Original Investigation

An Interactive Voice Response System to Continue a Hospital-Based Smoking Cessation Intervention After Discharge

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Abstract

Introduction: Hospitalized smokers benefit from tobacco counseling received in hospital only if it continues after discharge. Interactive voice response (IVR) technology may be useful in delivering this care.

Methods: We conducted a randomized controlled trial testing two intensities of follow-up contact using an IVR system; 738 cigarette smokers who received inpatient counseling at an academic medical center were enrolled. Participants were randomized to receive four IVR calls during the first month postdischarge that included the offer of a call back (CB) from a smoking counselor (IVR + CB, $N = 368$) or 1 IVR call at 2 weeks postdischarge that assessed smoking outcomes without offering any counseling support (IVR, $N = 370$). All were assessed by human telephone call at 12 weeks. Postdischarge counseling and medication utilization rates and self-reported smoking cessation were assessed at 2 and 12 weeks postdischarge.

Results: Of those randomized to IVR + CB, 59% received a CB offer and 34% of those receiving offers accepted. Cessation rates did not differ between IVR + CB and IVR at 2 weeks (39% vs. 39%, rate ratio: 1.02, 95% *CI*: 0.85–1.22) or 12 weeks (29% vs. 26%, rate ratio: 1.11, 95% *CI*: 0.90–1.41). Medication use did not differ by group but was higher among those accepting versus declining CB offers (69% vs. 52%, $p < .05$).

Conclusions: An IVR system is feasible for postdischarge follow-up and support for hospitalized smokers. Participants, especially pharmacotherapy users, took advantage of post discharge counseling offers, although offers were not associated with increased smoking cessation.

Introduction

A hospital stay is an opportune time to offer a smoking cessation intervention because hospitalization requires smokers to abstain temporarily from tobacco use. Since 2004 national hospital quality measures have required U.S. hospitals to report the proportion of smokers admitted for acute myocardial infarction, congestive heart failure, and pneumonia who receive smoking cessation advice during their hospital stay (The Joint Commission, 2008). Counseling rates have increased since the requirement was adopted (The Joint Commission, 2008).

Providing tobacco treatment to hospitalized smokers is effective, but interventions begun in the hospital have no discernable long-term efficacy unless they continue after discharge (Rigotti, Munafo, & Stead, 2008). In research studies, providing smoking cessation counseling by telephone after discharge is an effective strategy (Miller, Smith, DeBusk, Sobel, & Taylor, 1997; Taylor, Houston-Miller, Killen, & DeBusk, 1990), but these findings are cumbersome to implement in routine clinical practice. Identifying generalizable, cost-effective ways to provide sustained cessation support and monitoring after hospital discharge is a major challenge.

Interactive voice response (IVR) technology may offer an efficient way to channel limited hospital-based resources to smokers in need of continued support after discharge. IVR is a telephone technology that allows a computer to detect voice and touch tones during a normal telephone call and respond with prerecorded audio. An IVR system that initiates calls can be used to assess patients' smoking status and offer appropriate patients a connection to a live counselor. An automated IVR system can eliminate the substantial effort involved in making contact with and screening patients. As a result, hospital resources can target those patients most likely to benefit from continuing support. IVR systems have been applied in a variety of medical settings (Oake, Jennings, van Walraven, & Forster, 2009; Revere & Dunbar, 2001) and have been used successfully to assess patients at home after hospital discharge for adverse outcomes (Forster, Boyle, Shojania, Feasby, & van Walraven, 2009; Forster & van Walraven, 2007).

Three Canadian studies have explored the potential of IVR to follow smokers after discharge as part of a comprehensive

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hospital-based smoking intervention (the "Ottawa Model"), demonstrating that it is feasible to use IVR in this setting (Reid, Pipe, & Quinlan, 2006) and suggesting an intervention that includes optional automated postdischarge follow-up may increase smoking cessation (Reid, Pipe, Quinlan, & Oda, 2007; Reid et al., 2010). However, the specific contribution of IVR to cessation rates was assessed only in a small pilot study limited to smokers admitted with myocardial infarction (Reid et al., 2007). That study showed a benefit of IVR that did not reach statistical significance.

We conducted a randomized controlled trial of an IVR system to follow hospitalized smokers with any diagnosis. We compared the efficacy of an IVR system linking appropriate patients to telephone counseling during the first 30 days after hospital discharge with standard care that met national hospital quality standards (The Joint Commission, 2008) but offered no support after hospital discharge. The study tested 2 hypotheses: first, hospitalized smokers will accept enrollment in an automated follow-up system administered by IVR, and second, a series of IVR calls during the first month after hospital discharge that include the option to request a CB from a smoking counselor will increase smoking cessation rates at 2 and 12 weeks after discharge, compared with standard care.

Methods

Setting and Participants

The study was conducted at Massachusetts General Hospital (MGH), a 900-bed teaching hospital in Boston, MA. Study participants were cigarette smokers who received tobacco counseling during an inpatient stay. The smoking status of MGH inpatients is routinely identified on admission by physicians using a computerized admission order set that automatically refers smokers to the Tobacco Treatment Service (TTS). TTS counselors (nurses or social workers) visit referred patients at the bedside to help them manage nicotine withdrawal symptoms in the hospital and assist those who wish to remain abstinent from tobacco after discharge. They offer both cognitive–behavioral counseling and recommendations for pharmacotherapy. The median duration of bedside counseling during the study period was 25 min (interquartile range: 20–30). The study was approved by the Partners Health Care System's Institutional Review Board.

Study Design

We conducted a randomized controlled trial comparing two protocols for follow-up after hospital discharge using an IVR system (TelAsk Technologies, Inc., Ottawa, Canada). Patients were enrolled from December 2007 through July 2008. One arm (IVR only) received an outcome assessment call from the IVR system at 2 weeks after hospital discharge. The second arm (IVR + CB: IVR plus CB offer) received a series of four outcome assessment calls during the first 30 days after hospital discharge. In this arm, participants interested in quitting had the opportunity to request that their hospital smoking counselor call them back to provide further help. For both groups, the final contact occurred 12 weeks after hospital discharge and consisted of a telephone call from study staff for outcome assessment.

Procedure

Patients were eligible for enrollment if they were identified on admission as having smoked cigarettes in the past year, received bedside counseling from the MGH TTS during their hospital stay, were discharged to home, and had not been enrolled at a previous admission during the study period. Patients were excluded if they could not participate due to altered mental status or severe illness, had a communication barrier (hearing, speech, or language) that prevented participation, were admitted to the inpatient psychiatric service, or did not have a direct telephone line without an intervening switchboard (a technical requirement of the IVR system).

At the end of the inpatient counseling session, counselors discussed the study with eligible patients and obtained consent using an Institutional Review Board-approved script. Patients were asked to consent to be randomized to receive either 1 or 4 calls from the IVR system over 30 days and a live telephone call at 12 weeks after discharge. Participants were randomized by the counselor immediately after giving consent. Group assignment was stratified by tobacco counselor in balanced blocks of 4 randomly ordered assignments. Each counselor carried a set of sealed, sequentially numbered manila envelopes, each containing an individual assignment, along with an information sheet for the patient describing the corresponding IVR call protocol. After obtaining consent, the counselor randomized the patient by opening the next envelope and reviewing the information sheet with the patient. In this way, the counselors remained blind to the group assignment until after the patient had been counseled and enrolled.

After the inpatient counseling session, the counselor recorded the participant's age, gender, admitting service, and average number of cigarettes smoked per day during the month prior to admission. Intention to quit was assessed at the end of the counseling session by asking the patient "Which of the following statements best describes your plans after you leave the hospital." The response choices are "I will stay quit," "I will try to stay quit," "I don't know if I'm going to quit," and "I don't plan to quit." Length of stay was obtained from hospital records.

IVR-Only Follow-Up Protocol

IVR-only group participants received a call from the IVR system 14 days after discharge, at which smoking status ("Have you smoked a cigarette, even a puff, in the past 7 days?") and cessation medication use since discharge (nicotine replacement therapy, bupropion, and varenicline) were assessed (Supplementary Figure 1). The IVR system made up to eight attempts to reach a participant over 48 h. Participants who were not reached by the IVR system were called by a research assistant who attempted to complete the outcome assessment. At 12 weeks, a research assistant contacted all participants by telephone to assess these outcomes and ask if the participant found IVR to be an acceptable way to follow up with patients after hospital discharge.

IVR + CB Group Protocol

IVR + CB participants received a series of four calls from the IVR system, at 3, 7, 14, and 30 days after discharge. The day 7 and day 30 calls were cancelled if the participant had indicated in a previous call that he or she did not want to stop smoking but the Day 14 call was always made to assess smoking status outcomes. In addition to the assessment made for the other

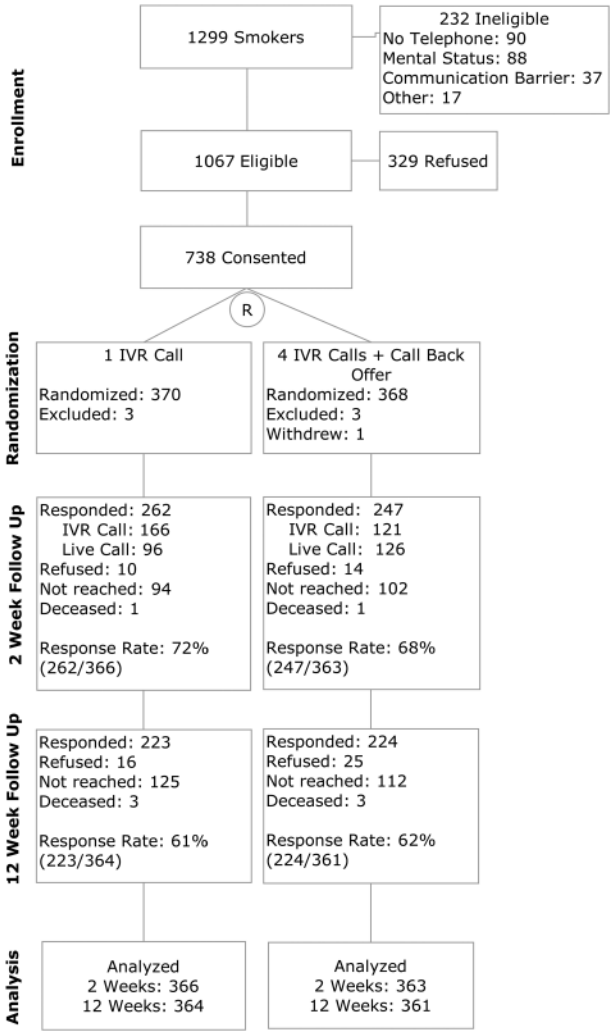

Figure 1. Participant flow and response rates.

groups, participants in this group were offered a CB from a counselor ("Would you like to have your smoking cessation counselor contact you to help create a quit plan or provide advice about medications?"). To focus counseling efforts on those most likely to benefit from them, CB offers were made only to those who either had not smoked in the past 7 days or wanted to quit within the next 2 weeks. Counselors attempted to reach those requesting CB within 48 h, made up to three attempts to reach participants who made a request, and offered approximately 10 min of counseling addressing the participant's concerns. For each completed call, counselors recorded the participant's primary reason for requesting the call (medication management or behavioral counseling), other topics discussed, and the duration of the call. As with the IVR-only group, participants who did not respond to the IVR at Day 14 were called by staff. The 12-week assessment was identical to the IVR-only arm.

Analysis

Baseline characteristics were compared using chi-squared tests, *t*-tests, and rank sum tests. Response rates were calculated excluding those participants who had died. Participants were counted as reached at 2 weeks if they responded to either the Day 14 IVR call or a live telephone call, and the assessment was counted as completed if the participant answered at least the first survey question regarding current smoking status.

We present self-reported 7-day point prevalence tobacco abstinence rates at 2 and 12 weeks after hospital discharge. These are calculated in two ways: (1) including all participants and counting nonrespondents as smokers and (2) including only respondents to the follow-up calls. Differences in abstinence rates were assessed by calculating rate ratios and 95% *CI*s. All analyses were conducted using Stata statistical software.

Table 1. Baseline Characteristics

Characteristic	Total	Study Arm	
		IVR only	IVR + CB
N	731	367	364
Age (mean)	52.2	52.3	52.1
Female (%)	44	45	44
Cigarettes/day (median)	15	17.5	15
Intend to remain quit (%)	37	38	35
Cardiac service (%)	36	36	36

Note. IVR = interactive voice response; IVR only = IVR call for outcome assessment only; IVR + CB = IVR call for outcome assessment plus offer of call back from hospital smoking counselor.

Results

Enrollment

Figure 1 depicts the flow of participants through the study. During the study period, 1,299 smokers were counseled of whom 232 (17.9%) were ineligible for enrollment. Among the 1,067 eligible smokers, 738 (69.1%) consented to participate in the IVR system and were randomized, and 329 (30.8%) refused to participate in the trial. Six of the randomized participants were determined to be ineligible and were excluded postrandomization but before the intervention was administered: one became too ill to participate before being discharged, one was not discharged to home, two gave telephone numbers that blocked incoming calls, and two had been previously enrolled. An additional participant withdrew before leaving the hospital, leaving 731 participants for analysis.

Baseline Characteristics

Table 1 compares the baseline characteristics of study participants by study arm (IVR only vs. IVR + CB). There were no significant differences between the arms for age, gender, cigarettes/day before admission, intention to remain quit after discharge, or the percent admitted to a cardiac service.

Follow-Up Response Rates

Response rates were calculated excluding those known to be deceased (Figure 1). Overall, response rates were 70% (509/729) at the 2-week follow-up (including contacts made

Table 2. Smoking Cessation Rates at Follow-Up by Study Arm

Follow-Up	Arm: IVR only, *N* (%)	Arm: IVR + CB, *N* (%)	Rate Ratio (95% *CI*)[a]
2 Weeks			
Respondents only	141/262 (54)	142/247 (57)	1.07 (0.91–1.25)
All participants	141/366 (39)	142/363 (39)	1.02 (0.85–1.22)
12 Weeks			
Respondents only	95/223 (43)	105/224 (47)	1.10 (0.90–1.35)
All participants	95/364 (26)	105/361 (29)	1.13 (0.90–1.41)

Note. IVR only = IVR call for outcome assessment only; IVR + CB = IVR call for outcome assessment plus offer of call back from hospital smoking counselor.

[a]Reference is IVR-only arm.

Table 3. Cessation Medication Use at 12-Week Follow-Up, Respondents Only

	N	NRT (%)	Varenicline (%)	Bupropion (%)	Any Medication (%)
Group					
IVR	222	32	18	3	47
IVR + CB	224	35	19	3	52
CB offer[a]					
Refused offer	96	34	18	2	52
Accepted offer	58	52	24	3	69

[a]Includes only those offered a call back.

by live telephone calls) and 62% (447/725) at the 12-week follow-up. Response rates did not differ by study arm.

The IVR system attempted to reach IVR + CB participants at four points. The rate of acceptance of the IVR call declined with increasing time since discharge from 52% on Day 3 to 30% at the final call on Day 30; 68% were reached at least once. Overall, 39% (287/729) completed the 2-week follow-up by IVR call and 30% (222/729) did not respond to the IVR call but did complete the follow-up in a live telephone survey.

Counseling CB

Offers of a counseling CB, made only to those who were not smoking or planned to quit within 2 weeks, were made to 59% (213/364) of the IVR + CB group. A total of 127 CB requests were made by 73 participants, representing 34% of those to whom an offer was made and 20% of those randomized to the IVR + CB group. Participants with the strongest intention to quit smoking at baseline ("I will stay quit.") were more likely than others to be offered a CB (74% vs. 51%, $p < .001$) but less likely to request a CB when an offer was made (23% vs. 43%, $p < .005$).

Counselors were able to reach and assist participants in 88% (112/127) of the CB requests. Median call duration was 6 min (interquartile range: 4–10). Telephone counseling sessions included discussion of medications (82%), behavioral strategies for remaining abstinent (63%), or both (53%).

Smoking Cessation

Table 2 presents self-reported 7-day point prevalence tobacco abstinence rates and rate ratios by study arm, calculated for respondents only and for all participants at 2 and 12 weeks after discharge. Participants randomized to the IVR + CB group did not differ from those in the IVR group in smoking cessation rates at either follow-up.

Postdischarge Cessation Medication Use

Rates of self-reported cessation medication use among respondents to the 12-week follow-up are presented in Table 3. There were no significant differences in pharmacotherapy use rates by study arm. In a subgroup analysis, restricted to those in the IVR + CB group who were offered a CB, those who requested a CB were more likely than those who did not to report using NRT (52% vs. 34%, $p < .05$) and any medication (69% vs. 52%, $p < .05$).

Acceptability of IVR System

At the 12-week follow up, 409 participants responded to the question concerning acceptability of IVR systems for following patients after hospital discharge. Overall, a majority (64%) felt such systems were acceptable. There was no difference by study arm.

Discussion

This study assessed the feasibility of replacing a live telephone follow-up call to recently hospitalized smokers with an automated IVR system and tested whether the system could be used to connect patients to postdischarge counseling. We found that the IVR system was acceptable to patients, with a substantial majority agreeing to enroll in the system. The system was reasonably effective at reaching participants, especially in the first few days after discharge. We found no evidence that participation in the system affected smoking cessation rates.

Our IVR system reached participants at rates slightly lower than those seen in previous studies of recently discharged hospital patients. At 3 days after discharge, our system reached 52% of those called, compared to 61% reached in a study of surgical patients (Forster & van Walraven, 2007). Because our study enrolled medical as well as surgical patients, our participants may have been less likely to be confined to home and therefore less available to take calls than surgical patients are immediately after discharge. In the first 30 days after discharge, our system reached 68% of those called at least once over four calls, compared to 74% to 96% reached over three calls in Canadian studies of cardiac patients (Reid et al., 2006, 2007). Cardiac patients have higher rates of smoking cessation after hospital discharge than a general hospital population. It is possible that participants in the Canadian studies were more responsive to IVR calls than ours because they all had cardiac diagnoses and were more motivated to quit. Regional differences may also explain the higher reach rates among the Canadian patients.

The primary goal of the IVR trial was to test whether frequent offers of cessation assistance during the first month after a hospitalization would prove acceptable to participants and improve smoking cessation rates at 2 and 12 weeks after discharge. CB were requested by a third of the participants who were offered them and in nearly 90% of cases the counselors easily reached and counseled the participant. CB were made by the same counselor who had seen the patient in the hospital, providing continuity of care. However, we found no evidence of an association between these offers and smoking cessation at the 2-week follow-up, when only two of the four counseling offers could have been made. At 12 weeks, when the series of IVR calls had been completed, only a small, nonsignificant increase in cessation was seen. The telephone counseling sessions were brief and focused on the participant's chief concerns. It is possible that counseling that was longer in duration or more directive would have been more effective.

The cardinal virtue of the IVR system is its ability to markedly reduce the human effort involved in following patients after discharge, compared to a system in which staff make live telephone calls to patients. In light of this, we encouraged all inpatients seen during the trial period to enroll, without attempting to screen out those who might be unlikely to benefit from the system because they were not ready to quit or were not interested in further counseling. It is possible that a trial with more focused inclusion criteria might have shown greater impact of participation in the IVR system.

Despite the failure of the CB offers to increase cessation, it is notable that a sizable proportion of our participants did request postdischarge counseling. A third of participants who were quit or ready to quit accepted an offer to have their counselor call them, indicating a substantial need for sustained cessation support. Most of those who requested CB reported using cessation medication during the follow-up period. Postdischarge counseling may be helpful in reinforcing teaching about medication that was initially delivered during a hospital stay, a period that can be overwhelming for patients.

Limitations

This study was conducted at a single, large academic medical center, and our findings may not be generalizable to other settings. Our main outcome, smoking cessation, is based on participant self-report, and biochemically confirmed rates might be lower.

Discussion

We found using an IVR system for postdischarge follow-up of hospitalized smokers was feasible, reduced workload, and was acceptable to patients. While we did not find evidence that the IVR calls promoted smoking cessation, many participants used the system to request additional counseling. An IVR system may be a useful tool to channel postdischarge counseling resources to appropriate patients.

Supplementary Material

Supplementary Figure 1 can be found online at http://www.ntr.oxfordjournals.org.

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Decalration of Interest

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