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E-cigarette use among treatment-seeking smokers: Moderation of abstinence by use frequency

Emily N. Subialka Nowariak[a,*], Rebecca K. Lien[a], Raymond G. Boyle[b], Michael S. Amato[c], Laura A. Beebe[d]

[a] Professional Data Analysts, Inc., 219 Main Street SE, Suite 302, Minneapolis, MN 55414, USA
[b] ClearWay Minnesota[SM], Two Appletree Square, 8011 34th Avenue South, Suite 400, Minneapolis, MN 55425, USA
[c] Truth Initiative®, 900 G Street, NW, Fourth Floor, Washington, DC 20001, USA
[d] University of Oklahoma Health Sciences Center, Department of Biostatistics and Epidemiology, College of Public Health, 801 NE 13th Street, Oklahoma City, OK 73104, USA

HIGHLIGHTS

- Participants with *any* past 30-day e-cig use had a lower quit rate versus no use.
- Less than daily past 30-day e-cig use was associated with lower quit success.
- However, quit success for daily e-cig use was comparable to no past 30-day use.
- Future studies should employ more refined measures of e-cig use.

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ABSTRACT

Introduction: Emerging literature suggests that frequency of use of electronic cigarettes (e-cigarettes) may be an important moderating variable in the relationship between e-cigarette use and smoking cessation. However, few studies have focused specifically on treatment-seekers, a group that may differ in important ways from smokers in the general population. This study looks at the relationship between e-cigarette use frequency and abstinence among a sample of treatment-seeking tobacco users.

Methods: Seven-month follow-up survey data from $N = 2760$ treatment-seeking tobacco users who utilized statewide tobacco quitlines in three states were used to assess the relationship between 30-day point prevalence abstinence and e-cigarette use frequency at follow-up. E-cigarette use was examined in two ways. First, we looked at any use in the past 30 days versus no use. Additionally, past 30-day e-cigarette use frequency was categorized into four groups: 0 days, 1–5 days – infrequent, 6–29 days – intermediate, 30 days – daily. Logistic regression models were constructed predicting 30-day point prevalence tobacco abstinence.

Results: Both infrequent (AOR = 0.35; CI = 0.20–0.59) and intermediate (AOR = 0.50; CI = 0.32–0.80) past 30-day e-cigarette use were associated with lower rates of tobacco abstinence versus no past 30-day use. However, daily e-cigarette users (AOR = 1.16; CI = 0.71–1.70) had similar 30-day abstinence when compared to non-users.

Conclusions: Results from this study of treatment-seekers support findings from studies of general population tobacco users that suggest frequency of e-cigarette use is an important moderating variable in the relationship between e-cigarette use and tobacco cessation. Future studies should employ more refined measures of e-cigarette use.

1. Introduction

Electronic cigarettes (e-cigarettes) first appeared for sale in 2007; marketing and use rose sharply in the years that followed (King, Patel, Nguyen, & Dube, 2015). By 2014, the National Health Interview Survey found an estimated 12.6% of adults in the United States had tried e-

* Corresponding author.
E-mail addresses: esubialka@pdastats.com (E.N. Subialka Nowariak), blien@pdastats.com (R.K. Lien), rboyle@clearwaymn.org (R.G. Boyle), mamato@truthinitiative.org (M.S. Amato), laura-beebe@ouhsc.edu (L.A. Beebe).

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cigarettes (Schoenborn & Gindi, 2015). Not surprisingly, they found that use of e-cigarettes was even higher among tobacco users, with 48% of current smokers and 56% of recent former smokers (quit in the last year) reporting having tried e-cigarettes.

An empirical question for tobacco control is whether e-cigarettes should be promoted as an effective cessation device. The evidence in support of cessation is on-going and not definitive. A systematic review noted that four randomized controlled trials (RCTs) found e-cigarette use to be effective in helping people to reduce or quit smoking cigarettes and that additional observational studies produced promising results (Glasser et al., 2017). A unique challenge for these early trials has been a lack of precision in how e-cigarette use has been defined. Definitions of use are important, because different use patterns are associated with different motivations for use.

Smokers who report using the devices as cessation aids are more likely to continue their use over time than users who report being motivated by curiosity (Pepper, Ribisl, Emery, & Brewer, 2014). Smokers who use e-cigarettes to aid in cessation also tend to use them more frequently than individuals motivated by curiosity. Amato, Boyle, and Levy (2016b) looked at patterns of e-cigarette use frequency in a statewide, population based survey, operationalized as days of use in the past month. They found that infrequent users (use on ≤ 5 days per month) were more likely to report curiosity as a reason for use and less likely to be using e-cigarettes to help them quit, compared to more frequent users. A one year follow-up study of the same cohort found that fewer than half of infrequent users, but more than half of daily users, were still using e-cigarettes (Amato, Boyle, & Levy, 2016a).

E-cigarette use frequency has also been found to be an important moderating variable for smoking cessation. A population-based, longitudinal study in the U.S. found that those reporting at least a month of daily use were more likely to quit than those with zero use, while intermittent users were no more or less likely to quit than non-users (Biener & Hargraves, 2015). Two very recent population-based, cross-sectional studies in the U.S. also found better cessation rates among more frequent e-cigarette users (Giovenco & Delnevo, 2018; Levy, Yuan, Luo, & Abrams, 2017). A longitudinal study of general population UK smokers found that a combination of device type and frequency of use at the time of follow-up was an important moderating factor, with daily tank users being more likely to quit, non-daily cigalike users being less likely, and non-daily tank users and daily cigalike users being no more or less likely to quit as compared to those not using e-cigarettes at follow-up (Hitchman, Brose, Brown, Robson, & McNeill, 2015). One speculative explanation for the difference is that daily use may be required to effectively resist cravings and realize cessation benefits, similar to the importance of adherence to evidence-based forms of nicotine replacement therapy such as lozenge, patch, or gum.

The majority of studies on the relationship between e-cigarettes and cessation have involved smokers with widely varying interest in quitting smoking, and less research has focused on the treatment-seeking populations. Treatment-seeking smokers are a more homogeneous population that may differ in important ways from smokers in the general population, particularly with regards to their motivation for quitting and reasons for e-cigarette use. No published RCTs have looked specifically at e-cigarette frequency and quitting among treatment-seeking smokers, thus observational studies provide the best information to date. Of studies that examined the relationship between e-cigarettes and quitting smoking among those actively enrolled in evidence-based tobacco cessation programs (Pearson et al., 2014; Vickerman et al., 2017; Vickerman, Carpenter, Altman, Nash, & Zbikowski, 2013; Zawertailo et al., 2016), only one study looked at e-cigarette use frequency. Vickerman et al. (2017) did not find a variable that combined frequency (daily versus non-daily) and device type (tank versus cartridge/disposable) to be an important moderator for quitting among their sample of telephone quitline participants.

Our study builds on the small number of previous studies of the relationship between patterns of e-cigarette use and smoking cessation among treatment-seeking tobacco users, by exploring the relationship between e-cigarette use frequency (days of use in the past 30 days) and abstinence from tobacco among treatment-seekers. Specifically, we examine 30-day point prevalence abstinence 7 months post-enrollment among a sample of treatment-seeking tobacco users across three statewide quitline programs.

2. Methods

2.1. Data sources

Data were collected from Minnesota, Oklahoma, and Florida tobacco quitline participants as part of three separate program evaluations. All three state programs offered traditional quitline services – telephone counseling and NRT. In addition, Florida offered a web-based program with NRT and Minnesota offered a 2-week NRT Starter Kit, which is a free 2-week supply of nicotine gum, patches, or lozenges provided to participants, independent of other cessation services. Some participants across the different programs also had access to additional support via text, web and/or email. Independent evaluations were conducted for each state, who share a common evaluator. The enrollment periods overlap but are different for each state depending on the available evaluation data: May 2014 – July 2014 for Minnesota, December 2013 – October 2014 for Oklahoma, and August 2014 – December 2014 for Florida. Eligibility and attrition of study participants are shown in Fig. 1. Participants were given the option to complete the survey by phone or web survey. Sample sizes for individual state evaluation studies were selected based on the unique needs of each state. The current study is secondary data-analysis of evaluation data; its three-state design was not considered during sample size estimation. Survey protocols were similar for each state: random selection of follow-up participants, pre-notification letters, up to 5 email reminders and 15 call attempts over 4 weeks, and monetary incentives ranging from $2 to $10. Response rates were 58.3% for Minnesota, 49.3% for Oklahoma, and 48.3% for Florida. The dataset of survey responders included 1094 Minnesota participants; 1190 Oklahoma participants; and 476 Florida participants, for a total of 2760 participants overall. All participants in the study were tobacco users, with nearly all (96.1%) identifying as cigarette smokers.

2.2. Measures

2.2.1. Frequency of e-cigarette use

The follow-up surveys determined e-cigarette use frequency using

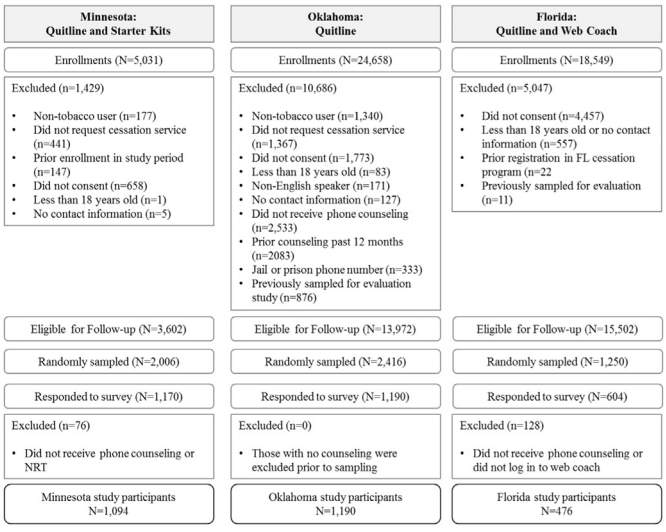

Fig. 1. Study eligibility and attrition by state.