Effects of post-discharge counseling and medication utilization on short and long-term smoking cessation among hospitalized patients

Edward P. Liebmann, Kimber P. Richter, Taneisha Scheuermann, Babalola Faseru

ABSTRACT

Numerous studies have tested the effects of multicomponent post-discharge smoking cessation interventions on post-discharge smoking cessation, and many are effective. However, little is known regarding the relative efficacy of the different intervention components on short or long-term cessation. The present study is a secondary analysis (n = 984) of a randomized controlled trial for hospitalized smokers that took place at two large hospitals in Kansas from 2011 to 2014. All study participants were offered post-discharge quitline services. Pharmacotherapy was recommended during bedside tobacco treatment. The study outcomes were self-reported cessation at 1-month and biochemically verified cessation at 6-months post-randomization. During the post-discharge period, 69% of participants completed at least one quitline call and 28% of participants reported using cessation pharmacotherapy. After controlling for known predictors of cessation among hospitalized smokers, both the number of total quitline calls completed post-discharge and use of cessation pharmacotherapy post-discharge were predictive of cessation at 1-month. After accounting for predictors of cessation and quitting at 1-month, total post-discharge quitline calls was associated with cessation at 6-months (OR [95% CI] = 1.23 [1.12, 1.35], p < 0.001) while post-discharge cessation pharmacotherapy use was not. The results suggest that both engagement in quitline services and use pharmacotherapy independently facilitate cessation beyond the influence of known clinical characteristics associated with cessation. Over the longer term, the effect of engaging in quitline services persists while the effect of pharmacotherapy diminishes. To optimize outcomes, future research should investigate methods to increase utilization of medications and promote sustained counseling engagement in order to sustain the effects of treatment during the post-discharge period.

1. Introduction

An estimated 7 million tobacco users are admitted to hospitals in the U.S. annually (CDC 2010; Wier et al., 2011), and hospitalization has proved to be an effective setting for treating tobacco dependence (Rigotti et al., 2012). Few hospitals treat tobacco dependence (Freud et al., 2008), although effective interventions exist (Rigotti et al., 2012). To be effective, it is critically important for hospitals to provide post-discharge tobacco treatment that includes at least one month of supportive counseling (Wier et al., 2011). Providing smoking cessation medications for patients as an adjunct to counseling significantly improves long term quit rates (Fiore et al., 2008). A number of studies have examined methods for implementing these two elements of care into hospital treatment and post-discharge care planning (Sherman et al., 2016; Rigotti et al., 2016; Rigotti and Stoney, 2016; Richter et al., 2016; Harrington et al., 2016; Fellows et al., 2016; Duffy et al., 2016; Cummins et al., 2016).

Post-discharge smoking cessation treatment providing automated telephone interactive voice response (IVR) counseling calls and free medication increased biochemically verified quit rates by almost two-fold (26% vs. 15%; RR 1.71, 95% CI, 1.14–2.56) in a single site study. This study targeted all hospitalized patients (Rigotti et al., 2014). However, in a multi-site study that incorporated the IVR-to quitline transfer to test the scalability of this approach, the difference in cessation rates was statistically significant at 3 months but not at 6 months after hospital discharge (Rigotti et al., 2016). Few hospital-initiated interventions have evaluated the relative and independent contribution of individual features of multi-component interventions. Cummins et al. (2016) used a factorial design to evaluate the effects of post-discharge quitline and nicotine replacement on self-reported cessation at 6 months. They observed a marginal effect (p = 0.051) for post-discharge pharmacotherapy on 6-month cessation and a non-significant
effect for quitline counseling. Simon (Simon et al., 1997) conducted an RCT of a multicomponent intervention including inpatient counseling, self-help materials, NRT and 3 months of telephone counseling post-discharge vs. self-help materials only. Quit rates were higher in the intervention group. Approximately 65% participants in the intervention arm and nearly 20% in the self-help only arm reported using NRT, however, NRT use was not significantly associated with quitting.

A better understanding of exactly what components post-discharge treatment should consist of would assist with developing better interventions. The focus of this study is to determine the independent effects of post-discharge counseling versus pharmacotherapy for cessation among participants in a study of hospital-initiated smoking cessation. Our analyses examine the effects of each on short and long-term abstinence. We also adjust for the effects of short-term abstinence in order to pinpoint the predictors of long-term abstinence.

2. Methods

2.1. Design and setting

This study is a secondary analysis of data from a clinical trial in which hospitalized smokers were randomized to either warm handoff or fax-referral to state tobacco quitline services for post-discharge treatment (Richter et al., 2016; Richter et al., 2012). State quitlines are effective in helping smokers quit (Stead et al., 2013). The fax-referral arm was the usual tobacco treatment care provided by the hospital tobacco treatment staff. It consisted of a) assessing withdrawal; b) adjusting inpatient nicotine replacement to enhance patient comfort; c) arranging medication prescriptions on discharge; and d) developing a quit plan. Staff fax-referred patients to the quitline on the day they were discharged from the hospital. In the warm handoff arm, staff conducted usual care steps a-c, then immediately linked patients with the quitline via telephone for registration and completion of a quit plan with the quitline provider. Alere Wellbeing provided quitline counseling, which consisted of 5 proactive calls that addressed motivation, barriers, and strategies for quitting and staying quit. Participants were enrolled in two Kansas hospitals with dedicated tobacco treatment interventionists on staff. Informed consent was obtained for all participants. The institutional review boards at both hospitals approved study protocols and measures.

2.2. Participants and procedures

Hospitalized patients who were 18 years and older, smoked at least 1 cigarette within the past 30 days and were planning to stay quit post-discharge were enrolled in the study (Richter et al., 2016; Richter et al., 2012). Tobacco users were identified through the electronic health record (EHR) and consented at bedside. The fax-referral arm was the usual care provided by the hospital tobacco treatment staff. Counseling was provided in one session and consisted of a) assessing withdrawal; b) adjusting inpatient nicotine replacement to enhance patient comfort; c) arranging medication prescriptions on discharge; and d) developing a quit plan. In fax-referral, counselors faxed an enrollment form to the quitline upon patient discharge, and the quitline contacted patients at home to enroll patients in services. In the warm handoff arm, staff conducted usual care steps a-c, then called the state tobacco quitline and transferred the call to the patients' mobile or bedside hospital phone for enrollment and an initial counseling session. Alere Wellbeing (now Optum) provided quitline counseling, which consisted of 5 proactive calls that addressed motivation, barriers, and strategies for quitting and staying quit.

No medications were directly provided as part of the study and prescribing hospital physicians were not part of the study team. However, tobacco treatment in both study arms involved gauging patients' interest in smoking cessation medications. For interested patients, counselors worked with patients' hospital medical teams to arrange medication scripts both in the hospital and on discharge. Additional detail on study procedures are provided elsewhere (Richter et al., 2016; Richter et al., 2012).

2.3. Measures

Total quitline counseling calls for each participant were provided by Optum, the state quitline contractor. Self-reported smoking cessation medication use (nicotine replacement therapy, varenicline, bupropion) at one-month post-discharge was collected from participants via telephone survey at 1-month. The baseline study survey included race and ethnicity, highest level of education, Heaviness of Smoking Index (HSI) (Heatherton et al., 1989), confidence in quitting/staying quit, previous use of smoking cessation medications and other tobacco products. Confidence in quitting was assessed using a single item: “How confident are you that you will be able to quit/stay quit once you are discharged from the hospital?” The item was scored on a 1 (Not at all confident) to 5 (Very confident) Likert scale. The AUDIT-C (Bush et al., 1998), a 3-item measure, was used to assess problem drinking.

In addition, key study data were collected from the EHR. These included: birth date; sex; health insurance; length of stay; whether admission was through the emergency department (ED); and ICD-9 codes for primary and secondary discharge diagnoses. Primary diagnoses were grouped into the major ICD-9 categories. We used a defined list of ICD-9 codes to identify patients with tobacco-related diseases (Lando et al., 2003). Primary or secondary psychiatric disorders were indicated by ICD-9 codes 290-319, excluding 305.1 for tobacco use disorder.

The dependent variables were self-reported 7-day point prevalent abstinence at 1-month (7DPP) and biochemically verified abstinence 7-day point prevalence at 6-months. Self-reported abstinence was assessed during the 1-month telephone survey. Abstinence at 6-months was verified via salivary cotinine. Participants with ≤15 ng/ml salivary cotinine were considered abstinent. Expired carbon monoxide (CO), with a cut-off point of 10 ppm was used to verify abstinence in participants still using NRT (SRNT, 2002).

2.4. Statistical analysis

Nine-hundred eighty-four of the original 1054 participants were included in the present analysis (93.4% of all participants). Participants (n = 70) who were missing at both 1-month and 6-month follow-ups were excluded. Participants included in this study (n = 984) were compared to participants lost to follow-up (n = 70) on all baseline characteristics. The participants who were lost to follow-up were significantly less likely to have health insurance (84.1% vs. 94.3%, p = 0.002), less likely to be at-risk drinkers (14.5% vs. 31.7%, p = 0.004) and less likely to be assigned to the warm-hand off treatment arm (37.7% vs. 50.9%, p = 0.045) than the participants who were not lost to follow-up. Descriptive statistics were calculated for the entire sample as well as stratified by smoking status (abstinent versus still smoking) and outcome (7DPP at 1-month and verified abstinence at 6-months). Logistic regression was used to assess the relationship of the predictor variables and outcome variables. Descriptive statistics for the entire sample and stratified by smoking cessation outcome are presented in Table 1 along with bivariate odds ratios.

We used multivariable logistic regression models to determine the adjusted odds of post-discharge treatment participation (use of counseling and medications) for short and long-term abstinence. In accordance with guidelines for logistic regression, factors with p-values < 0.25 were selected for inclusion in the multivariable logistic regression models (Hosmer and Lemeshow, 2000). Treatment arm, nicotine dependence, gender, age, health insurance and high-risk drinking (AUDIT-C) were included in the multivariable logistic regression models regardless of p-value as these are known confounders of cessation (Hyland et al., 2004). Intent-to-treat analysis was used,
non-responders at 1-month (4.4%) and 6-months (11.3%) were treated as smokers. Rates of missing data on the predictors in the sample were low (0.2–5%). Our outcome measure at 1-month differed from our outcome measure at 6 months (self-report 7DPP versus biochemically verified 7DPP abstinence). Multiple imputation with chained equations (MICE) using 20 imputed datasets was used for both bivariate and multivariable analyses (Royston and White, 2011). The analyses were performed Stata, version 14.1 (Stata Statistical Software: Release 14 [Computer Program], 2015).

3. Results

3.1. Sample characteristics

Baseline descriptive statistics for the overall sample and for smokers abstinent at one and six months are presented in Table 1. Primary reasons for hospitalization have been described in the main outcome paper (Richter et al., 2016). Bivariate odds ratios (OR) assessing the degree of association of each baseline predictor with each outcome are also presented in Table 1. By 1-month, 456 subjects (46.3%) reported abstinence. At 6-months, 267 (27.1%) subjects were verified abstinent. The mean age of participants was 50 years, predominately female (56%), White (71%) and were likely to have with-the-majority had some form of health insurance (94%). The median level of cigarette consumption was 15 CPD and 72% of the sample reported daily smoking (<25/past 30 days). Seventy-two percent of the sample reported smoking within 30 min of waking.

With respect to post-hospitalization treatment engagement, 68.5% of all participants completed at least one quitline call, 28% of all participants reported using cessation pharmacotherapy, and 20% utilized both quitline services and cessation pharmacotherapy. Of participants who used pharmacotherapy, 85% used any form of nicotine replacement therapy, 79% used the nicotine gum or patch, 5% bupropion, and 12% varenicline.

3.2. Bivariate predictors of 1-month and 6-month abstinence

Both post-discharge medication use and counseling participation were associated with cessation outcomes. A greater total number of quitline calls completed was associated with a significantly greater likelihood of abstinence at 1-month (OR [95% CI] = 1.22 [1.13, 1.31], p < 0.001) and at 6-months (OR [95% CI] = 1.30 [1.19, 1.41], p < 0.001). Post-hospitalization pharmacotherapy use was also associated with abstinence at 1-month (OR [95% CI] = 1.39 [1.05, 1.85], p = 0.02) and six months (OR [95% CI] = 1.43 [1.04, 1.95], p = 0.03). Lastly, abstinence at 1-month was strongly associated with abstinence at 6-months (OR [95% CI] = 5.52 [4.02, 7.58], p < 0.001).

Among sociodemographic characteristics, education was the only significant factor at 6 months (Table 1). Having a tobacco-related disease diagnosis and not having a psychiatric diagnosis were significantly associated with the likelihood of abstinence at 1-month, but not at six months. However, risk for heavy drinking, as measured using the AUDIT-C, was associated with a lower likelihood of abstinence at 1-month. With respect to nicotine dependence, HSI was significantly associated with cessation at 6-months.

Multiple participant characteristics were associated with the likelihood of abstinence at one and six months. Of the smoking related variables, daily smoking was inversely associated with abstinence at 1-month and 6 months. Likewise, confidence in post-hospitalization quitting was associated with abstinence at 1-month and 6 months. A longer length of stay (LOS) was also associated with abstinence at both one and six months.

3.3. Multivariable model results

The results from the multivariable logistic regression models are presented in Table 1. By 1-month, 456 subjects (46.3%) reported abstinence. At 6-months, 267 (27.1%) subjects were verified abstinent. The mean age of participants was 50 years, predominately female (56%), White (71%) and were likely to have with-the-majority had some form of health insurance (94%). The median level of cigarette consumption was 15 CPD and 72% of the sample reported daily smoking (<25/past 30 days). Seventy-two percent of the sample reported smoking within 30 min of waking.

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note. OR = odds ratio; HSI = Heaviness of Smoking Index; ED = emergency
department (ED), and a longer length of hospital stay. 

1.09 (0.97, 1.03) 1.13

When adjusting for known predictors of smoking cessation among
hospitalized smokers (Lando et al., 2003), both post-discharge phar-
macotherapy use and total number of quitline calls were associated
with short-term cessation. Only quitline utilization was associated
with long-term cessation. This is consistent with meta-analyses of hospital-
based tobacco cessation studies (Rigotti et al., 2012) and adds to this
literature by describing the independent effects of counseling and
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4. Discussion 

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Of particular note, quitline call engagement remained predictive of
cessation at 6-months even after adjusting for 1-month smoking ces-
sation. Quitline counseling facilitates smoking cessation by increasing
self-efficacy for cessation and developing skills related to coping with
cravings (Schuck et al., 2014). This suggests that quitline counseling
may have helped participants sustain their medication-assisted quit
attempts, and might also be particularly effective for those making
delayed quit attempts well after hospital discharge. One explanation
for this may be that the motivational processes underlying the cessation-

| Table 2 | Multivariable model results. |
|----------------------------------|-----------------------------|
|                                  | One-month 7DPP              |
|                                  | OR [95% CI]                 |
| Warm handoff vs. fax referral     | 0.85 [0.64, 1.13]           |
| Age                              | 1.00 [0.99, 1.01]           |
| Female                           | 1.04 [0.78, 1.39]           |
| Has insurance                    | 1.32 [0.72, 2.41]           |
| Other race                       | 1.52 [0.80, 2.89]           |
| Hispanic                         | 0.69 [0.36, 1.33]           |
| Ed. > high school                | 1.58 [1.15, 2.18]           |
| Smokes ≥25/30 days               | 0.58⁎⁎ [0.42, 0.81]         |
| HSI                              | 0.96 [0.88, 1.05]           |
| Confident                        | 1.22⁎⁎ [1.07, 1.38]         |
| Used other tobacco products      | 1.42 [0.75, 2.67]           |
| Alcohol use disorder             | 0.80 [0.59, 1.09]           |
| Possible depression              | 0.87 [0.65, 1.15]           |
| Psychiatric comorbidity          | 0.72⁎ [0.54, 0.98]          |
| Tobacco-related disease diagnosis| 1.46 [1.08, 1.96]           |
| ED admission                     | 1.51⁎⁎ [1.14, 2.01]         |
| LOS (days)                       | 1.09⁎ [1.06, 1.13]          |
| Used meds. post-discharge        | 1.45⁎ [1.06, 1.99]          |
| Total quitline calls             | 1.25⁎⁎ [1.14, 1.35]         |
| Abstinent at 1 mo.               | 4.67⁎⁎⁎ [3.33, 6.54]        |

Note. OR = odds ratio; HSI = Heaviness of Smoking Index; ED = emergency
department; LOS = length of stay; 7DPP = seven-day point prevalence; Meds = smoking cessation pharmacotherapy (NRT, varenicline, bupropion).
Study location: Kansas, USA; study date: 2011-2014.
⁎ p < 0.05.
⁎⁎ p < 0.01.
⁎⁎⁎ p < 0.001.

promoting effects of ‘teachable moments’ that occur during hospitaliza-
tion (McBride et al., 2003) may wane following discharge. Engaging
in counseling could build on that teachable moment to bolster the self-
efficacy and skills needed to quit at a later date. To improve utilization
of counseling calls, hospitals should ensure patients receive cessation
medications (which has been shown to increase call utilization) and
prepare patients for follow-up calls from the quitline (Burns et al., 2012;
Scheuermann et al., 2019).

Post-discharge use of cessation medication does not appear to have this
same effect. Its effect appeared limited to supporting 1-month ab-
stinence. After controlling for early abstinence it had no independent
effect on 6-month abstinence. The novel feature of the present study is
that we examined cessation at short and long term follow up, measured
participation in both counseling and medications, and accounted for the
effects of quitting at 1 month. No other studies, including the factorial
design trial conducted by Cummins et al., controlled for the effects of
early abstinence. This is perhaps why the study was able to distinguish
between the effects of counseling and medications at 6 months.

The present study also contributes to the existing literature on
barriers and facilitators related to smoking cessation among hospita-
lized smokers. Only one in four used medications post discharge. The
relatively low rate of pharmacotherapy use is notable given the high
rates of health insurance in this sample. Although most private and
public insurers are required to cover cessation medications, compliance
may not be consistent and some proportion of patients may not have
used medications due to inability to get their prescriptions filled.

In addition, Similar to Bentz et al., we found that only two-thirds of
participants, all of whom were referred to quitline, engaged in coun-
seling (Bentz et al., 2006). The effects of confidence and smoking re-
lated-illness observed in the present analysis are consistent with other
studies (Lando et al., 2003; Mackenzie et al., 2004). In addition, the
effects of psychiatric diagnosis and longer length of hospital stay ob-
served in the present analysis coincide with findings from a study of
post-discharge smoking relapse among patients hospitalized for acute
coronary syndrome (Perez et al., 2008).

In contrast to the present study, Cummins’ (Cummins et al., 2016)
factorial experiment achieved a marginal effect for post-discharge phar-
camotherapy on 6-month cessation and a non-significant effect for
quitline counseling. Findings may differ between studies due to dif-
f erent utilization patterns: Cummins’ trial had a lower rate of post-
discharge quitline counseling in the quitline arm (47%) versus the
present study (68%) but achieved a higher rate of pharmacotherapy
utilization (67%) than the current study (29%).

This study has several limitations. The relative contribution of
pharmacotherapy and quitline services to cessation could not be defi-
nitively ascertained due to selection bias—participants were not ran-
domly assigned to receive these interventions. The most motivated
to quit, or able to do so, may have been more likely to use pharma-
cotherapy or engage in quitline services. We tried to control for this by
adjusting for known predictors of cessation. In addition, the study
recruited patients who intended to stay quit post-hospitalization. The
findings may not generalize to other hospital settings or to patients who
are not motivated to quit. In addition, we were not able to measure
whether participants actually filled the prescriptions for medication
they were discharged with, which could have been a meaningful pre-
dictor of cessation.

We were not able to test the phenomenon of reverse causation be-
cause of insufficient data to examine the temporal associations between
individual counseling calls/medication use and smoking status long-
itudinally. It is possible that smokers who were having more success
with quitting were more likely than those who relapsed to persist with
medication use and counseling. Also, odds ratios generated from the
multivariable logistic regression models might overestimate the
strength of association.

4. Discussion

When adjusting for known predictors of smoking cessation among
hospitalized smokers (Lando et al., 2003), both post-discharge phar-
maceutical use and total number of quitline calls were associated
with short-term cessation. Only quitline utilization was associated
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for this may be that the motivational processes underlying the cessation-
5. Conclusions

Post-discharge counseling may have a latent effect on long-term cessation. The benefits of post-discharge pharmacotherapy and quitline services is contingent upon patients accessing and using these resources. Thus, enhancing smokers’ uptake of pharmacotherapy and quitline services—and enhancing medication adherence and utilization of coaching calls—are important and synergistic strategies for improving the efficacy of hospital-initiated intervention.

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Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

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