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Referring Hospitalized Smokers to Outpatient Quit Services A Randomized Trial

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Abstract

Introduction—Linking outpatient cessation services to bedside counseling for hospitalized smokers can improve long-run quit rates. Adding an assisted referral (AR) offer to a tobacco treatment specialist consult service fits the team approach to care in U.S. hospitals.

Design—A two-arm patient-randomized trial tested the effectiveness of adding an AR offer to outpatient smoking-cessation services and interactive voice recognition (AR+IVR) follow-up to a usual care (UC) tobacco-cessation consult for hospitalized smokers.

Setting/participants—Over 24 months (November 2011–November 2013), 898 hospitalized adult smokers interested in quitting smoking were recruited from three large hospitals in the Portland, Oregon area: an integrated group model HMO ($n=622$), a community hospital ($n=195$), and an academic health center ($n=81$).

Intervention—Tobacco treatment specialists identified smokers and provided an intensive bedside tobacco use assessment and cessation consultation (UC). AR+IVR recipients also received proactive ARs to available outpatient counseling programs and medications, and linked patients to a tailored IVR telephone follow-up system.

Main outcome measures—The primary outcome was self-reported 30-day abstinence at 6-month follow-up. Secondary outcomes included self-reported and continuous abstinence and biochemically confirmed 7-day abstinence at 6 months. Follow-up was completed in September 2014; data were analyzed in 2015.

Results—A total of 597 and 301 hospitalized smokers were randomized to AR+IVR and UC, respectively. AR+IVR and UC recipients received 19.3 and 17.0 minutes of bedside counseling

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($p=0.372$), respectively. Most (58%) AR+IVR patients accepted referrals for counseling, 43% accepted medications, and 28% accepted both. Self-reported 30-day abstinence for AR+IVR (17.9%) and UC (17.3%) were not statistically significant ($p=0.569$). Differences in 7-day, continuous, and biochemically confirmed abstinence by treatment group also were insignificant, overall and adjusting for site.

Conclusions—Adding an AR to outpatient counseling and medications did not increase cigarette abstinence at 6 months compared to UC alone.

Introduction

Cigarette smoking is the leading cause of preventable death and disease in the U.S., resulting in 480,000 deaths and more than \$170 billion in excess medical care expenditures per year.^{1,2} Although smoking rates have declined substantially since the late 1990s,^{1,3} more needs to be done. Counseling programs to help smokers quit are effective and highly cost effective, particularly when combined with cessation medications.^{3–5}

The forced abstinence associated with a hospital stay, particularly in smoke-free facilities, represents an opportunity to initiate professional treatment and link patients with multiple intervention contacts after discharge. This approach can lead to significant increases in quit rates.^{3,6–12} In 2012, the Joint Commission recognized the importance of treating tobacco dependence for all hospitalized smokers by broadening the requirements for effective treatment to include referral to outpatient services and follow-up.^{13,14}

Creating an integrated clinical pathway—from inpatient assistance to outpatient cessation services—is challenging for any healthcare delivery system, even integrated organizations that also provide outpatient and behavioral health services. An effective model includes in-hospital treatment by trained professionals whose primary responsibility is tobacco cessation¹⁵ and a hospital-managed follow-up program for continuity of care.¹⁶ Integrating inpatient and outpatient cessation services is much more daunting for free-standing community and academic hospitals that serve patients who are potentially covered by dozens of health insurance plans. Typically, insurance plans cover inpatient services, but prior authorization is needed for outpatient coverage.

In 2010, NIH funded seven clinical trials to evaluate the effectiveness and cost effectiveness of hospital-based smoking-cessation programs that linked smokers to post-discharge outpatient interventions.¹⁶ Investigators from each study and NIH formed the Consortium of Hospitals Advancing Research on Tobacco to create common data elements that would enable data pooling and analyses across studies. This study presents data from the Inpatient Technology-Supported Assisted Referral study (U01 HL105231; clinical trials registration, NCT01236079), a patient-randomized clinical effectiveness trial. Each participant received a comprehensive bedside tobacco-cessation consult as part of usual care (UC), delivered by a trained tobacco treatment specialist (TTS): a physician assistant, research registered nurse, or health educator, depending on the study site. Patients also received information about outpatient cessation programs and medications. Patients randomized to the study treatment also received ARs for post-discharge tobacco-cessation services (counseling and

medications) plus interactive voice recognition support (AR+IVR). IVR was used to provide efficient post-discharge follow-up for treatment plans initiated during hospitalization.^{17–19}

The Inpatient Technology-Supported Assisted Referral study tested the hypothesis that adding an AR to outpatient quit services and IVR follow-up to a bedside smoking-cessation consultation would significantly increase self-reported 30-day abstinence at 6-month follow-up compared to the bedside consult service only. The overall goal of the study was to demonstrate that combining tobacco treatment expertise with electronic health systems technology could effectively link in-hospital tobacco dependence treatment to cost-effective outpatient follow-up care, thus increasing patient's use of outpatient quit programs and medications compared to UC. A detailed description of the study protocol is available elsewhere.²⁰

Methods

A randomized controlled clinical effectiveness trial was conducted with 900 patients who had been admitted to one of three large hospitals. All study participants received bedside tobacco cessation consults as part of UC, and 597 patients were randomly selected to receive a TTS-delivered AR+IVR. Participants completed baseline and 6-month follow-up assessments, with a \$50 incentive for completing follow-up. Blinded study staff arranged and conducted the assessments. Intervention fidelity was monitored by tracking inpatient cessation service delivery, documented ARs to outpatient counseling services and medication prescriptions, and notifications to primary care providers. The study was approved by the IRB of each institution and the Consortium of Hospitals Advancing Research on Tobacco Data Safety Monitoring Board. All participants provided written informed consent and were monitored for adverse events.

Setting and Population

Participating hospitals included:

1. an inpatient facility for an integrated, group model HMO that provides and coordinates the entire scope of care, including access to a range of tobacco-cessation services through its Health Education Department (HES);
2. a large community hospital serving a diverse urban population; and
3. an academic health center with specialty tertiary healthcare services.

All hospitals have comprehensive electronic medical record systems and are located on tobacco-free campuses. The community and academic hospitals offer inpatient tobacco-cessation consult services for smokers referred by hospital staff. The consults were provided by dedicated TTSs, who formed the basis for the UC intervention described below. The HMO hospital implemented a dedicated nurse-delivered tobacco consult service for the study.

The study population comprised adult patients (aged ≥ 18 years) who had been admitted to one of the hospitals and reported having smoked a cigarette (even a puff) within the previous

30 days, spoke English, had a working telephone, and were interested in remaining abstinent from smoking post-discharge. Because of the need for 6-month in-person follow-up and biochemical confirmation tests, eligibility was restricted to patients living within 50 miles of their hospital. Patients were also excluded if they were admitted to a critical care, labor/delivery, or psychiatric unit; were pregnant or breastfeeding; had access restrictions (e.g., isolation bed due to resistant infections); were physically too ill to participate in a research study (i.e., could not complete the 6-month follow-up); or were cognitively unable to provide informed consent. Patients with a history of mental illness were included if admitted to non-psychiatric units.

Each weekday morning, TTSs at each site identified admitted smokers using electronic administrative and medical records. A list of eligible smokers was generated for tobacco-cessation consultation, in-person screening, and recruitment. As part of the UC cessation consult, TTSs confirmed eligibility and assessed interest in study participation. Informed consent was conducted, including an explanation that participants would be randomly assigned to receive either printed instructions (UC) or TTS assistance in obtaining outpatient services and medications (AR+IVR). Consented patients completed baseline assessment prior to randomization. The TTSs at the HMO site provided the UC consult and performed study screening, enrollment, and baseline data collection at a single visit. Research assistants at the community and academic hospitals consented, enrolled, and randomized interested patients following the TTS consult. The TTSs completed the referrals following the encounter.

Patients were assigned to AR+IVR or UC via a 2:1 allocation ratio. This strategy enhanced both the appeal of the intervention to hospital stakeholders and analyses of potential dose effects on outcomes for AR+IVR participants. The study statistician managed randomization procedures and fidelity. Randomization was conducted via a selection and documentation procedure that ensured balanced enrollment over time, blinded the TTS, and prevented post-randomization assignment changes. Each site assigned patients using secure, preprinted, sequentially numbered randomization envelopes. Randomized block sizes maintained group balance and prevented TTS staff from guessing assignment. Randomization fidelity was monitored regularly by comparing information from the randomization log, prescreening priority list, and the consult and enrollment checklists. Study investigators and follow-up staff were blinded to treatment group assignment.

Inpatient Tobacco Cessation Consult (Usual Care)

The TTSs conducted comprehensive tobacco use and cessation consults at bedside for all study participants as part of UC. The consults were designed to take about 15 minutes. The UC intervention involved a tobacco use and quit history assessment, discussion of the health consequences of tobacco use and benefits of quitting (focusing on the latter), and tailored discharge treatment recommendations based on patients' tobacco history and personal circumstances. Patients were given printed and verbal instructions about available services and U.S. Food and Drug Administration–approved medications, and how to access quit counseling and medications on their own. If patients agreed, the UC consult at the academic

hospital included a single, brief follow-up call shortly after discharge to assess smoking status.

Access to quit programs and medications differed across sites and insurance coverage. Patient costs differed depending on insurance and program type. Copayments for HMO patients were \$0 for most Internet and telephone programs and a refundable \$65 for individual or group counseling. Patients enrolled through the HMO's HES Department could purchase prescription and over-the-counter quit medications at copay. Community and academic hospital patients were provided information about alternative counseling programs and medications typically covered by insurance. Patients were encouraged to call their insurance provider to determine cessation program coverage. Patients with Medicare, Medicaid, or no insurance coverage were given information about telephone counseling provided through the pertinent state-administered quitline.

Assisted Referral Plus Interactive Voice Recognition Intervention

The AR+IVR patients were offered the UC cessation consult and materials, as well as assistance in enrolling in outpatient cessation programs and arranging for quit medications to be included in discharge medications orders. Patients could accept or refuse the referral offer. At the HMO site, patients could accept a bedside warm transfer call to HES or arrange a callback at a more convenient time. Trained HES behavioral interventionists discussed program options and encouraged enrollment. Programs included evidence-based single and multisession telephone counseling, individual and group classes, and an interactive web-based program.^{3,17,18} HMO patients interested in medications received nicotine-replacement therapy (NRT; transdermal patches, lozenges, gum), bupropion, or varenicline, as part of their discharge medication packet. Medication orders were electronically submitted, approved, and processed prior to discharge.

Community and academic hospital participants were offered a faxed referral to the Oregon or Washington state quitline (1-800-QUIT-NOW) for evidence-based proactive single or multiple call counseling.²¹ The state quitlines offered NRT, bupropion, or varenicline (prescriptions and dispenses) based on patients' insurance coverage.

Information about study enrollment and recommended options for post-discharge cessation treatment were sent to patients' primary source of health care electronically or by fax. Overall, the duration of any selected intervention ranged from a single phone call to approximately 12 weeks for multisession phone coaching and medications.^{3,21}

The IVR intervention was provided via a standard automated calling system for participants at each site. After discharge, AR+IVR recipients received four IVR follow-up calls over a 7-week period, at days 4, 14, 28, and 49.²² Participants were prompted for smoking status, cessation program enrollment status, and cessation medication use, and received tips for quitting.

Study Measures

The primary outcome of the study was self-reported 30-day abstinence from cigarettes at 6 months post-randomization for AR+IVR compared to UC. Secondary analyses included

self-reported 7-day and continuous abstinence, and biochemically confirmed 7-day abstinence. In-person follow-up assessments were conducted at 6 months post-randomization at the HMO research clinic, location convenient to the patient, or by mail or telephone. Participants who attended follow-up visits were given a salivary cotinine assessment (NicAlert[®] test strip) if they reported not smoking in the previous 7 days. Participants were also given an exhaled carbon monoxide assessment (Bedfont Smokerlyzer[®] Carbon Monoxide Monitor).²³ Saliva test strips alone can be crude measures of abstinence, whereas use of both saliva strip and carbon monoxide tests improves the combined sensitivity and specificity of the measures.²⁴ Thus, abstinence was biochemically confirmed if both salivary cotinine (< 10 ng/mL²⁵) and CO (< 5 ppm) tests were consistent with quitting.²⁵

Patient-level information was collected on study screening and recruitment, bedside cessation delivery, and patient sociodemographics, health status, and tobacco history. Health status measures included height and weight for BMI, the Patient-Health Questionnaire-2 depression screen, the three-item Alcohol Use Disorders Identification Test, and the EuroQual^{26–28} for health-related quality of life. Tobacco history questions included amount smoked and other tobacco use, amount of time after waking before first cigarette, other household smokers and indoor smoking rules, and confidence in quitting. Self-reported smoking abstinence (30-day, 7-day, continuous) and cessation counseling program and medication use were obtained at 6-month follow-up. Follow-up was conducted in person at a research clinic or other location, by telephone, or by mail.

Statistical Analysis

The study had 80% power (two-tailed α set at 0.05) to detect an 8–percentage point difference in self-reported 30-day abstinence at 6 months, with sample size of 900 and a 2:1 allocation ratio of AR+IVR to UC. Expected abstinence for the UC group was 15%, based on data from Stevens et al. (2000)²⁹ and unpublished data from participating sites. The treatment effect on primary and secondary smoking outcomes (abstinent versus not abstinent) was evaluated using logistic regression with SAS, version 9.2. The independent variable was arm (AR+IVR versus UC). A significant OR > 1 would provide support for the effectiveness of the AR+IVR intervention. Sensitivity analyses were performed including hospital site as a covariate to account for clustering of patients within sites, and baseline patient characteristics. A significant coefficient for the product term would indicate that the effectiveness of the intervention differed by site. Predicted probabilities of quitting at 6 months and 95% CIs were estimated by treatment arm and arm by site. Group differences in cessation service utilization were evaluated using chi-square and Fisher's exact tests. Bedside consult time was compared using a two-sided *t*-test. Abstinence rates were assessed based on an intent-to-treat approach, and participants lost to follow-up were coded as smokers.

Results

Study participants were recruited over 24 months (November 2011–November 2013). Follow-up assessments were completed in August 2014, and data analysis was completed in

2015. TTSs conducted initial electronic medical record prescreening for 3,828 hospitalized adult smokers who met study eligibility criteria (Figure 1). Prescreening identified 2,908 (76%) patients who were eligible for a bedside quit consult and study recruitment visit. TTSs identified 986 (34%) patients who were screened eligible at bedside and interested in participating in the study, of whom 898 were randomized (HMO, 622; community, 195; academic, 81) were randomized to AR+IVR ($n=597$) or UC ($n=301$). Twenty-three percent ($n=672$) were discharged prior to the consult ($n=464$), unavailable after three attempts ($n=68$), or had no consult attempt made ($n=140$; staffing limitations at the HMO site). Two randomized HMO patients were excluded because their screening and enrollment packets were lost within the internal HMO system. Follow-up was completed for 78% of AR+IVR and 80% of UC patients, with no differences by site.

At baseline (Table 1), study participants had a mean age of 53 years and tended to be female (54%), non-Hispanic (95%), white (73%), and living with others (79%). Nearly half were married or living with a partner. Participants had smoked most (25) days the previous month with mean of 13 cigarettes per day on those days. Most patients smoked their first cigarette within 30 minutes of waking (65%) and lived with another smoker (58%). Mean confidence in quitting was 4 on a 5-point scale, indicating most patients were confident that they would be able to quit.

The TTSs provided patients an intensive bedside consultation about their tobacco use, experience with quitting and cessation services, interest in quitting, available quit services, and self-help materials (Table 2). Overall, TTS bedside consultations averaged 19.3 (SD=21.4) minutes for AR+IVR recipients and 17.0 (SD=15.5) minutes for UC patients; the difference was not significant ($p=0.372$). Mean consult times were shortest at the academic hospital and longest at the community hospital, but group differences within sites were not significant. Patients in the AR+IVR arm were not required to accept an AR offer, but most (58%) accepted a referral to HES (HMO patients) or the state quitline for coaching, while 42% accepted an offer to receive quit medications at discharge, and 28% accepted both. A handful of UC patients received a referral to the state quitline, while 7.6% were received medications at discharge (part of UC at the academic hospital). More than three quarters of primary care providers were informed of their study enrollment. AR+IVR patients completed an average of two IVR calls. Most (51%) completed Call 1, and completion rates fell for each subsequent call.

Participants in the AR+IVR group reported somewhat higher utilization of cessation counseling programs and medication use at 6-month follow-up compared with UC patients. Eight percent of participants in the AR+IVR group reported using a quit program and 5% in the UC group reporting using such a program; however, this difference was not significant ($p=0.096$). AR+IVR patients (7%) were more likely to use telephone quitlines than UC patients (3%, $p=0.014$). More AR+IVR participants used quit medications (48%) than UC participants (38%, $p=0.013$), with higher percentages of patients (38%) reported using NRT patches compared with UC (28%, $p=0.007$). Other quit medications (other NRT, bupropion, varenicline) were used less, and rates did not differ by treatment arm.

Differences in smoking abstinence at 6-month follow-up were not significantly different by treatment arm for any definition of abstinence, even after adjusting for site and baseline patient characteristics. Unadjusted mean predicted probabilities of quitting were for AR+IVR and UC patients were 18% and 17% (OR=1.10, 95% CI=0.78, 1.53, $p=0.569$), respectively, for self-reported 30-day abstinence (primary outcome). Self-reported 7-day abstinence was 24% for AR+IVR and 22% for UC; continuous abstinence was 13% for AR+IVR and 14% for UC. Unadjusted biochemically confirmed abstinence was 10% for both AR+IVR and UC recipients, among 453 participants with an in-person follow-up assessment.

Overall, self-reported abstinence rates at each site were higher for AR+IVR patients compared with UC, but treatment arm differences were not significant (Table 3). Self-reported 30-day abstinence was highest for patients from the academic hospital (30% and 21% for AR+IVR and UC, respectively) and lowest for community hospital patients (12% and 20%). Compared with 30-day abstinence, 7-day quit rates were generally higher, whereas continuous abstinence rates were lower. Descriptively, there was a large decline (19% to 12%) from 7-day to 30-day abstinence for the AR+IVR recipients at the community hospital.

Discussion

This trial demonstrated that dedicated TTSs can provide intensive cessation counseling lasting nearly 20 minutes as part of an integrated hospital care delivery team, and that most smokers will accept an AR offer as part of this service. The bedside intervention was delivered as planned. The additional 2–3 minutes spent with patients in the AR+IVR group suggest that adding an AR is not burdensome. Unfortunately, the referral did not increase the use of outpatient counseling programs compared to usual care, and had only a small impact on medication use. There were no differences in self-reported or biochemically confirmed abstinence between AR+IVR and UC patients.

The failure to increase quit rates compared to UC appears to be related to the AR process. Other factors do not appear to have been at issue. First, the treatment fidelity data presented here and elsewhere³⁰ show that the AR+IVR and UC interventions were delivered as intended. Both groups were provided intensive bedside consultation, information about outpatient services, and encouragement to enroll in cessation programs and obtain quit medications. AR acceptance rates were robust. UC differed somewhat between hospitals, but not in ways that affected treatment groups differentially.

Second, treatment arms showed similarity in both baseline characteristics and study follow-up rates. Baseline data on amount smoked, nicotine addiction, household smoking, income, health status, and confidence in quitting were all similar. Follow-up rates were nearly 80% for both treatment groups, which reduced the potential diffusion effects of imputing non-responders as smokers. Furthermore, biochemically confirmed abstinence rates of patients with a follow-up clinic visit were the same across treatment groups.

Use of ARs may be the most pragmatic strategy for busy clinicians interested in helping patients quit smoking,^{3,6,12} but they appear to be insufficient in getting patients enrolled in counseling programs. Katz and colleagues^{31,32} successfully implemented brief counseling and referral to outpatient counseling programs in Veterans Administration hospitals and emergency departments, with modest impacts on referrals. They found that 23% of hospitalized smokers accepted referrals.³² Smokers with an emergency department visit accepted a referral only 7% of the time.³¹ A large study in primary care clinics found that less than 5% of smokers accepted a faxed referral to a state quitline.³³ In this study, acceptance rates were higher for outpatient counseling referrals (58%) and medications (43%), and 28% of patients accepted referrals for both counseling and medications. Patients in the current study may have been more interested in quitting or more familiar with cessation services, compared with previous studies. The high rates of referral acceptance did not translate into increased use of counseling services compared to UC. Counseling rates for both groups were modest.

Use of ARs appears to be effective in increasing use of cessation medications. The AR+IVR intervention increased patient-reported use of quit medications following hospital discharge compared with UC (48% and 38%, respectively, $p=0.013$). This result was consistent with a recent trial of a pharmacist-led inpatient program combining counseling and medications (inpatient and post-discharge), which increased outpatient medications use compared with control (60% to 44%, $p<0.001$).³³ Reported medication receipt was lower across hospitals sites in the current study compared with the pharmacist-led program.

The AR+IVR intervention did not increase quit rates compared to UC, overall or by site. The good news, however, is that abstinence rates for both groups were robust. About 18% of study participants reported not smoking in the previous 30 days at 6 months, while 22%–24% had not smoked in the previous 7 days. By comparison, Stevens et al.^{12,29} found that intensive bedside counseling with post-discharge follow-up calls resulted in quit rates of 16% and 14%, respectively. A study of Veterans Administration hospital patients found that less than 14% of smokers reported not smoking in the previous 7 days at 6-month follow-up,³² whereas only 12% of patients in a pharmacist-led hospital program were abstinent (30-day) at 6 months.³³ Other studies achieved considerably higher quit rates. Reid and colleagues³⁴ implemented the “Ottawa Model” in nine Canadian hospitals. A pre–post implementation analysis found that 29% of post-implementation program recipients were continuously abstinent at 6 months, compared with 18% pre-implementation. Earlier meta-analyses found augmenting bedside counseling with post-discharge counseling calls achieved a 23% quit rate (7-day at 6 months) compared with 19% for controls. Overall, abstinence rates from this study appear to be near the high end of results from previous studies.

Limitations

This study has several limitations. First, under-recruitment at the academic hospital ($n=81$) led to the addition of the community hospital ($n=195$). The limited numbers at these two sites adversely affected treatment group comparisons within and between settings. Second, follow-up data were collected through multiple methods, including in-person visits,

telephone calls, and mailed surveys. A 79% follow-up rate was achieved. However, the 21% were classified as smokers even though many are likely to have quit. Third, biochemical assessments of abstinence were obtained at in-person visits only ($n=453$), which reduced the sample size for these comparisons by about 50%. Treatment arm differences in biochemically confirmed abstinence were small and consistent with self-reported abstinence, suggesting missing tests did not adversely influence the study. Fourth, site differences were observed in overall abstinence rates. Patients from the academic hospital generally had the highest abstinence rates and community hospital patients had the lowest. Patients' baseline characteristics and intervention use had no effect on abstinence, so the differences are likely due to unobserved patient, provider, or hospital factors.

Hospitals in this study used dedicated TTSs to deliver usual care and the AR. A question remains of who should provide counseling in the hospital. Nursing interventions that reinforce or complement other health provider cessation efforts are an important component in helping smokers to quit.³⁵ However, counseling interventions are generally delivered by a research nurse or trained smoking-cessation counselor, not by a nurse who is responsible for other aspects of patients' clinical care.⁶ Others suggest brief cessation services can be added effectively to unit nurse duties,^{19,35,36} but the impact on delivery and outcomes appears limited.^{6,31,35} Hospitals involved in this study supported the use of dedicated staff to deliver bedside tobacco consult services and referrals.

Conclusions

Post-hospitalization cessation counseling and medications have proven to increase abstinence, decrease hospitalizations, and improve mortality.^{6,9} Despite being accepted by patients, the AR program had little effect on patient-reported counseling and a small effect on medication use compared to usual care. Thus, more needs to be done to ensure that the linkage to outpatient services is robust.

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Glossary

ITSAR	Inpatient Technology-Supported Assisted Referral
AR	assisted referral
IVR	interactive voice recognition
HMO	health maintenance organization
D/C	discharge

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Figure 1.
ITSAR Study recruitment and retention flow diagram.

Table 1

Baseline Characteristics of the ITSAR Study Population, by Treatment Group

Baseline measure	Assisted referral plus IVR Follow-up (n=597)	Usual care (n=301)
Demographic characteristics		
Age (M, SD)	53.0 (12.6)	53.8 (13.2)
Female (n, %)	338 (56.6)	144 (47.8)
Hispanic/Latino (n, %)	28 (4.7)	15 (5.0)
Race (n, %)		
White	425 (71.2)	228 (75.7)
Black/African American	60 (10.1)	19 (6.3)
American Indian/Alaska Native	8 (1.3)	8 (2.7)
2 or more races	84 (14.1)	35 (11.6)
Other ^a	20 (3.4)	11 (3.7)
Education (n, %)		
<High school diploma	77 (12.9)	34 (11.3)
High school diploma/GED	178 (29.9)	98 (32.6)
Some college/degree	340 (57.1)	169 (56.1)
Current living arrangement, lives with others (N, %)	470 (79.0)	239 (79.7)
Married/partnered (n, %)	268 (45.0)	144 (47.8)
Health insurance (n, %)	N=524 ^b	N=267 ^b
Commercial/Private	312 (59.5)	158 (59.2)
Medicare	126 (24.0)	75 (28.1)
Medicaid	63 (12.0)	19 (7.1)
Other	23 (4.4)	15 (5.6)
Household annual income (n, %)	N=510 ^b	N=255 ^b
<\$30,000	245 (48.0)	112 (43.9)
\$30,000-\$70,000	169 (33.1)	94 (36.9)
>\$70,000	96 (18.8)	49 (19.2)
Baseline health measures		
BMI=kg/m ² (%) (n, %)		
Obese (BMI ≥30)	214 (35.8)	123 (40.9)
Overweight (25 ≤ BMI <30)	171 (28.6)	70 (23.3)
Normal (18.5 ≤ BMI <25)	177 (29.6)	98 (32.6)
Underweight or less (BMI <18.5)	35 (5.9)	10 (3.3)
AUDIT-C score, scale 0-12 (M, SD)	2.3 (2.8)	2.3 (2.7)
PHQ-2 score, scale 0-6 (M, SD)	2.3 (2.1)	2.0 (2.1)
EQ5D5L score, scale 0.0-1.0 (M, SD)	0.55 (0.23)	0.55 (0.22)

Baseline measure	Assisted referral plus IVR Follow-up (n=597)	Usual care (n=301)
Tobacco history		
In the past 30 days, on how many days did you smoke? (M, SD)	25.1 (5.6)	24.6 (6.3)
On the days you smoked, how many cigarettes on average did you smoke? (M, SD)	12.9 (8.2)	13.2 (9.6)
Have you used other tobacco products in the past 30 days? (n, %)	64 (10.7)	27 (9.0)
E-cigarettes	38 (6.4)	18 (6.0)
Smokeless tobacco	11 (1.8)	7 (2.3)
Cigars/pipes	18 (3.0)	5 (1.7)
How soon after you wake up do you smoke your first cigarette? (n, %)		
5 minutes	201 (33.7)	97 (32.3)
6-30 minutes	187 (31.4)	94 (31.3)
31-60 minutes	87 (14.6)	44 (14.7)
>60 minutes	121 (20.3)	65 (21.7)
Does anyone in your household smoke, other than you? (n, %) ^c	273 (58.1)	138 (57.7)
Which of the following statements best describes the rules about smoking inside your home? (n, %)		
No one is allowed to smoking anywhere inside your home	398 (66.7)	200 (66.4)
Smoking is allowed in some places or at some times	73 (12.2)	36 (12.0)
Smoking is permitted anywhere inside your home	126 (21.1)	65 (21.6)
How confident are you that you will be able to quit/stay quit once you are discharged from the hospital? (scale 1-5, where 1=not at all confident, and 5=very confident) (M, SD)	4.0 (1.1)	3.9 (1.1)

ITSAR, Inpatient Technology-Supported Assisted Referral; IVR, interactive voice recognition; GED, general educational development; AR, assisted referral; UC, usual care

^aAsians and Native Hawaiian/Pacific Islanders were included in the other race category due to low numbers.

^bThere were 73 AR+IVR and 34 UC participants with missing primary insurance information. Income was not provided by 87 AR+IVR and 46 UC patients.

^cAsked of 709 participants who reported living with others.

Table 2

Smoking Cessation Interventions Received, by Treatment Group

Intervention component	Assisted referral plus IVR Follow- up n=597	Usual care n=301	p-value
Inpatient services			
Bedside tobacco consult			
Discussed quit services	595 (99.7%)	300 (99.7%)	0.718
Provided quit materials	591 (99.0%)	300 (99.7%)	0.279
Consult time, minutes (mean, SD)	19.3 (21.4)	17.0 (15.5)	0.372 ^a
HMO hospital	18.5 (21.4)	16.6 (18.1)	0.602 ^a
Community hospital	24.1 (23.8)	20.3 (5.2)	0.286 ^a
Academic hospital	14.5 (10.6)	11.7 (5.6)	0.220 ^a
Assisted referral offer accepted			
HES/fax to quitline	343 (57.5%)	5 (1.7%)	<0.001
Discharge medications	255 (42.7%)	23 (7.6%)	<0.001
Both accepted	167 (28.0%)	1 (0.3%)	<0.001
PCP informed about quitting	453 (75.9%)	25 (8.3%)	<0.001
Outpatient services			
IVR completed calls, post discharge			NA
Call 1	302 (50.6%)	—	
Call 2	262 (43.9%)	—	
Call 3	215 (36.0%)	—	
Call 4	187 (31.3%)	—	
Total calls completed per patient (mean, SD)	2.0 (1.7)	—	
Quit program use, self-reported at 6 months	n=466	n=242	
Any program	39 (8.4%)	12 (5.0%)	0.096
Telephone quitline	32 (6.9%)	6 (2.5%)	0.014
In-person class (solo/group)	1 (0.2%)	4 (1.7%)	0.049
Other	7 (1.5%)	4 (1.7%)	1.000
Medications used since leaving the hospital, self-reported at 6 months	n=466	n=242	
Any medication	223 (47.9%)	92 (38.0%)	0.013
NRT patch	178 (38.2%)	68 (28.1%)	0.007
NRT gum/lozenge/spray	64 (13.7%)	36 (14.9%)	0.679
Bupropion	21 (4.5%)	9 (3.7%)	0.622
Varenicline	18 (3.9%)	12 (5.0%)	0.492

Note: Boldface indicates statistical significance ($p < 0.05$).

IVR, interactive voice recognition; AR, assisted referrals; UC, usual care; HMO, health maintenance organization; PCP, primary care physician; HES, Health Education Services; NRT, nicotine replacement therapy

^aTwo-sided Wilcoxon test.

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Table 3

Self-Reported and Biochemically Confirmed Smoking Abstinence at 6 Months Follow-up, by Treatment Group^a

Cigarette smoking abstinence at 6 months	AR+IVR n=597 Abstinence % (95% CI)	UC n=301 Abstinence % (95% CI)	p-value ^b
Self-reported 30-day abstinence (primary outcome)			0.159
Academic	30.2 (17.8, 42.5)	17.9 (3.7, 32.0)	
Community	12.3 (6.7, 18.0)	20.0 (10.3, 29.7)	
HMO	18.1 (14.4, 21.8)	16.3 (11.3, 21.4)	
Self-reported 7-day abstinence			0.591
Academic	30.2 (17.8, 42.5)	21.4 (6.2, 36.6)	
Community	18.5 (11.8, 25.1)	21.5 (11.5, 31.5)	
HMO	24.4 (20.3, 28.5)	22.1 (16.5, 27.8)	
Self-reported continuous abstinence			0.823
Academic	20.8 (9.8, 31.7)	17.9 (3.7, 32.0)	
Community	8.5 (3.7, 13.2)	7.7 (1.2, 14.2)	
HMO	13.5 (10.2, 16.8)	15.4 (10.5, 20.3)	
CO and saliva cotinine-confirmed 7-day abstinence^c	n=296	n=157	0.799
Academic	13.6 (−0.7, 28.0)	20.0 (−4.8, 44.8)	
Community	8.7 (2.0, 15.3)	5.9 (−2.0, 13.8)	
HMO	10.2 (6.1, 14.4)	9.7 (4.3, 15.2)	

Saliva cotinine tests for smoking were positive for NicAlert® test strip scores ≥ 1. The analysis used only data for 453 patients with in-person visits who were subject to the biochemical tests. IVR, interactive voice recognition; AR, assisted referral; UC, usual care; HMO, health maintenance organization; PCP, primary care physician; NRT, nicotine replacement therapy

^a Non-responders coded as smokers.

^b p-value for site-by-arm interaction.

^c Expressed carbon monoxide (CO) tests were positive for smoking for cotinine levels ≥ 5ppm.