entirely three times, they were not randomized; if they missed an appointment window later in the study, they were categorized as missing.

At each of the 15 visits, participants received incentives. At longer visits that included surveys, participants received \$20 gift cards and two bus tokens (\$3 value). For attending brief retention visits and the week 8 end of treatment visit, participants received \$10 gift cards, two bus tokens, and another small item of appropriate utility for homeless persons. Small gift items included playing cards, tote bags, movie passes, water bottles, T-shirts, and personal care items (e.g., soap, toothbrush, washcloth). For attending the final 6-month visit, participants received a \$40 gift card and a sweatshirt. For participants who attended all 15 sessions, the monetary incentives totaled \$275 over 6 months. Shelters were compensated \$25 for each 2-h time period used to conduct the study at their site. Amounts received by individual shelters in a calendar year varied depending on the number of hours occupied for the study; examples included \$3500 minimum and \$16,425 toward the high end.

Intervention components

Motivational Interviewing

Participants in the intervention arm received six MI counseling sessions, each lasting approximately 20 min. The core principles of MI were retained although the emphasis was on adherence due to the unstable living conditions of the population. All MI sessions were audio-recorded and reviewed during weekly supervision meetings. During these meetings, tapes were reviewed for treatment fidelity and direct instruction with a licensed clinical psychologist trained in MI.

At the initiation of the project, the MI counselors received two full days of training on the theory and method of conducting MI. The training was conducted by a doctoral-level psychologist on the research team and included didactic components (e.g., spirit of MI, empathic listening, cognitive dissonance) as well as role-playing and supervised practice conducting the counseling sessions. Following initial training, counselors received approximately 40 h of supervised training.

Standard Care

Participants in the comparison condition received 'standard care (SC)', a one-time session of health education and brief advice to quit smoking which lasted approximately 10–15 min [25]. This session was administered along with 8 weeks of wearing an NRT patch. Although this amount of intervention exceeded what homeless persons typically would receive in clinical settings, it was considered the most ethical control intervention [21,31,32]. Topics covered in the SC session included smoking history, current level of cigarettes per day, direct advice about the health risks of smoking and the health benefits of quitting, affirmation of the participant's decision to quit, an assessment of preparedness to quit, and elicitation of strategies for coping with a craving for tobacco. In contrast to MI, counselors

directed the SC session. Counselors aimed to talk 80% of the session and to allow the participant to talk only 20% of the time versus the opposite in MI, that is, participants were encouraged to talk 80% of the time. Toward the end of the session the counselor asked the participant to identify cues that prompted smoking and offered basic strategies to cope with those cues. The SC counselors received two sessions of training from a doctoral-level health communications specialist; training included role-playing sessions, the importance of study fidelity, and basics in smoking cessation advice provision. Over the course of the study, SC counselors' sessions were monitored by the health communications specialist and/or a doctoral-level medical anthropologist. All sessions were tape recorded; 10% were reviewed and used in biweekly meetings with the SC counselors to discuss protocol fidelity.

Treatment adherence monitoring and measurement

Adherence to use of the NRT patch was the study's secondary outcome of behavior change. Research staff verified by direct observation that participants were wearing their patches ('patch checks') at each appointment. In addition, participants brought patches remaining in their 2-week supply to appointments to be counted and documented by the research staff ('patch counts'). Further, the Morisky scale was administered to assess perceptions of adherence to NRT patch [33]. These three strategies helped to ensure accurate documentation of NRT patch adherence among study participants.

With respect to adherence to MI and SC treatments, all counseling sessions were tape recorded. Doctoral-level members of the research team (a licensed psychologist and a medical anthropologist) listened to 10% of all tape-recorded sessions to monitor quality. The licensed psychologist was responsible for overseeing the MI counseling sessions, while the medical anthropologist supervised the SC counseling sessions.

Outcomes

Primary and secondary outcomes

The primary outcome on which the study was powered was cotinine-verified 7-day point prevalence of tobacco abstinence at 26 weeks from study enrollment using a cut-off of <20 ng/ml. Cotinine was measured in a saliva sample collected at baseline in all participants and again at week 26 whenever a participant reported 7-day abstinence from smoking. Patch adherence was measured weekly for the first 2 weeks of treatment and biweekly for the last 6 weeks of treatment by (1) 'patch checks' (visual verification of whether a participant was wearing a patch); (2) 'patch counts' (documenting the number of patches left in the participant's possession); and (3) administration of the Morisky scale, a self-reported adherence scale modified to assess adherence to NRT patch [33].

Treatment effect moderators

Moderators are variables that may affect the relationship between the primary independent variable (intervention) and the dependent variable or outcomes of interest (smoking and quitting behaviors, adherence to NRT) but are not considered direct causal pathways. For this study, moderating variables included baseline participant characteristics such as demographics (i.e., age, ethnicity, gender, income, education level, marital status,

employment status) to be included in secondary analyses. Other moderators included smoking level and psychosocial variables such as social support and the degree of hopelessness reported [34,35]. To assess self-efficacy to refrain from smoking, autonomous and controlled motivation to quit smoking, and smoking urges, three instruments were administered, respectively: the Smoking Self-Efficacy Questionnaire (SEQ-12) [36], the Treatment Self-Regulation Questionnaire (TSRQ) [37], and the Questionnaire of Smoking Urges (QSU) [38]. Additional potential moderators included psychiatric comorbidities assessed with the Rost–Burnham screener for depression [39], the Patient Health Questionnaire (PHQ) for depression [40], the M.I.N.I.-generalized anxiety disorder assessment, and the perceived stress scale [41]. Further, study participants were asked questions about drug treatment history and drug and alcohol dependence (Table 2) [39].

Statistical considerations

The sample size was determined a priori assuming a two-tailed type I error of 0.05, a power of at least 80%, and a 6 month biochemically verified quit rate of 18% and 8% for intervention and SC (control arm) groups, respectively. Power calculations indicated that 214 participants in each of the two arms would provide a statistical power in excess of 80% (at a 5% significance level) to detect statistically significant main effects using the Fisher exact test.

The primary outcome is biochemically verified 7-day abstinence at 6 months postrandomization. Following intention-to-treat analyses, participants lost to follow-up or in violation of the study protocol will be assumed to be smokers. The primary analyses will be a comparison of the verified abstinence rates at 6 months. The comparison will use the two-sided Fisher's exact test. Multiple logistic regression models will include the main effects term of the intervention group (NRT + MI vs. NRT + SC) to estimate adjusted odds ratios (and CIs) of quitting. Covariates eligible to enter into the model include age, ethnicity/race, gender, income, and educational level. The adjusted analyses will be conducted as secondary analysis. Other baseline covariates will be selected based on univariate analyses. In addition, assessment of the effect of the treatment main effect on verified 7-day abstinence also will use repeated measures methods, such as random-effect models, across two time points (8 and 26 weeks). Analysis of outcomes at 8 and 26 weeks will allow us to test the immediate and sustained effects of treatment. An interaction term between the main effects term of the intervention group and each potential moderator will be added first and tested in each regression model with the 6 months cessation outcome. Second, if the interaction is significant, we will perform subgroup analyses for each potential moderator.

To address the secondary hypothesis that the MI intervention group will have greater adherence than those in the SC arm, adherence analyses will be performed using the three adherence measures: Morisky scale scores, patch count, and patch checks. These analyses will be conducted through the use of two-group continuity corrected chi-square tests to compare the proportions of adherers versus nonadherers between the two arms. Participants lost to follow-up will be classified as nonadherers for the intent-to-treat analysis. The adherence outcomes will be analyzed further using multiple logistic regression models and

random-effect models following methods similar to those described for the primary outcome.

Discussion

PTQ is the first adequately powered smoking cessation clinical trial to be conducted among homeless smokers. The community-based study design addressed many of the challenges confronted by researchers when recruiting, retaining, and intervening with a homeless population. Challenges included high mobility in and out of the region as well as among shelters in the Twin Cities, life circumstances that make it difficult to keep appointments, and limited forms of available communication.

Designing this study required maintaining a delicate balance between internal and external validity. In comparison with other smoking cessation trials, inclusion criteria were minimal and included prior use of other tobacco products. Whereas psychiatric comorbidities and co-drug dependencies often preclude persons from participating in a smoking cessation trial, among the homeless, for whom prevalence of smoking is very high, we considered them to be intervention moderators. Given the mobility and shared living quarters, concern over sharing patches argued against inclusion of a placebo patch arm. Further, a placebo arm would compromise ethical principles of research among poor and marginalized persons.

Lessons learned

Throughout the process of designing and tailoring the study for a highly mobile and underserved population, the study team learned several lessons. For one, we learned the importance of engaging the perspectives of shelter leadership by forming and convening a CAB who provided us valuable insights that benefited the study's recruitment, enrollment, and retention. Recruitment and retention activities had to be innovative and flexible due to the frequently shifting life circumstances that challenged the study population. All research activities took place in shelters and temporary housing units, selected as the locations most convenient to study participants. Recruitment was completed through health fairs, flyers posted in the shelter common areas (e.g., cafeterias, waiting rooms), and *via* word of mouth between enrollees and potential recruits.

In the pilot-testing phase prior to the actual study, the appointment at which eligibility was determined and the baseline survey was administered were combined; a large proportion of participants were lost between the initial combined appointment and the following appointment. To minimize attrition in this mobile population, we added a week between the eligibility and baseline survey appointment. Requiring a week of wait time helped to select participants who were motivated to participate in the study.

To further enhance recruitment and retention, based on advice from the CAB convened at the beginning of the project, the study staff scheduled follow-up visits with participants enrolled in both arms using their location preferences. A detailed locator form was kept in each participant's study file to track changing nighttime residence. Scheduling by the participant's counselor allowed for more flexibility to accommodate the frequent fluctuations in participants' lives. Another insight provided by the CAB was that rapport

between staff and participants would be integral to participant enrollment and retention. The study team employed homeless persons with significant experience (either personal or by family members) as community mobilizers. We believe that the shared experience between staff and participants optimized the return rate for follow-up appointments.

One of the key lessons learned in this trial was the need to remind participants of upcoming visits to encourage attendance. Individual and shared cell phone plans were very common among participants. Frequent use of cell phones facilitated communications regarding upcoming appointments. As reminders, participants were telephoned by project staff daily in the week prior to scheduled visits. In unusual cases of no cell phone, the project team left messages for study participants at the most recent nighttime residence. Each study site had a way of conveying messages to residents, such as a communal message board. Study staff familiarized themselves with methods at each site and made use of them. Eight retention contacts were added between the last treatment visit and the 6-month follow-up appointment to ensure continued contact and to encourage attendance at the final study visit.

Conclusion

The ‘PTQ’ study design allowed for rigorous examination of the long-term effectiveness of administering a combined treatment of pharmacotherapy and behavioral counseling to assist homeless individuals to quit smoking. The large sample of participants recruited across eight shelters and transitional housing units provided the statistical power necessary to provide a statistically meaningful answer to the primary research question. Innovative design elements of the trial included the population with which it was conducted, counting people who did not attend the 6-month visit as smokers for intention-to-treat analyses, and using direct observation to measure patch adherence [42].

The logistical and procedural challenges in designing and conducting a smoking cessation clinical trial for homeless persons were numerous and had to be accommodated in the study design and procedures. Due to the unique characteristics of homeless populations, the trial was designed specifically to: (1) achieve recruitment goals which would ensure a representative sample and adequate statistical power; (2) retain participants from a highly mobile population; and (3) assess a context-appropriate intervention.

In general, challenges were met with a flexible and adaptive approach to cope with the unexpected exigencies of any community-based clinical trial. The significance of this study was to identify an effective program of tobacco cessation treatment with an innovative combination of pharmacotherapy and sociobehavioral interventions for homeless persons who face a multitude of competing needs. Our study findings are expected to inform the evidence base for tobacco cessation interventions in homeless and other transient populations.

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Figure 1.
Overview of study procedures.

Figure 2.
CONSORT diagram: screening and enrollment of study participants.

Table 1

Community-based shelters and transitional housing facilities, population served, services offered, and average length of stay

Community-based research site	Overview of guests' demographics	Services offered	Average length of stay (days)	No. of persons served/year
Dorothy Day Center (DDC)	The DDC is a run by the umbrella organization Catholic Charities of Minnesota. The population that utilizes DDC is mostly male and mostly single; 15% of the guests are over the age of 55.	Emergency shelter, space for 250 Transitional housing, 42-bed women's shelter Meals (breakfast, lunch, dinner) Food shelf Medical/mental health care Housing and employment advocacy Counseling support Laundry and bathroom/shower facilities Computer lab	90	2688
Our Savior's Shelter (OSS)	OSS offers faith-based activities along with other services. In the emergency shelter program, 85% of the individuals are male, 46% are African American, and 88% have a high school diploma or Graduate Equivalency Degree (GED) or more. In the transitional housing program, there are 15 men, 16 women, and 9 children.	Emergency shelter, 40 beds per night Transitional housing, 40 men, women, and children Two meals a day (lunch, dinner) Bathroom/shower facilities Case management services Permanent supportive housing services	34 32	650
Listening House (LH)	The LH is a drop-in center that caters to the needs of those who are homeless or in poverty. The population is mostly men (84%). The residents are 49% African American, 37% Caucasian, 9% Hispanic, 4% Native American, and 1% immigrant; 28% are also veterans; 10% are above 50 years of age.	Daily drop-in center (no overnight stays) Mailing address and telephone contact Basic health care, chiropractic care Case management Sock exchange and foot care Clothing supply and maintenance support HIV/AIDS screening and education clinic Voicemail, mailing address, and telephone contact	N/A	200+
Union Gospel Mission	The Union Gospel Mission site is a faith-based site that concurrently runs a short-term emergency relief alongside a transitional housing program and an intense alcohol and drug treatment facility.	Emergency shelter, space for 120 Transitional housing, 145 rooms		

Community-based research site	Overview of guests' demographics	Services offered	Average length of stay (days)	No. of persons served/year
		Alcohol drug treatment Center, 75 men – 24-h service desk – Intensive treatment programs – Bible study and work therapy – Large group service – Health care/dental services – Clothing giveaway – Spanish interpreters		
Naomi Family Center (run by Union Gospel Mission)	The Naomi Family Center serves women and children. It provides long-term transitional housing program that focuses on providing housing stability for women and children.	Transitional housing 25 different life-skill classes and Bible 48 women and 87 children are housed	548	90
People Serving People (PSP)	PSP is a short-term transitional housing center that is geared to helping families find housing. The program's stated goal is to help children by giving them direct care or assisting their parents in gaining the skills that will keep their families off the streets. The program serves women and children. About 60% of those that PSP serves are under 18 years of age, and 32% of the total population is under 5 years	Emergency shelter, 99 rooms. Transitional housing, 10 supportive apartments Three meals a day Medical clinic open 5 days a week Mental health and chemical dependency services, employment assistance, literacy, early childhood development, and legal aid programs Guest access to voice mail, e-mail, and in-house library 24-h front desk service supplying diapers, formula, warm clothing, and other basic needs Training programs in life skills, culinary arts, facilities training, and workforce development Counseling services Family advocates ensuring families get connected with the resources and services they need	46	319

Table 2

Schedule of observations

Constructs, Predictors/Covariates	Items	Baseline	Wk 1	Wk 2	Wk 4	Wk 6	Wk 8	Retention contacts Wk 10, 12, 14, 16, 18, 20, 22, 24	Wk 26
Housing	3	X							
Competing needs	4	X							
Smoking history	6	X							
Quitting history	3	X							
Cigarette accessibility	5	X							
Nicotine dependence	1	X							
QSU	10	X	X	X	X	X	X		X
TSRQ	15	X				X	X		X
Importance and confidence of tobacco	2	X	X	X	X	X	X		X
SEQ	12	X					X		X
Social influence	3	X					X		
Social support for smoking cessation	5	X							
Family in study	1						X		
Weight concerns and control	7	X					X		X
Perceived harms of smoking	3	X							
Perceived harms of secondhand smoke	1	X							