Acceptance of a Prescription for Smoking Cessation Utilizing an I-Pad Educational Application

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Smoking is one of the leading causes of preventable deaths in the United States.\(^1\) Smoking has been one of the most discussed subjects in the healthcare literature for decades.\(^3,5\) Scientists have examined the various aspects of smoking, ranging from the effects of numerous therapies and interventions to stop smoking. Research has confirmed that the ill effects of smoking pose an enormous threat to the public health.\(^4,5\) This has led the government, as well as professional, non-profit organizations to investigate different methods to assist smokers to stop smoking.\(^3,5-7\)

The U.S. Department of Health and Human Services (USDHHS) has established guidelines and recommendations for treating tobacco use as a chronic disease.\(^3,5\) The primary goals of treatment are to lower the healthcare costs associated with smoking and achieve better health outcomes through smoking cessation education.\(^5,8\) Healthcare providers such as nurse practitioners play an important role in implementing effective smoking cessation treatment and educating patients on options for quitting.\(^9\) However, healthcare providers’ adoption rates of utilizing these guidelines for smoking patients has been low.\(^10\) Many barriers and challenges exist, but the top reasons for not applying the changes are the cost of implementation, time constraints and loss of productivity.\(^11\)

**Physiological Effects**

According to the CDC,\(^4\) the addictive element nicotine is an indirect carcinogen; i.e., its addictive properties increase the intake of carcinogens found in tobacco. Tobacco contains nicotine that affects the transmission of nerve signals among neurons, muscle cells and organs.\(^3\) It also has a direct, adrenergic effect causing a release of epinephrine which stimulates tachycardia, hypertension and vascular resistance. Inhaled smoke exerts carbon monoxide
binding in the respiratory system and cardiovasculature, resulting in increased myocardial oxygen consumption and decreased oxygen delivery. At the cellular level, nicotine produces atypical nuclei which is considered a precancerous stage. It further depresses the immune system by altering immunoglobulin levels, reducing natural killer lymphocyte activity and decreasing macrophage adherence. In addition, nicotine activates the receptors within the brain and when a critical level is reached, it results in the depression of the central nervous system.

Nicotine addiction in smokers is dependent on the amount of smoking, rate of absorption and the nicotine concentration. Cigarette smoking has been linked to chronic inflammation of respiratory airways, including frequent bronchial obstruction and chronic bronchitis. The National Cancer Institute reported that long term smoking has a lethal effect associated with lung cancer. In addition, there has been a strong association found between smoking and cardiovascular diseases. There is a threefold increased risk of having a heart attack in smokers compared with non-smokers. Cigarette smoking is a strong risk factor in abdominal aneurysms, peripheral vascular disease, stroke and heart attacks.

The overall quality of life and life satisfaction appear to be reduced in smokers with associated higher morbidity and mortality rates. There are a broad number of diseases associated with smoking. The burden of smoking includes a 33% higher workplace absenteeism rate, increased health care costs including more hospital days, outpatient visits, and longer nursing home stays. Non-smokers have the lowest annual healthcare expenditures compared to active and former smokers.

**Review of the Literature**

Zwar and Richmond reviewed multiple meta-analyses addressing primary healthcare providers’ such as nurse practitioners having “golden opportunities” to intervene with smokers to
quit smoking. Zwar and Richmond\textsuperscript{14} recommend that general practitioners should develop their practice to include providing smoking cessation advice to smokers. The authors also confirmed that general practitioners have access to numerous smoking cessation pharmacotherapies, referral models and knowledge of evidence-based guidelines to implement smoking cessation interventions.

More than 20\% of adults over the age of 18 years smoke cigarettes in the US.\textsuperscript{15} This equates to 50 million Americans of various backgrounds.\textsuperscript{5} Smoking has been found to have a direct link to cancers in the lung, oral cavity, larynx, bladder and renal pelvis.\textsuperscript{3,6,7} Smokers are at greater risk for blood clotting diseases that can cause heart attacks, strokes or blood vessel blockages in the body.\textsuperscript{7} Cigarette smoking is the direct cause for chronic obstructive pulmonary disease that affects lung compliance and can fuel frequent respiratory infections and disorders.\textsuperscript{7} Furthermore, smokers can develop emphysema throughout the years of smoking with frequent bronchial obstruction and chronic bronchitis.\textsuperscript{8,12} Eighty percent of all lung cancer deaths and 90\% of deaths from chronic obstructive lung disease is related to smoking.\textsuperscript{3}

Besides smokers, individuals exposed to secondhand smoke can be damaged by the sidestream and mainstream smoke of cigarettes. There is sufficient evidence to infer a causal relationship between active smoking and respiratory symptoms in children and adolescents, including coughing, phlegm, wheezing and dyspnea.\textsuperscript{4} Children exposed to secondhand smoke have been found to have more frequent respiratory tract disorders.\textsuperscript{16} According to the American Cancer Society,\textsuperscript{7} 150,000 to 300,000 children annually under the age of 18 months have lower respiratory tract infections that are associated with second hand smoke. Approximately 7,500 to 15,000 children of smoking parents are hospitalized each year for lower respiratory tract infections and have a higher tendency to be admitted to critical care units.\textsuperscript{6} Moreover, there are
complications associated with children’s lung growth after exposure to secondhand smoke.\textsuperscript{6} Bronchial asthma can be profound in young children with smoking parents.\textsuperscript{17} As many as 300,000 new cases of bronchitis and pneumonia in children under the age of 18 months are found to be associated with secondhand smoke.\textsuperscript{4} Children that live in smokers’ households, experience more middle ear infections, which is the most common cause of hearing loss in children.\textsuperscript{4,6} Short term effects of smoking exposure are coughing and throat irritation that can lead to an increase in heart rate and blood pressure in all ages.\textsuperscript{16,18}

In a systematic review by Asfar, Ebbert, Klesges, and Relyea\textsuperscript{15} on smoking reduction interventions, indicated that pharmacological interventions can significantly reduce smoking rates. For that reason, pharmacological interventions should be one of the primary methods to help patients to stop smoking. Nicotine replacement therapy can double the chances of quitting smoking.\textsuperscript{5} Pharmacotherapy assists with decreasing withdrawal symptoms.\textsuperscript{5} Currently, there are five nicotine replacement therapies available in various formats, including: patch, gum, oral inhaler, lozenge and nasal spray.\textsuperscript{7} Other medications, such as Bupropion and Varenicline, are available to assist with smoking cessation.\textsuperscript{5,7} Bupropion is an atypical antidepressant which in low doses reduces nicotine cravings.\textsuperscript{7} Varenicline is a partial nicotinic agonist, therefore it can reduce cravings and makes smoking less pleasurable.\textsuperscript{7}

Using information technology to disseminate smoking-related mortality and morbidity information has been successful in promoting tobacco cessation.\textsuperscript{19,20} A study with tailored smoking cessation messages in family practice settings had positive effects among moderate to light smokers.\textsuperscript{21} In another study, a computerized tailored smoking cessation program was effective in increasing smoking cessation rates among the general smoking
population. Technology was useful as an adjunct to medical advice when followed with pharmacotherapy among adult smokers.

Finkelstein and Cha researched fifty-five smokers in a hospital setting and a mobile application was used for educational purposes to enhance tobacco cessation knowledge. Knowledge gain was measured, and the main components included initial knowledge level, employment status, and high application acceptance. The results indicated an increase in patients who wanted to quit.

Currently, smartphones are 35% of the mobile phones used in the US. In addition, seven in ten smokers want to quit smoking and over half of smokers attempt to quit every year. Patients having the ability to review educational information on a smartphone or iPad are beneficial in aiding smokers to stop smoking.

**Smoking Cessation Guidelines**

The effects of smoking are detrimental to individuals and the public health, therefore helping people to stop smoking is one of the top healthcare initiatives. Decreasing the risks of tobacco-related illnesses is a top priority of the US Surgeon General. However, variations in clinical practice and inconsistent tobacco cessation education content can create barriers for success.

The latest guidelines set forth by the Surgeon General, the Agency for Healthcare Research and Quality, and the CDC recommend a smoking cessation strategy called the five A’s for healthcare providers. The five A’s stands for Ask, Assess, Advise, Assist and Arrange. With the modern technological advances, mobile technology is a useful tool for providing consistent educational aid in the primary care setting, incorporating the available tool that is proven valid with evidence-based data.
Phase I Research

Recently, a research study was conducted at a CA, privately-owned family practice clinic. The clinic sees an average of 60 to 100 patients a day. Upon the patient’s arrival at the office, the medical assistants gathered the patient’s health history including whether the patient was a tobacco user. This step is the “Ask” step of the five A’s. 25 As part of the standard practice, the nurse practitioner assessed the tobacco user’s readiness to quit as well as advising the user to quit. Based upon the patient’s responses, the steps for “Assist” and “Arrange” were provided. Choices of pharmacotherapy were discussed, and prescriptions were provided to interested patients. Follow up appointments were arranged by the clinic staff.

Medical assistants entered patient smoking history into the clinic’s health records. The nurse practitioner reviewed patient health records. A data extraction form was used to record the number of patients who were smokers visiting the clinic in a 10-day period, their demographic information and who did or did not participate in the current standard of care smoking cessation education session. The educational session was three to five minutes and patients who did or did not accept a pharmacotherapy prescription were recorded. These data comprised the baseline benchmark for the research.

Phase II Research

In phase II of the study, an innovative, new standard of care was implemented. The new standard of care utilizing the same five A’s 25 but with the addition of a mobile application in the education of smoking cessation.

There are numerous applications (apps) for stopping smoking, but the majority of them are for tracking smoking daily habits. Table I depicts some of the available apps for smoking cessation the researchers recommend.
| Application          | Type of Application       | Web Site                                                                 |
|----------------------|----------------------------|--------------------------------------------------------------------------|
| Stop Smoking         | Tips/advice                | https://appadvice.com/app/stop-smoking-pro-quit-the-cigarette-addiction/933597884 |
| SmartQuit            | Tracker                    | http://www.doh.wa.gov/YouandYourFamily/Tobacco/SmartQuit                 |
| No Smoking           | Diary                      | https://itunes.apple.com/us/app/no-smoking-diary/id939134649?mt=8         |
| Quit Advisor Plus    | Tracker                    | https://appadvice.com/app/quit-advisor-plus/861240366                     |
| Trigger Monitor      | Tracker                    | https://itunes.apple.com/us/app/trigger-monitor-the-breaking-bad-habits-program/id663321017?mt=8 |
| QuitNow              | Tracker                    | http://quitnowapp.com/en                                                  |
| Quit Smoking Now     | Education, meds, learn health benefits | https://play.google.com/store/apps/details?id=com.EAGINsoftware.dejaloYa&hl=en |

The numerous apps available with educational materials were reviewed and the app selected had the easiest reading level and was consistent with the smoking cessation guidelines on the five A’s including current medications available for clinicians to prescribe for eligible patients. An iPad application, *No Nonsense*, a tobacco cessation education app was selected to enhance the education session. *No Nonsense* is an educational tool to use with patients to watch while teaching patients about smoking cessation (3-10 min). Clinicians can provide the education verbally and/or through written materials. Smoking cessation guidelines encourages clinicians to ask all patients if they smoke and if they do, if they would be willing to participate in a brief tobacco cessation education session. The goal of the education session was to provide pharmaco therapeutic assistance to all patients for whom it is not contraindicated.

Currently, smoking cessation education and counseling is a billable treatment. Healthcare providers can be reimbursed for providing this intervention along with the office visit fee. Billing is according to the time spent with the smoking patients. The CPT (Current Procedural
Terminology) code 99406 is for smoking and tobacco use cessation counseling visits lasting at
least three to 10 minutes. CPT code 99407 is for greater than 10 minutes of smoking and tobacco
use cessation counseling. Thus, enhancing the standard of care by adding tobacco cessation
education is not only good for patients, it is good for the clinic practice. Patients were told that
the app is available to download through Google Play Store for the android phone or the App
Store for the I-phone.

Medical assistants collected the initial data as in Phase I. Data from the data extraction
forms were entered into an analytical database, verified, and cross-checked by the researcher.
Data were subdivided into those patients seen during the baseline period and patients seen during
the enhanced educational period. Data were analyzed using Predictive Analytics Software
version 20.0 (SPSS/IBM, Inc. Chicago, IL). These data were compared to the baseline
benchmark.

Descriptive statistics were analyzed on the demographic characteristics of each group
including frequencies, percentages, means, and standard deviations. Inferential statistics were
used to compare the two groups on the primary outcome, acceptance of a prescription
for pharmacotherapy, and (b) the secondary outcome the number of the five A’s
completed. Inferential statistics were used to conduct unplanned sub-group analyses to determine
whether Phase II patients who accepted a prescription were different from
those who refused. Comparisons were made of gender, ethnicity, age, number of years
smoked, and number of cigarettes/cigars smoked per day.

Results

Subjects ranged in age from 21-65, 86%, of women accepted a prescription, but only
15% of men did, $2 (1) = 9.38, p = .002$, ES = 70%, 95% CI [25%, 86%]. Eighty percent of non-
Hispanic patients accepted a prescription, however only 27% of Hispanics accepted a prescription, $2 (1) = 4.44, p = .04, ES = 42\%, 95\% CI [2\%, 71\%]$. All the patients (100%) who had previously attempted to quit smoking accepted a prescription, but only 29% of those who had never attempted to quit smoking, accepted a prescription, $2 = 5.29, p = .02, ES = 71\%, 95\% CI [10\%, 87\%]$. Only, three of 29 patients (10%) who received the standard tobacco cessation counseling accepted a prescription to assist with quitting smoking, while eight of the 20 (40%) who received counseling using the *No Nonsense* application, accepted a prescription, $2 (1) = 5.98, p = .01$. The enhanced counseling was most effective among non-Hispanic patients ($p = .04$), women ($p < .01$), moderate smokers ($p < .01$), and patients who had attempted to quit smoking previously ($p = .02$). Table II summarizes the results of Phase I and II.

Table II Summary of Phase I and Phase II

| Phases                   | I   | II  |
|--------------------------|-----|-----|
| Male                     | 29  | 13  |
| Female                   | 9   | 7   |
| Hispanic                 | 23  | 15  |
| Non-Hispanic             | 6   | 5   |
| Never attempted          | 27  | 17  |
| Attempted to quit once   | 1   | 3   |
| Attempted to quit twice  | 2   | 0   |
| Accepted RX              | 3   | 8   |

**Implications**

The results have numerous implications for NPs. They indicate that an application such as *No Nonsense* can be used to increase the effectiveness of tobacco cessation counseling in primary care. Therefore, primary care providers not only need to use standard smoking cessation education but incorporate a mobile application like *No Nonsense* to assist their patients in stopping smoking. These results clearly indicate that an iPad or other mobile device using the *No*
**Nonsense** app can be used to increase the effectiveness of tobacco cessation counseling in primary care. Additional research needs to be conducted on which application enhances stopping smoking in patients’ best.

This intervention has the potential to change healthcare practice nationally. It provides a strategy that (1) can easily be implemented in the primary care setting with startup costs of only $200 to $400 per practitioner, (2) has no maintenance costs, (3) will increase revenue to the practice by adding a billable service from 5% to 20% for office visits (depending on the smoking rate of the population served), and (4) most importantly, is effective in reducing primary and secondary exposure to tobacco/smoking, a robust risk factor for respiratory, cardiac, and cancer conditions in patients of all ages.

Many smoking cessation programs are effective in reducing the effects of smoking. There is a positive dose-response relationship between the intensity of counseling and quit rates. With today’s mobile technology, healthcare providers can easily tailor smoking cessation counseling during patient encounters. Therefore, a simple technological enhancement to a standardized smoking cessation intervention such as *Nonsense* can increase the amount of time spent and information delivered to patients and is likely to increase quit smoking rates. The specific techniques implemented in this research increased the effectiveness of smoking cessation education and represents an opportunity to increase the quit rates among the 70% of smokers who visit a primary care provider each year.

The research employed a low-cost tablet computer and a free app to focus the patient’s attention on participatory smoking cessation education. Results showed that smokers who viewed the app’s cessation information on the tablet were more likely to
accept pharmacotherapy to aid with quitting smoking. In addition, patients successfully completed the five A’s steps as specified in the recommended guidelines. 

Clinical smoking intervention in primary care settings can improve quality, access and outcomes of smoking cessation. The degree of improvement depends on the sophistication of the intervention as well as the smokers’ choices. If all clinicians used a mobile technology to provide smoking education, conceivably the rate of accepting pharmacotherapy could be quadrupled. Healthcare providers can incorporate mobile technology in their daily medical practice to address smoking cessation along with the five A’s of smoking cessation intervention. This can be achieved with every appropriate patient encounter to capture the opportunity to educate patients on stopping smoking. From identification of tobacco users to providing them with a short, three-minute motivational face to face education, clinicians can educate their patients to quit smoking, for health improvement reasons and for their family members’ health.

Summary

This research confirmed that smoking cessation education enhanced with mobile technology, specifically an iPad app, can improve the rates of patients accepting pharmacotherapy for tobacco cessation in a primary care setting. Incorporating mobile technology in smoking cessation education is an effective, innovative approach to tobacco cessation. This represents an opportunity for FNPs to increase rates of delivering tobacco cessation education and highlights the need for clinicians to go beyond providing smokers with a simple admonition to quit. Instead all FNPs should follow the guidelines below:

- All patients should be asked for their smoking/tobacco use status.
- All smoking patients should be assessed for their readiness to quit.
• All smoking patients should be advised to quit; the utilization of an iPad in this step can boost the initial quit rate by providing tailored education and support for abstinence on a continuing basis, increasing the patient’s knowledge of supportive lifestyles and strategies with each visit.

• All smoking patients who express an interest in quitting should be introduced to the different types of pharmacotherapy available for stopping smoking. Using an iPad app at this stage can give smokers the information on choosing the appropriate type of pharmacotherapy that matches their needs and values.

In conclusion, all smoking patients, who are willing to receive a prescription, should be automatically scheduled for follow up to monitor their use and response to pharmacotherapy, to reassess their readiness to remain smoke free, and to advise them on additional strategies to support their continued smoking abstinence. Returning patients who continue to use tobacco, should be reassessed using the five A’s to find appropriate quitting strategies and support their renewed quit attempts. Do not give up on the smokers since a seed is planted in their mind to quit as it holds a great promise for future adherence with good follow up.

**Keywords:** Smoking cessation, mobile technology, patient education, stop smoking apps

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