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Final Capstone Project

Tobacco Treatment in College Health

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University of Kentucky

College of Nursing

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DNP Capstone Project Overview

The college years are a critical time in the development of smoking behavior and tobacco use. Smoking is linked to 30% of cancer deaths, 80% of deaths from chronic obstructive pulmonary disease and early cardiovascular disease and death. Effective treatment interventions at this time provide an opportunity to drastically reduce premature morbidity and mortality.

This document follows the progression from the discussion of the problem to evaluation of an intervention. The first manuscript is a review of existing literature on Internet interventions with young adults, including methodology, theoretical frameworks and outcome measures for tobacco treatment to guide the development of a program in college health. The second manuscript describes the use of a guide such as Rosswurm and Larrabee's model for evidence-based practice in the development of an innovative intervention. The third manuscript incorporates information from the first two manuscripts in the evaluation of an email-based intervention using Certified Tobacco Treatment Specialists and peer coaches for the treatment of tobacco dependence in college students.

Section A: Manuscript 1: A Review of the Evidence on Technology-based Interventions for the Treatment of Tobacco Dependence in College Health

BACKGROUND

The importance of targeting tobacco use in young adults or college student population

The college years are a critical time in the development of smoking behavior and tobacco use. Despite knowledge of the long-term health effects of tobacco,¹ one-third of college students start or become regular smokers during their undergraduate years.²⁻⁷ If all tobacco products are included, the results are even more alarming. Including cigar use, snus, smokeless tobacco and hookah or waterpipe, it is estimated that between 28.8-48.3% of college students have used one or more tobacco products in the past month.⁸⁻¹⁰ Smoking is linked to at least 30% of all cancer deaths, almost 80% of deaths from chronic obstructive pulmonary disease, and to early cardiovascular disease and death.¹¹ More immediate health effects on young adults include increased respiratory symptoms, such as shortness of breath, increased breathlessness after exercise, persistent cough, and wheezing.^{12, 13} For young women, smoking increases the risk for developing high-grade cervical lesions and cervical cancer^{14, 15} as well as premenstrual syndrome.¹⁶ Tobacco use may also have harmful effects on academic success.^{2, 8}

According to the United States (U.S.) Surgeon General, research suggests that most of the deaths related to smoking and tobacco use can be eliminated with successful cessation before age 30.^{17, 18} Effective interventions treating tobacco dependence during young adulthood provide an opportunity to drastically reduce premature morbidity and mortality and may also improve academic achievement. The purpose of this paper is to review the

available evidence on email, text and other Internet interventions with young adults, including methodology, theoretical frameworks and outcome measures for tobacco dependence treatment to assist in the design of interventions in college health.

Interventions for the treatment of tobacco use and dependence

The updated U.S. Public Health Service-sponsored Clinical Practice Guideline (CPG) for treating tobacco use and dependence¹⁹ provides recommendations for clinical interventions for treatment in adolescents and adults. This systematic review of 8700 articles and abstracts provides the basis for more than 35 meta-analyses of interventions and also provides guidance on evaluating outcomes of studies. Although the gold standard for follow-up after the intervention is six months, shorter time frames are acceptable according to the CPG.¹⁹ Abstinence data should be reported based on the occurrence of tobacco use within a specified time period or point prevalence (usually 7 days) prior to the follow-up assessment and should use an intention-to-treat (ITT) approach in which all subjects are included in the denominator, even those lost to follow-up.¹⁹ Biochemical confirmation of self-reported abstinence of tobacco use with exhaled carbon monoxide (CO) or salivary cotinine is desirable, but not necessary.¹⁹

Key guideline recommendations include: identifying tobacco use by “asking” at every visit; “assessing” the tobacco users willingness to make a quit attempt; “assisting” in quitting by providing counseling and one of the seven first-line medications; and “arranging” for follow-up contact.¹⁹ Brief interventions, motivational interviewing techniques and telephone quitlines were found to be effective strategies in adults. For adolescents, interventions that varied in intensity, format, and content yielded significant results, but there were too few studies to perform meta-analysis on specific counseling

techniques and little evidence on the use of medications.¹⁹ The group aged 18-24 years is sometimes included in discussions about adolescents and other times included in discussions on adults; specific recommendations for the population of young adults and college students are not outlined in the Guideline.

An algorithm for choosing among smoking cessation treatments presented by Hughes,²⁰ using an evidence-based approach, suggests a brief assessment of the smoker's prior quitting history followed by one or two medications and counseling in most people.

Internet counseling formats are recommended as second-line treatment due to limited, but efficacious studies.²⁰ Hughes' population focus was adults; he did not specify treatments for younger adults or college students.

Internet interventions

According to Fiore et al.,¹⁹ E-health or Internet based interventions show promise as an effective delivery system and may be combined with more traditional therapies; they may include email, websites, computer generated reports or other components. A systematic review of Internet-based interventions for smoking cessation²¹ suggests that although these types of interventions may assist with cessation, there is a lack of consistent results. Interventions that are interactive, requesting information from participants about their tobacco usage and triggers to tailor information, may be more effective than more passive methods where material is displayed on static websites.²¹ Larger effects may also be seen when Internet interventions are included along with other more traditional methods.²¹ A meta-analysis of randomized controlled trials (RCT) with 29,549 participants enrolled in Web-based or computer-based smoking cessation programs and 13, 499 enrolled in control groups indicated sufficient clinical evidence to support the use of these programs

for adult smokers.²² Although adolescents and young adults were included in the meta-analysis, the mean age of participants was 38 years. The following discussion focuses on a variety of interventions targeting young adults or college students.

Interventions for young adults or college student population

Grimshaw and Stanton²³ evaluated the effectiveness of strategies designed to help young people quit smoking, but limited their review to ages 20 and younger. Their systematic review of 15 trials (n=3605) suggests that complex interventions addressing characteristics of young adult smoking and incorporating elements sensitive to the stages of change outlined by the Transtheoretical Model (TTM) show promise with pooled odds ratio (OR) at one year of 1.70 (95% CI 1.25-22.33).²³ Studies evaluating pharmacological interventions in adolescents did not achieve statistical significance or were very small scale.²³

Over half of college-aged smokers would like to quit, but many underestimate the addictive power of nicotine and most did not use any of the recommended treatment methods during prior quit attempts.^{2, 24-27} Significant proportions of the young adult population can be reached by offering tobacco dependence treatment through their educational settings, including college health service.³ In a previous review of interventions to reduce tobacco use on U.S. campuses, Murphy-Hoefer²⁸ found fourteen studies, of which only five received a “satisfactory” rating mainly due to the lack of random sampling or a comparison group. One study used computer-administered interventions targeting cigarette smoking; based on the TTM, it demonstrated a higher, though non-significant cessation rate in the intervention group. There was wide variability in definitions of current tobacco use, quit status and duration of abstinence for

the studies, but published reports indicate that interventions can have a positive effect on college tobacco use.²⁸

Self-help programs may be more appealing to young adults and cost effective, especially when tailored to key characteristics of students and based on stages of change.^{29, 30} In a RCT of an age-tailored, self-help program for college students, 11.4 % of students quit compared to 5.6% using the adult-oriented usual care kit.³⁰ Innovative strategies utilizing multi-media, mobile phones and the Internet have shown some success and may be a promising way to assist traditionally hard to reach groups.^{31, 32} Young adults are technologically savvy; most have access at home or at school to computers and many college classes involve on-line discussion groups.

The Internet and mobile phones are available whenever college students choose to access. Unlike the traditional therapies underutilized by young adults, technology-based programs offer convenience and anonymity. Use of these modalities may provide timely, effective interventions to assist in tobacco treatment efforts in this population, but research is lacking or inconsistent.^{3, 19, 23} Previous research has either focused on treatment for tobacco dependence in older adults or primary prevention in adolescents. Young adulthood is a key period in the transition to regular tobacco use; a systematic review of the available literature on effective, innovative, technology-based strategies in this population will add to this relatively new body of knowledge.

METHODS

Identification of Research

The following question guided the search for evidence: what is the available evidence on Internet interventions for tobacco treatment in young adult or college tobacco users? *The*

Cochrane Handbook for Systematic Reviews of Interventions (version 5.0.2) provided guidance in the preparation of the review.³³ The search strategy involved a comprehensive literature search for studies published between 1999- the second week in February 2011. Criteria for considering studies were initially limited to include only RCT. However, when those limits were applied only a few articles were retrieved. Therefore studies with quasi-experimental designs and cohort studies were also included. Participants included those aged 18-30 who used any tobacco product in the past 30 days, without exclusion based on gender, ethnicity or language spoken. Any type of Internet, computer or technology-based intervention, (e.g. e-mail, static or interactive websites), in all settings, with or without other therapies, were included. Studies that only used the Internet for recruitment into smoking cessation programs or did not include outcome data were excluded. The primary outcome measure was status of tobacco use six months after the start of the intervention, as recommended by the CPG, but trials with shorter term follow-up were also included.

Electronic searches were conducted in PubMed, MEDLINE, Web of Science, The Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO and the Cochrane Central Register of Controlled Trials (CENTRAL) using exploded MeSH terms: “young adult*”, “Internet” and “tobacco cessation” as well as searching terms “tobacco” or “smoking” and “internet” or “email” or “web” and “young adult” in the topic, title or abstract with limiting factors for “research,” “human” and “RCT.” Terms were searched independently first and then in combination with one other term, then all terms together. Hand searching of reference lists of articles yielded additional studies for review.

Selection of Studies

Seventy-six studies were initially identified and their abstracts reviewed. After duplicate studies selected from different databases were identified, either by identical title or description in the abstract, 11 articles were excluded. An additional 47 studies did not meet the review criteria. Full-text reports for the remaining 18 studies were examined for compliance with eligibility criteria. Seven studies were excluded because despite including participants ages 18 – 30, the majority were middle aged (mean age ranged from 31.2-43.9 years). An additional three studies were excluded because the participants were high school students (mean age range 14-17 years). Eight studies were identified that met the established inclusion criteria.³⁴⁻⁴¹

Data from relevant trials were extracted according to recommendations by the Cochrane Collaboration to including the following: study design, method of randomization and blinding; participant selection, demographic characteristics, tobacco usage; theoretical framework; intervention description; and outcome measures, including length of abstinence, attrition rate and results (**Tables A1 and A2**). Examining the randomization process, “blinding,” comparability of baseline measurements and outcome measures, assessed publication bias.

Study Quality Assessment

After reviewing the articles, they were assessed using guidelines presented by Melnyk and Fineout-Overholt⁴² and the Cochrane Collaboration.⁴³ According to Melnyk and Fineout-Overholt⁴² key critical appraisal questions need to be answered when evaluating evidence: what are the results of the study; are those results valid; and will the results help me in caring for my patient? Two different worksheets were created that

synthesized recommendations from Melnyk and Fineout-Overholt,⁴² the Newcastle Ottawa Scale,³³ Titler⁴⁴ and the Cochrane Collaboration⁴³ to evaluate the RCTs and the cohort studies. These were utilized to evaluate individual articles for characteristics of the population, design, study variables, relevant outcome criteria, data analysis, and results. The reviewer scored each criterion with a score of “0” if the criterion was not met or not clearly stated or “1” if the criterion was met. According to the Cochrane Collaboration⁴³ for RCTs, if there are no serious design flaws, a study is methodologically sound if the total score is at least six. **Tables A3 and A4** reflect the assessments of quality for the selected studies.

In the RCTs, all participants were randomly assigned via computer-generated programs into treatment or control groups either individually or by group with blinding to assessors, but not providers,^{36-38, 40} an important indicator of internal validity. There were detailed descriptions comparing baseline characteristics of the two groups in all of the RCTs. The characteristics of the participants in the cohort studies were similar.^{34, 35, 39, 41} All of the authors except one³⁹ also reported outcomes using ITT by classifying missing data as if participants were still smoking or using tobacco. The highest attrition rate³⁴ was 46% at six months, but using a conservative ITT analysis the results were still significant.

Data synthesis and analysis

After data were extracted from the full articles it was entered in tables and summarized using a narrative approach. Quantitative analysis was not carried out for this review due to the heterogeneity of the interventions. Instead, detailed information regarding the

characteristics of the interventions, dose and duration, conceptual framework and outcome measurements is presented below along with comments related to study quality.

RESULTS

Four RCT were included in this review^{36-38, 40} and four cohort studies.^{34, 35, 39, 41} **Table A1** summarizes the extracted data.

Demographics of study samples

The average age of participants ranged from 18-25 years for all of the studies; most were recruited from U.S. colleges or university campuses. Overall, there were slightly more females represented than males and most of the participants were white, non-Hispanic. Two of the studies^{38, 40} included all smokers, regardless of interest in tobacco dependence treatment. All other participants indicated an interest in quitting. There was wide variability in the definition of a smoker or tobacco user, from smoking any cigarettes in the past 30 days,³⁸ smoking 1 cigarette per day,^{36, 37, 40} smoking > 28 cigarettes per week^{35, 41} or use of smokeless tobacco within the past 30 days.³⁹ Participants were light smokers, smoking from 9-15 cigarettes per day (cpd) at baseline, consistent with use in the young adult population.^{5, 45, 46} Follow-up periods ranged from 6 weeks to 10 months.

Theoretical Frameworks

Of the eight studies included in this review, five were based on or included elements of the TTM.^{34, 35, 39-41} TTM outlines a series or stages of change involved in the process of behavior change: precontemplation, contemplation, preparation, action, maintenance and termination.⁴⁷⁻⁴⁹ Two utilized some variation of social cognitive learning^{37, 38} which stresses the dynamic relationship between cognition, behavior and environment.⁵⁰ Rodgers³⁶ did not specify a framework.

Intervention components

Most of the interventions involved limited or no human interaction. One intervention consisted of computer-generated feedback delivered by counselors.⁴⁰ Another began with a 15 minute in-person counseling session with the remainder of the intervention via email.³⁷ Three had personal counseling email letters generated by computer programs or peer coaches tailored to stages of change or social cognitive theory either weekly for 4-30 weeks or 10-12 e-mails over a six month period.³⁷⁻³⁹ Three had personalized, automated text messages generated by computer programs and sent to participants' mobile phones at intervals based on user characteristics and specified quit dates.^{35, 36, 41} Other interventions included web-based cessation guides, chat rooms or discussion boards^{34, 35, 38, 39, 41} and feedback provided by computerized questionnaires.⁴⁰ One site required weekly visits and interactive quizzes over 30 weeks;³⁸ another consisted of four web-based sessions with tailored feedback.³⁴

Outcomes

The primary outcome measure for all of the studies was smoking or tobacco abstinence (**Table A2**). How this was defined varied in duration of abstinence and timing of assessment. Five of the studies evaluated self-report of 7-day point prevalence abstinence with biochemical validation using salivary cotinine.^{35-37, 40, 41} Both An³⁸ and Gala³⁹ reported 30-day point prevalence abstinence, but only An included biochemical validation using exhaled CO. Escoffery's³⁴ primary outcome was self-report of quitting, but without indication of duration of abstinence or biochemical validation. Gala,³⁹ Obermayer,³⁵ Riley⁴¹ and Rodgers³⁶ reported assessment 4-6 weeks after intervention, while Abrams,³⁷ An,³⁸ Escoffery³⁴ and Prokhorov⁴⁰ followed participants for at least six

months. Secondary outcomes in four of the studies included self-reports of a reduction in the quantity and frequency smoked or number of dips and chews per day,^{37, 39 36, 41} while the remaining three reported number of quit attempts.^{35, 38, 40} Assessment of participants' perspectives on change or movement in stage of change,⁴⁰ coping and self-efficacy^{39 40,}⁴¹ or program usage³⁴ were also included.

Effectiveness

The expected success rate for adults making quit attempts without intervention is 4-7 percent;¹⁹ all of the studies reported larger effects with their interventions. Only Abrams,³⁷ An³⁸ and Prokhorov⁴⁰ included self-report of 7-day or 30-day abstinence with biochemical validation at follow-up of at least six months as recommended by the CPG. Abstinence rates were 10.2-33.1% for their intervention groups compared to 5.7-16.9% in the control groups; analysis performed by t-tests and chi-square ($p < .05$),³⁷ logistic regression modeling ($p < .001$)³⁸ and linear mixed model regression (two-sided $p = .06$).⁴⁰ Obermayer,³⁵ Rodgers³⁶ and Riley⁴¹ also reported biochemically validated self-report of 7-day abstinence, but only six weeks after enrollment. In the study by Rodgers,³⁶ 13.9% of those in the intervention group quit compared to 6.2% in the control group by chi-square analysis ($p < .0001$). Obermayer³⁵ and Riley⁴¹ reported cotinine-validated 7-day abstinence rates of 17-45% for their cohorts at six weeks. Gala³⁹ indicated that 8% ($n=1$) of participants abstained from smokeless tobacco for 30 days four weeks after enrollment; no biochemical verification. At a 6-month assessment, 25.7% of Escoffery's³⁴ participants reported quitting, without defining what that meant or validating biochemically. There was no difference found in prolonged quit rates (continuous abstinence for 24 weeks) in the studies by An³⁸ or Rodgers.³⁶

Secondary outcomes evaluated additional measures. Consumption was reduced by five to eight cpd^{36, 41} and spit tobacco reduced from 3.9 to 2.9 chews per day³⁹ for those who continued to use tobacco. One of the studies³⁸ noted a decrease in the number of days smoking (from 18.1 to 12.3 days per month), but no difference in the number of cigarettes smoked on those days. Process evaluation indicated participants felt engaged with most of the interventions with most indicating they read emails, text messages and website information.^{35, 37-39} One study lost almost half of its participants before the 6-month follow-up and reported low participation in the discussion board and “Ask-the-Expert” components.³⁴

DISCUSSION

Overall, this review suggests that Internet, e-mail, text messaging, computer or web-based designs have potential for use in interventions for the treatment of tobacco dependence in young adults but much more testing is necessary, particularly RCTs. Using ITT and including those lost to follow-up, all of the studies demonstrated statistically significant improvements in quit rates. Compared to quit rates of 12-33% in reviews of other interventions for young adults and college students,^{23, 28} quit rates of 10-45% presented in this review offer encouraging evidence for strategies in this hard to reach group, but should be viewed with caution. The lack of control groups and short follow-up assessment in studies included in this review fails to produce convincing evidence.

Baseline characteristics of the participants were consistent with those of college tobacco users, strengthening the ability to generalize the results. All of the studies reported data using conservative ITT analyses, which minimizes bias. Four of the studies followed

participants for at least six months as recommended by CPG.^{34, 37, 38, 40} Most also included biochemical verification of self-reports of abstinence.^{35-38, 40, 41}

A major limitation of this review was the paucity of RCTs. Most of the participants indicated an interest in smoking cessation and identified themselves as smokers, contrary to many young adults. Many of the studies' participants were regular, although lighter users of tobacco, smoking 9-15 cpd^{34, 37, 38, 40 41} when compared to the 25.4 cpd in their adult counterparts.^{51, 52} Social or occasional users of tobacco, common in college settings, were only included in one study.³⁸ Other than smokeless tobacco, other forms of tobacco use, such as snus or hookah, were not addressed.

Participants were primarily white, college students, limiting the ability to generalize findings to minority populations and young adults not enrolled in post-secondary education. Studies also neglected to address sub-populations such as lesbian-gay-bisexual-transgender groups who may be a higher risk for tobacco dependence.⁵³

Studies not meeting the criterion for follow-up six months after the quit date limit the ability to generalize for longer-term success.^{35, 36, 39, 41} Participants who were recruited by self-selection may limit the ability to generalize to the broader population and results may not apply to those in the precontemplation stage of change. In addition, high attrition rates of up to 46%^{34, 40} threatened the internal validity of those studies. Although using ITT is standard practice in adult studies, young adults might be lost to follow-up for a variety of reasons not related to continued tobacco use and therefore bias the findings towards no effect.²³

Several studies^{34, 39} did not use biochemical verification of abstinence. According to the Society for Research in Nicotine and Tobacco (SRNT) Subcommittee on Biochemical

Verification,⁵⁴ this may not be necessary or desired as it does not affect outcomes when data collection is done via the Internet with no face-to-face contact for adults. Although An³⁸ and Riley⁴¹ did not find significant differences between those self-reporting abstinence and those in which this was verified, other studies found significant rates of over-reporting of quit status. At six months, self-reported quit rates decreased from 25-10.2% when validated with cotinine levels in Abrams' study,³⁷ from 22-17% in Obermayer's³⁵ study and from 28.1-13.9% for Rodgers.³⁶ Other studies have found similar rates of over-reporting, making the argument for biochemical verification in this population.²³

In studies with multiple components or multiple contacts,^{34, 35, 37-39, 41} it may be difficult to determine the relative contribution of each aspect. One of the interventions utilized computer technology, but was delivered in-person.⁴⁰ Because of the use of multiple components, differences in interventions and number of contacts, it is not clear what types of computer-based applications are most effective. Email and texting, however, are effective ways to communicate with college students and psychological support can be effectively conveyed.^{55, 56} Additionally, the theoretical frameworks used in the studies are similar to those used for more traditional interventions for young adults and provide insight into the value of including tailored messages along with cognitive framing and peer support in treatment strategies.²⁸

There is wide discrepancy in the definition of what constitutes "abstinence" and length of time for follow-up, making it difficult to determine efficacy. There are limited studies evaluating the evidence for any treatment programs in this age group and even fewer that evaluate strategies using current technologies embraced by this population. The paucity

of studies in the young adult population hinders efforts to develop effective evidence-based strategies for the prevention of the transformation of occasional smokers to daily smokers and for treatment in this population. However, the potential for developing useful evidence through research in this area seems strong.

IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

Increased rigor with definitions of smoking/tobacco use, consistency in interventions used and standardized outcome measurements are needed to determine which technology-based methods are most effective. Head-to-head comparisons of different Internet or texting interventions with only one different component in the treatment group would be helpful to determine which aspect of the program is most favorable. Theoretical foundations should be utilized in the design and implementation of programs. An approach for college students using a combination of theories such as TTM with social cognitive theory would address many of the factors associated with tobacco use in this population.

All programs should use evaluation of self-reported 7-day abstinence six months after the start of the intervention as the primary outcome measure to allow for better comparison between strategies. Even with the challenges posed by over-reporting and loss to follow-up due to graduation, transfers and such, it would provide a consistent starting point for appraisal. Ideally biochemical validation should be included, but this may not be practical for smaller studies and those without funding for lab testing. Secondary outcomes should include evaluation of prolonged abstinence through measures of 30-day abstinence or number of days of continued abstinence (not even a puff) to better assesses the more transient nature of tobacco use and quitting in young adults. They should

include use of all tobacco products such as smokeless, hookah and cigars to assess polyuse and ensure participants are not switching to another form of tobacco. Additional well-designed RCTs are needed for young adults with evaluation of at least six months. Studies should include all smokers, not just those interested in cessation to determine the best methods for increasing motivation to quit.

The Internet and/or text messaging may be useful adjuncts to other therapies such as clinic visits or telephone support. Even the addition of one email or text message weekly or monthly by providers may help prevent relapse in a group with the highest rate of quit attempts and highest prevalence of current smoking. Treatment for tobacco dependence is cost-effective when compared to other commonly used disease prevention interventions. According to the CPG,¹⁹ the cost of tobacco dependence treatment per life-year saved is estimated at \$3,539 compared to \$5,200 for hypertension screening in men ages 45-54. The cost per quit for more traditional treatment methods ranges from a few hundred to a few thousand dollars.¹⁹ Abrams' email intervention cost an average of \$39.33 per participant.³⁷ This cost is incremental per user, with possibilities for a high reach, cost-effective strategy to impact behavior in this population.

CONCLUSIONS

Uses of technologies such as the Internet and text messaging have potential as effective tools for behavior-change, particularly with young adults, but more study is needed.

Although this review demonstrated limited evidence for technology-based interventions in this population, knowledge was gained regarding their potential and feasibility.

Conclusive evidence is lacking due to small sample sizes, under-representation of intermittent and all tobacco users, short follow-up time frames and lack of control groups

with randomization. There is a need for affordable, personalized, age-appropriate interventions for tobacco treatment. College health services are moving to electronic medical records with the ability to communicate via email in a secure, private manner. This has the potential to reach large numbers of students, many who may not identify themselves as smokers or seek traditional methods for treatment. The cost is minimal per user and may provide a means to impact behavior in this challenging population.

Table A1.
See Page 61.

Table A2. Outcome measurements for studies

Study	6-months abstinence	30-day point prevalence	7-day point prevalence	Quit	Quit attempts	Reduction	Biochemical verification
An et al. 2008	✓✍	*✓☼	✓☼		✓		✓
Abroms et al. 2008			*✓☼			✓	✓
Escoffery et al. 2004				✓			
Obermayer et al. 2004			*✓		✓		✓
Prokhorov et al. 2008			*✓☼		✓		✓
Gala et al. 2008		*✓				✓	
Riley et al. 2008			*✓			✓	✓
Rodgers et al. 2005	✓✍		*✓☼			✓☼	✓

***Bold type**=primary outcome measure; ✓=present; ☼=statistically significant; ✍=not statistically significant

Table A3. Quality Assessment for RCT

Criteria	An et al. 2008	Abroms et al. 2008	Prokhorov et al. 2008	Rodgers et al. 2005
Randomization adequate	1	1	1	1
Blinding	0	0	0	0
Treatment allocation concealed	1	0	0	1
Groups similar at baseline	1	1	1	1
Eligibility criteria specified	1	1	1	1
Adequate description of intervention	1	1	1	1
Compliance adequate	1	1	1	1
Outcomes clinically relevant	1	1	1	1
Assessment 6 months post-intervention	1	1	1	1
Loss to follow-up described/acceptable	1	0	0	0
Analysis by ITT	1	1	0	1
Total	10	8	7	9

Note: range = 0=12 points; 1=yes, criterion was met; 0=no, criterion was not met or not clearly stated.

Table A4. Quality Assessment of Cohort Studies.

Criteria	Escoffery et al. 2004	Gala et al. 2008	Obermayer et al. 2008	Riley et al. 2008
Representative of population	1	1	1	1
Control group present	0	0	0	0
Appropriate design	1	1	1	1
Adequate description of intervention	1	1	1	1
Compliance Adequate	0	1	1	1
Outcomes clinically relevant	1	1	1	1
Assessment 6 months post-intervention	1	0	0	0
Loss to follow-up described/acceptable	0	1	0	1
Analysis by ITT	1	0	1	1
Total	6	6	6	7

Note: range 0-9 points; 1=yes, criterion was met; 0=no, criterion was not met or not clearly stated.

Section B: Manuscript 2: Tobacco treatment in college health: Development of an intervention using an evidence-based model

Working with young adults on behavior changes like tobacco treatment may be challenging for Advanced Practice Registered Nurses (APRNs) but has potential for impacting the future health of individuals. Utilization of a guide, such as Rosswurm and Larrabee's model for evidence-based practice, is helpful when exploring innovative strategies. This article provides an example of how APRNs may facilitate evidence-based change at the practice level through the development of an Internet based intervention for tobacco treatment in college health.

The Population and the Problem

Smoking and tobacco use results in over 440,000 premature deaths each year in the United States.¹¹ Smoking is linked to at least 30% of all cancer deaths, almost all deaths from chronic obstructive pulmonary disease, and to premature cardiovascular disease and death.¹ Increased respiratory symptoms such as shortness of breath, increased breathlessness after exercise, persistent cough, and wheezing are some of the more immediate health effects in young adults.²⁻⁴ For young women, smoking increases the risk for developing high-grade cervical lesions and cervical cancer⁵ as well as PMS.⁶ Smoking is also associated with lower academic achievement.⁷ According to the Harvard College Alcohol study, tobacco users are 27 % less likely than nonusers to have a grade point average above B.⁸ In addition, tobacco use extracts a high financial toll, accounting for \$167 billion in health care expenditures and productivity losses annually in the United States.¹ Most of the deaths and disease related to tobacco use can be eliminated with successful cessation before age 30.⁹

The college years are a critical time in the development of smoking behavior and other tobacco use. Regardless of when they first tried smoking, the majority of young adults become regular smokers after age 18.¹⁰ Young adults ages 18-25 had the highest rate of current smoking for any population group at 38.4% with somewhat lower rates for those enrolled in higher education: 25.6% of young adults enrolled in college full-time reported cigarette use in the prior 30 days compared with 41.2% of those not enrolled.¹¹ Strategies for preventing and reducing tobacco use in young adults are essential in order to impact the heavy toll tobacco and nicotine addiction put upon our nation. The purpose of this article is to review effective interventions and recommend evidence-based strategies for clinical practice.

Potential Interventions

Many young adults can be reached by offering treatments through college health services; however evidence is limited regarding effective strategies with this population. Most students are unaware of the availability of services on their campuses or unimpressed with the value of resources for treatment.¹² The updated Clinical Practice Guideline (CPG) for treating tobacco use and dependence provides recommendations for clinical interventions for the general population including the “5 As”: “asking” about use at every visit, “advising” all tobacco users to quit, “assessing” willingness to make a quit attempt, “assisting” in quitting by providing counseling and medications, and “arranging” for follow-up contact.¹⁹ Brief interventions, motivational interviewing techniques and telephone quitlines were found to be effective strategies. Interventions delivered through multiple formats and tailored to smoker-specific variables, such as stages of change were rated high or very high.¹⁹ College students and other young adults may not utilize

common treatments or may have negative opinions about the traditional approaches, reflected in gaps in treatment for this population.²⁵ Students who are non-daily smokers, including those who smoke only in social situations, often do not self-identify as smokers and therefore may not perceive a need for treatment.⁵⁷

Interventions need to address students who may not self-identify as smokers, or may be light or occasional users, as even low levels of use presents a health risk. College smokers may underestimate the harm associated with smoking⁵⁸ but the Surgeon General's report on "How tobacco smoke causes disease" makes it clear that every cigarette causes damage at the cellular level.⁵⁹ Young adults may have different perceptions of their risks and needs are likely motivated by different factors than their older adult counterparts.

According to Fiore et al.,¹⁹ E-health or Internet based interventions show promise as an effective delivery system for treating tobacco use at low cost while reaching large numbers of smokers. Young adults are technologically savvy; most have access to computers at home or at school and many college classes involve on-line discussion groups. Intuitively, an Internet-based intervention seems to be a good option for tobacco treatment in college health. Further, college health services are moving to electronic medical records (EMR) along with the ability to communicate via e-mail in a secure, private manner. Use of health information technology (HIT) in this mode enhances the ability to reach large numbers of clients with education efforts, but to ensure this intervention has the desired outcome a systematic process for implementing evidence-based practice is valuable.

Application of Rosswurm and Larrabee's Model to a college health setting

Rosswurm and Larrabee⁶⁰ developed a model to guide practitioners in the shift from intuition-based practice to evidenced-based practice. Successful use of their model has been demonstrated with implementation of evidence-based practice in acute care settings.^{18, 19}The following discussion illustrates application of this model in the development of an Internet-based intervention for tobacco treatment in college health.

The model has six steps:

- Step 1: Assess need for change in practice
- Step 2: Link problem interventions and outcomes
- Step 3: Synthesize best evidence
- Step 4: Design practice change
- Step 5: Implement and evaluate change in practice
- Step 6: Integrate and maintain change in practice (**Figure B1**).

Step 1: Needs assessment

Step 1 of the Rosswurm and Larrabee⁶⁰ model is an assessment of the need for a change in practice. Need has been defined as the difference between “what is” and “what should be”^{61 61} or the gaps, lacks and wants relative to a population and health problem.^{20, 21}

Needs assessment provides a way to define those gaps or specific problems, organize pertinent information into decisions about interventions and help move the planning process from the intuitive phase to the development of effective strategies.²²

To assess the need for change in practice, practitioners collected internal and external data about current practice for comparison.⁶⁰ For the problem of tobacco use in college students at a large Mid-Western university, the need for a change was precipitated by a policy change. As of November 19, 2009, use of any tobacco product (traditional and e-

cigarettes, cigars, chew, snuff, snus, water pipes, pipes, etc.) is not allowed on any university property including classroom buildings, student housing, parking areas and grounds. A multi-disciplinary campus committee began meeting prior to the effective date of the policy to evaluate the need for additional services for tobacco treatment. Members felt current services were underutilized and/or less than ideal. Standard practice at University Health Service (UHS) included individual face-to-face counseling on tobacco treatment and medications as appropriate. Group counseling sessions had been offered, but no students attended. In anticipation of the policy change, two UHS professionals (APRN and a health educator) became certified as Tobacco Treatment Specialists (TTS) in 2008. They began offering counseling on tobacco cessation in November 2008 and provided intensive counseling with 36 patients in 2009, a limited impact for the estimated 6,400 tobacco users based on prevalence rates of 25.6%.²³ Focus groups with students were held to assess the need and interest for alternative treatments. Findings from UHS corresponded with external data. According to national data, half of college-aged smokers would like to quit, but many underestimate the addictive power of nicotine.²⁴ During 1993-2007, young adults, including college students, had the highest quit attempt rate during the previous year, but most did not use any of the recommended treatment methods.^{25, 27} Nurse practitioners are likely to *ask* about tobacco use and *advise* tobacco cessation, but are often inconsistent in providing specific *assistance* to their patients.²⁸ Based on the internal and external findings, the need to develop an intervention for tobacco treatment was identified.

Step 2: “Link problem with interventions and outcomes.”⁶⁰ helps to refine the problem statement. By linking standardized classifications or diagnoses with potential

interventions or activities, process and outcome indicators can be identified.^{17,28} A causal analysis aids in understanding what plays a part in the problem and helps to organize key, contributing factors so that interventions may be planned appropriately.⁶² Key contributing causes or mediating factors of tobacco use in this population were identified and included: lack of knowledge and experience with tobacco treatment, lack of understanding of health consequences, campus-wide tobacco-free policy, community smoke-free law, concern over the amount of effort involved in quitting, social needs, stress, and other developmental issues, along with target marketing by tobacco companies. In addition, tobacco users may not be identified or recruited to participate in programs, or counseling not consistently offered by providers. By making connections between causes or contributing factors and interventions, practitioners may provide more successful, effective services.²¹

Desired outcomes need to reflect patients and healthcare providers, as both impact successful treatment efforts. Process indicators, to be used in **Step 5 (Table B1)**, were selected for providers and included asking all students presenting to UHS about tobacco use, advising tobacco users about the intervention and documenting the diagnosis of tobacco abuse on the EMR. Linking the problem of tobacco use with activities related to the proposed intervention identified additional process outcomes. Outcomes for patients, based on the CPG, will occur six months after the intervention and include self-report of quit attempts, days of abstinence from tobacco, and/or increased motivation to quit.¹⁹ During **Step 3: “Synthesize the best evidence,”**⁶⁰ interventions and outcomes were further clarified. A systematic review of the literature was performed, focusing on the problem of tobacco use in college students, potential interventions and outcomes. A

comprehensive literature search for studies published from 1999-February 2011, in multiple databases including PubMed, CINAHL and PsycINFO was conducted, along with hand-searching of reference lists. Inclusion criteria were: participants ages 18 -30, intervention involved use of the Internet through websites, e-mail or mobile phone text messaging and outcome measurement of tobacco cessation/abstinence.

Six studies met the inclusion criteria (three randomized controlled trials and three cohort studies) (**Table B2**). Most of the interventions involved limited or no human interaction. One intervention consisted of computer-generated feedback delivered by counselors.³⁰ Another began with a 15-minute in-person counseling session with the remainder of the intervention via e-mail.²⁹ Three had personal counseling e-mail letters generated by computer programs or peer coaches who tailored the intervention to stages of change or social cognitive theory either weekly for 4-30 weeks or in 10-12 e-mails over a six month period.^{29,31} Advice was provided to help guide smokers toward preparing for a quit attempt and taking action. Social support was provided to help participants deal with slips, help them problem-solve and deal with difficult situations. Other interventions included web-based cessation guides, chat rooms or discussion boards³²⁻³⁴ and feedback provided by computerized questionnaires.⁴⁰ One site required weekly visits and interactive quizzes over 30 weeks.³² Another consisted of four web-based sessions with tailored feedback³³

With smoking abstinence as the primary outcome measure, there was a statistically significant improvement in quit rates for all of the studies included in the review.

However, because of the use of multiple components, differences in interventions and the number of contacts, it is not clear what types of computer-based applications are most

effective. Overall, this review suggested that the Internet may be an effective intervention channel for tobacco treatment in young adults but more testing is necessary.

Because major gaps in the literature regarding tobacco treatment in young adults exist, program planning may be challenging. Combining the evidence with clinical judgment, it was determined that there was sufficient evidence to support the development of an e-mail intervention tailored to the needs of college tobacco users. Since many health services are moving to EMR and have the ability to communicate via e-mail in a secure, private manner, there is potential to reach large numbers of students, many who may not identify themselves as smokers or seek traditional methods for treatment.

Step 4: “Design a change in practice”

Step 4⁶⁰ requires that practitioners define the proposed change, fully describe process variables, identify necessary resources, plan activities leading to implementation, develop procedures, protocols or standards and delineate desired outcomes.²⁸ This step also entails consideration of theoretical frameworks to guide the intervention, as well as an understanding of organizational change.

The design for the proposed change incorporated theoretical foundations. Practitioners need to understand what and why the problem exists so they may better implement *how* to solve the problem.²² A combination of the Transtheoretical Model (TTM) and Social Cognitive Theory (SCT) was used to guide design of the intervention as they deal with many of the factors associated with tobacco use in this population.

SCT,³⁶ which stresses the dynamic relationship between cognition, behavior and environment, addresses the importance of relationships in the use of tobacco by college students. College smokers may quit more out of concern for those around them and

frustration over social restrictions than perception of health risks.^{37,38} Promoting self-efficacy, increasing positive expectations and enlisting social support are strategies found to be beneficial with behavior change in young adults.^{29,39} Elements of SCT are also woven into the process of TTM.

TTM outlines a series of stages involved in the process of behavior change: pre-contemplation, contemplation, preparation, action, maintenance and termination.⁴⁰

Individuals move through the stages as their motivation to quit smoking increases. This theory has been used successfully to guide other tobacco treatment interventions.¹⁹

Tailoring interventions to the participant's level of readiness may increase the likelihood of movement to the next stage and encourage quit attempts.⁴⁰ Self-efficacy, or one's belief in their ability to quit or make a change, is encompassed in the TTM process.

The proposed change was further defined by weaving fundamentals of TTM and SCT into an e-mail coaching intervention. The intervention includes coaching e-mails written by staff TTS and peer coaches based on templates with elements from both frameworks.^{13,36} They are tailored to the student's stage of change, smoking triggers, and reasons for quitting as well as other factors. Messages might focus on topics such as healthy ways to deal with stress, alcohol as a trigger or undesirable social aspects of smoking, i.e. "my girlfriend thinks it stinks." E-mail was used for the intervention based on findings from the literature review and supported by the focus groups with students. They are sent out approximately weekly over a 3-month period.⁶⁰ Students are encouraged to respond to questions posed regarding their quit attempt and communicate with their coaches for additional support.

With the intervention defined, practitioners need to understand how the proposed change affects the organization. According to Nadler,³⁴ effective implementation of change within an organization involves key action steps such as identifying dissatisfaction with the current state and building participation in the change. UHS had not been successful in identifying and treating tobacco users. Staff members expressed dissatisfaction over this and prevalence rates at the University. Consistent and regular identification of tobacco users has been challenging. Although there are questions regarding tobacco use in the history section of the EMR, providers have not systematically identified tobacco users and documented it as a diagnosis. Occasional or social smokers may still be missed by simply asking, “Do you smoke?” because of the discordance between behavior and smoking identity.³⁵ A recent study by Ridner et al. noted that 20.3% of college students who were current smokers (smoked in the last 30 days) self-identified as non-smokers.³⁵ The environment was conducive to change but involvement of other members of the organization was needed for effective implementation.

To build participation in the change process, representatives from across the clinic were enlisted to form a committee including registration, administration, Information Technology (IT), providers, Medical Assistants (MA), TTS and peer coaches. They provided feedback and support during the development and pilot phase.

Training was provided during staff meetings about the problem of tobacco use in college students along with information about the intervention. MAs and nurses also were instructed to ask about *any* tobacco use in the prior 30 days as part of the vital signs and offer tobacco users “Quit kits” containing information and tools for quitting. The committee performed a review of electronic records for diagnosis of tobacco use to

establish a baseline for comparison and communicated their findings to providers and administrators.

In order to accomplish the goals and objectives of a program, necessary resources must be identified.⁶⁰ The intervention was tested initially with a limited number of students. For the pilot program, existing staff and volunteers provided labor along with a peer coach, hired at a cost of \$1000 per year. Other indirect costs include salary and benefits for the TTS, at no additional cost as they are already part of services offered by UHS, along with space, utilities, quit kits and use of computers.

A fundamental step in the process of change is asking, “how will we know that a change is an improvement” and setting clear, measurable targets.⁴¹ Based on the goal of this intervention- to reduce tobacco use among students on campus- outcome objectives were developed to reflect the desired results along with the process objectives and activities that reflect the manner in which those results will be achieved(**Table B1**).^{62, 63}

Step 5: “Implementing and evaluating change in practice.”⁶⁰

By implementing the intervention on a pilot scale first, knowledge was gained and staff enthusiasm built to sustain the change. From November 2010-September 2011 the intervention was implemented with 50 students who received “Quit Kits” during their clinic visits. Progress toward objectives was closely monitored during this phase and communicated with stakeholders. Participants completed a paper and pencil baseline assessment of their tobacco use, triggers and motivation to quit to help tailor the coaching emails. At the end of the intervention (12 weeks) and again 6-months after enrollment participants were sent emails with a hyperlink to an on-line survey reassessing their tobacco use. These data were compared to a “usual care” group of 138 students who

received “Quit Kits” either prior to the pilot study and those during the pilot timeframe who were not enrolled in the intervention. Information from the usual care group was drawn from the baseline assessment and the on-line survey at 6-months.

Computer records were evaluated to make sure e-mails were sent according to schedule, were evidence-based and to assess engagement with the intervention. This review found that 48% (n=24) of the participants in the intervention group responded to at least one of the coaching emails. Response to the survey at the end of the three month intervention period completed by 28% of the intervention participants (n=14) assessed satisfaction with the program. Participants reported reading most or all of the emails and felt the number was “just right,” but were less sure about how well the emails helped with their attempts to quit.

Table B3 provides details on response rates to the on-line surveys and outcomes for those in the intervention group. At three months, 28.6% of those responding reported 7-day abstinence from tobacco and 21.4% reported 30-day abstinence. Nine (18%) of the intervention participants completed the 6-month survey; 11.1% (n=1) reported 7-day and 30-day abstinence. In comparison, 18 (13%) of the usual care group completed the 6-month evaluation of which 33.3% (n=6) reported 7-day and 30-day abstinence. All those in the intervention group responding to either the 3-month or 6-month survey reported at least one quit attempt of at least 24 hours.

Five members (28.6%) of the usual care group noted they had also received some email coaching on their on-line surveys. Review of their EMR confirmed this, revealing that all five had at least one clinic visit for tobacco treatment followed by additional communication via email with a CTTS. When analysis was repeated using any email

contact as an intervention, 30-day abstinence rates were 35.7% (n=5). Intervention participants were slightly more likely to have had in-person counseling for treatment of tobacco dependence compared to the usual care group (66.7% vs. 50%, p=0.68) based on respondents to the 6-month survey. When the EMR was reviewed for all participants (n=188), those in the intervention were over two times more likely to have had in-person counseling (44 vs. 17.4%, p<0.001). Those in the intervention group were also more likely to have used one or more of the FDA-approved medications to assist with their quit attempt (77.8 vs. 66.7%, p=0.68).

This information was analyzed by team members; they reflected on the results and provided feedback on the process. The response rate to the 6-month survey was low, possibly related to the lack of incentives for completing follow-up along with other factors. Although this created challenges when evaluating the effectiveness of the practice change, knowledge was gained. It appeared one of the benefits to email coaching for college students might be to encourage the use of other evidence-based practices such as individual counseling in the clinic and use of medications. Additional information about the benefits and accessibility of those treatments were included in modifications to the protocol and program prior to clinic-wide implementation of the intervention.

Step 6: “Integrate and maintain change in practice.”

Rosswurm and Larrabee⁶⁰ recommend using feedback from staff, survey data and cost data, and recommendations from stakeholders in making decisions about the future of a program. Team members decided that the addition of email coaching helped fill a gap in providing specific assistance to tobacco-using students at UHS with increased demand

for services. Appointments for tobacco treatment increased by more than three-fold with 111 students seen for in-person counseling in 2011. Stories were shared about students who were still smoking at the end of the pilot study but who returned six months to a year later for another quit attempt – and this time were successful. Staff members appreciated the feedback provided by incorporation of the emails into the EMR so that they could further encourage quit attempts among their patients. The intervention was implemented clinic-wide in November 2011 with continued monitoring of outcomes to guide practitioners as they maintain this change in practice.

Conclusions

Use of an evidence-based model for integrating research into practice can improve the quality of patient care and helps synthesize empirical data with clinical judgment.⁶⁰ An innovative approach to the problem of tobacco use in college health, based on utilizing the best available evidence and incorporating clinical judgment and patient preferences and values, has potential for addressing one of the major causes of morbidity and mortality in the U.S.

Figure B1. Rosswurm and Larrabee's Model for Evidence-Based Practice⁶⁰ Applied to Tobacco Treatment in College Health

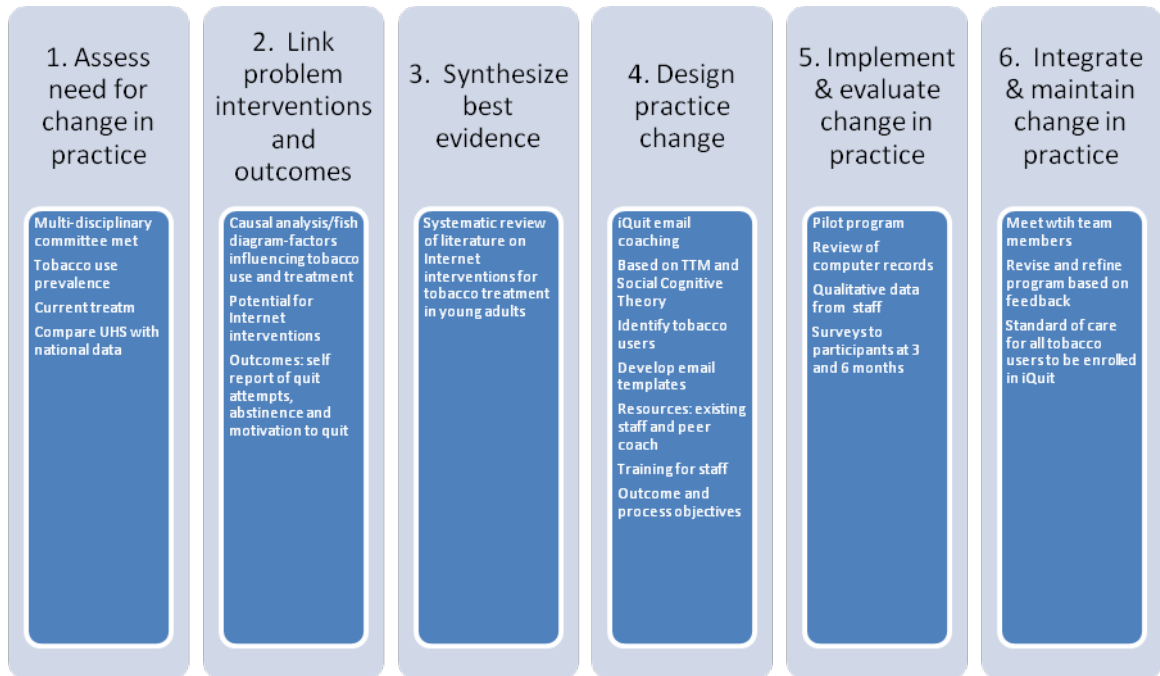


Table B1. Outcome, process objectives, activities, responsible party and data collected.
Goal: reduction in tobacco use by students

Outcome objective	Process objective	Activity	Data collected
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		(Responsible party)	(outcome reported)
1. Participants' self-report abstinence from tobacco (not even a puff) for at least 7 and/or 30 consecutive days.*		Write survey for evaluation (APRN). Send out survey 6 months after enrollment (APRN).	Response to survey questions (% of participants reporting abstinence)
2. Increased identification of tobacco use reflected in diagnosis of tobacco use including nondaily, social smokers and smokeless tobacco users.	100% of patients asked "have you used any tobacco product in the past 30 days" and documented on EMR. 10 % of those who responded "yes" will have documented diagnosis of tobacco use.	Documentation on EMR (MA, LPN, RN) Training for MAs and nursing staff (APRN, TTS) Documentation of diagnosis on EMR (MDs, APRNs) Training for clinical staff (APRN) Review of EMR for documentation annually (APRN)	EMR question complete for every patient (% completed) Diagnoses of tobacco use (% all patients with diagnosis of tobacco use and % of those responding "yes" to template question with diagnosis of tobacco use).
3. Participants indicate a quit attempt of at least 24 hours in the 30 days following enrollment.	Enroll tobacco users in e-mail intervention E-mails delivered according to schedule, as indicated by retrospective computer records	MAs offer 100% of tobacco users a quit kit and complete baseline questionnaire (MA, LPN, RN) Assemble Quit Kits(TTS) Design templates for e-mails including schedule for sending (TTS, APRN, peer coach). Review schedule and e-mails (TTS, APRN, peer coach).	Response to survey question (% participants indicating a quit attempt) Delivered e-mails (% of participants who had all e-mails delivered according to schedule)
4. Participants indicate they read some/most of e-mails sent based on response to on-line survey sent at completion of program.	Participants respond at least once to e-mails sent during intervention	Write and send e-mails (APRN, TTS, peer coach). Write survey for evaluation (APRN). Send out survey at completion of intervention (APRN).	Response to survey question (% participants that select they read some/most of e-mails)

***Primary outcome objective**

Table B2. Characteristics of studies of Internet interventions for tobacco treatment in young adults

Author, year	Participants	Intervention	Outcomes
Abroms, 2008	RCT of 83 undergraduate student	"X-Pack Program" In-person counseling session	7-day point prevalence abstinence at 3-months

	smokers mean age 19.8 mean 9.1 cpd	(15 minutes) Self-help kit Counseling emails generated by staff counselors tailored to stages of change (10-12 over 6 months)	(31.3%) and at 6-months (25.0%) with biochemical verification at 6-months (10.2%)
An, 2008	RCT of 517 college smokers mean age 19.8 mean 14.1 cpd	“ReallU” Weekly peer coach emails Web-based cessation guides Discussion boards Interactive quizzes (30 weeks)	30-day point prevalence abstinence (40.5%) with biochemical validation (33.1%) at 30-weeks
Escoffery, 2004	35 college smokers; average age 21, mean 9 cpd	“Kick-It” Web-based sessions with tailored feedback (2 months) Ask-the-expert via email questions Personal story discussion board	Self-report of quitting at end of intervention (14.3%) and at 6-months (25.7%)
Gala, 2008	18 smokeless tobacco using college baseball athletes mean 3.9 times per day	Interactive website with self-monitoring tools, motivational and educational materials over 4 weeks Computer-generated tailored counseling emails Message board	30-day point prevalence (8%) at 4-weeks
Obermayer, 2004	46 college students ages 18-25 mean 9.5 cpd	Personalized, automated text messages Web-site feedback to view log of messages, track progress and receive support messages from others Educational modules	7-day point prevalence abstinence (22%) with biochemical validation (17%) at 6-weeks
Prokhorov, 2008	RCT of 426 community college students mean age 22.8 years mean 12.5 cpd	“Look At Your Health” Computer-generated feedback delivered by counselors using motivational interviewing approach	7-day point prevalence abstinence (28.5%) with biochemical validation (16.6%) at 10-months

Table B3. Percent of those in intervention group achieving objectives

Outcome objective	Number data available (%)	Percent achieving objective (n)
30-day abstinence at 3-months	14 (28%)	28.6% (4)
30-day abstinence for at 6-months	9 (18%)	11.1% (1)
Made at least one quit attempt	18 (36%)	100% (18)
Engagement with intervention	50 (100%)	48% (24)
Read some/most of emails	9 (18%)	67% (6)

Section C: Manuscript 3: iQuit Tobacco: Evaluation of an email intervention for tobacco treatment in college health

Despite strides made towards reducing tobacco use in the U.S., it continues to represent a major cause of morbidity and mortality.⁵² Quitting at younger ages is associated with greater reduction in premature death,^{18 11} yet this group has the highest prevalence rates. As many as 30% of young adults, ages 18-30, enrolled fulltime in higher education were current (used in past month) smokers; rates for peers not enrolled approach 41%.^{5, 8, 52, 64, 65} Many of those who begin college as occasional or “social” smokers will become regular smokers by the time they graduate.^{3, 4, 66} Prevalence for use of tobacco products such as cigars, smokeless, hookah or waterpipe, e-cigarettes and other emerging products as well as use of multiple products is higher among young adults as well.^{5, 8, 10} The U.S. Surgeon General has placed increased emphasis on strategies to reduce use in young adults.⁶⁷ Consistent with that focus, the American College Health Association (ACHA) recommends that colleges and universities offer and promote practical, evidence-based programs and services to reduce tobacco use among students.⁶⁸ Coordinated, multi-component community strategies recommended by both the U.S. Surgeon General and ACHA have demonstrated effectiveness in reducing tobacco use among young adults.^{67, 68} Since November 2009, the University of Kentucky has had a comprehensive tobacco-free policy prohibiting use of any tobacco product on any university property. To complement this, University Health Service (UHS) began offering treatment for tobacco dependence with two CTTS in the clinic in addition to the provision of free nicotine replacement products (NRT) through the university tobacco-free task force.

Young adults are the most likely group to make quit attempts, but the least likely to use evidence-based recommendations such as counseling and medications.^{19, 27, 64, 65} Although many institutions offer smoking cessation classes, research suggests they are not effective in reducing prevalence.⁶⁹ Reviews of other interventions targeting young adults have shown inconsistent results.^{23, 28} Current services at UHS were underutilized; in-person counseling was only provided to 36 patients in 2009.

In contrast to traditional therapies underutilized by young adults, E-health programs offer convenience and anonymity. Use of the Internet and mobile phone applications may provide timely, effective strategies to assist in tobacco treatment efforts in this population.^{3, 23} More research is needed on the effectiveness of programs that use these technologies tailored to reach this group.^{24, 70} In light of this need, the “iQuit Tobacco” pilot study was designed and implemented to evaluate an email based intervention based on prior research using Certified Tobacco Treatment Specialists (CTTS) and peer coaches with two goals: reducing tobacco use and increasing motivation to quit.⁷¹

METHODS

Participants

Participants were students at a large, Midwestern University, ages 18-30, who were current tobacco users, defined as use of any form of tobacco in the past 30 days. Students presenting for services in the Primary Care and Gynecology Clinics at University Health Service (UHS) were identified, resulting in a non-randomized convenience sample consisting of two cohorts: a usual care group and intervention group (iQuit Tobacco). The groups included enrolled undergraduate and graduate students who were eligible for services at UHS during April 2010-September 2011. They were required to have

computer access and communicate in English. There were no exclusions for gender, race, ethnic background or health status. IRB approval was obtained prior to implementation of study procedures.

Procedure

Usual care in UHS regarding tobacco use

Since October 2009, all students presenting to UHS are asked “have you used any tobacco product in the past 30 days” by the nursing assistant (NA) during intake with their response documented on the electronic medical record (EMR). If they respond in the affirmative, they are offered a Quit Kit containing pamphlets about quitting, flavored toothpicks, putty, and gum. Students complete a paper and pencil baseline assessment collecting demographic information and assessment of tobacco use. They are contacted via email with an invitation to return to the clinic for individualized counseling. UHS has two CTTS offering face-to-face counseling for the treatment of tobacco dependence in addition to counseling provided by physicians and nurse practitioners. Students may be seen as frequently as desired, ideally every two weeks for three months, but the majority are seen 1-2 times and do not return for follow-up. There had not been standardized evaluation of quit status in place. Free nicotine replacement therapy (NRT) products are available through another university program.

Intervention procedure:

In addition to receiving Quit Kits and the usual standard of care, iQuit Tobacco participants also received 10-12 email messages from CTTS and peer coaches tailored to their stages of change over a 12-week period. From November 2010-September 2011, students with a positive response to the tobacco use question were also asked if they were

interested in participating in the study intervention at which time written informed consent was obtained (n=51). The same baseline data collected from the usual care group was obtained. Participants in the usual care arm (n=138) had either received services up to six months prior to the start of the intervention (April-November 2010), were not asked about participation or declined participation in the intervention. Both groups were eligible to participate in other treatments. Usual care members were sent an email with information about the study and a hyperlink to the survey six months after receipt of Quit Kits; consent was implied with completing the questionnaire. The intervention group received emails with links to the on-line survey at the end of the 3-month intervention and six months after enrollment. On-line survey data were collected using Qualtrics software⁷² with no direct contact with researchers. **Figure C1** provides a schematic of the differences in procedures between the two groups.

Intervention

The intervention was a series of email messages based on the Transtheoretical Model (TTM)⁷³⁻⁷⁵ and social cognitive theory⁵⁰, adapted from previous research by Abrams et al.⁷¹ which showed promising results with college students. Messages were tailored to participants' stage of change and designed to promote self-efficacy (**Figure C2**) and sent approximately weekly for three months. The email format was used to address issues cited as barriers to treatment such as lack of time for clinic visits.²⁵ Information was also provided about health effects, the addictive nature of tobacco, second-hand smoke, as well as skills and tools on how to quit. Emails were tailored to use of other tobacco products, smoking triggers and planned quit date. About half the emails were sent from CTTS. The remaining one-half were sent from peer health coaches to enhance social

support and provide positive peer influence during the quitting process. Participants were encouraged to reply to the emails with responses to questions posed.

Measures

Measures for this study were obtained from the paper and pencil baseline questionnaire, review of health-related information on the EMR and on-line surveys.

Demographics

Sociodemographic information including age, gender, academic status, was self-reported on the baseline assessment and on-line surveys.

Tobacco Use

Self-report of current tobacco use was obtained at baseline. Participants were asked to select all types of tobacco products used in the past year and indicate quantity of each. They were asked if they had smoked 100 cigarettes in their lifetime, average number of days per week they used tobacco and number of days since last tobacco use. Nicotine dependence was assessed by the number of minutes to first cigarette/dip after waking.⁷⁶⁻⁷⁸ Tobacco use was reassessed by self-report via on-line surveys at the end of the 3-month intervention for iQuit participants and six months after receipt of a Quit Kit for both groups. The primary outcomes were 30-day and 7-day abstinence. Participants were asked “have you smoked (or used another tobacco product) in the past 30 days/in the past 7 days?” If the response to either question was “yes” they were asked to select all products used and the amount. Secondary outcomes evaluated reduction in tobacco use, number of quit attempts and days since last use.

Readiness/Motivation/Stage of change

Stage of change at baseline was assessed with the question “when do you plan to quit using tobacco?”⁴⁹ Responses reflected pre-contemplation (“not sure”), contemplation (“in the next 6 months”) and preparation (“in the next 30 days” or “today”).

Two scaling questions assessed motivation and confidence regarding quitting at the baseline assessment.⁷⁹ Scales ranged from 0-10 (0=not at all want to quit/confident in success to 10=very much want to quit/confident in success). Participants still using tobacco at follow-up were asked about their desire to quit while tobacco-free participants were asked about their confidence in not relapsing using the same scales. A scale adapted from The Smoking: Self-Efficacy/Temptation (short form), a 9-item self-efficacy scale⁸⁰ assessed confidence at follow-up with higher scores indicating greater confidence in not smoking.

Use of treatment for tobacco dependence

Participants were asked about their plans for using FDA approved medications to assist with quitting at baseline and whether they actually used medication at follow-up. They were queried about contact with other tobacco treatment services during the study period. Retrospective review of the EMR provided assessment of individual clinic visits for tobacco treatment, contraindications to pharmacotherapy and pertinent medical history.

Satisfaction/Engagement

Participants in the treatment arm were questioned about satisfaction at the end of the intervention. A 5-point Likert scale ranging from strongly disagrees to strongly agree assessed how helpful the emails were with their quit attempt. Additional questions assessed feelings about the number of emails and information provided with responses “too few/little,” “just right,” and “too much/many.” Computer records were reviewed and

engagement was coded as “1” if participants responded to at least one of the emails sent to them and “0” for no response.

Statistical Analysis

Analyses were conducted using 2-tailed tests with $p < 0.05$ level of significance. Variables were assessed for differences between groups at baseline and follow-up using chi-square tests for nominal variables and independent t tests for continuous variables. Paired t tests were used to compare responses over time. All statistical analyses were completed using IBM® SPSS® statistical software version 20. Analysis was performed and reported in two formats: (1) using an intention-to-treat (ITT) model assuming all participants with missing data were still smoking/using tobacco and (2) for those with follow-up data at the 6-month interval.

RESULTS

Baseline characteristics

Between 11/1/2010-9/30/2011 fifty-one participants were enrolled in the intervention group. One participant withdrew after the first week, so her data were not included. The usual group included 138 Quit Kit recipients meeting inclusion criteria between 4/1/2010-9/30/2011. Of that cohort, 18(13%) completed the 6-month survey compared to 9(18%) of the iQuit participants; the difference in completion rates was not significant ($p=0.39$). Of the 50 intervention participants, 13(26%) completed the on-line survey at 3-months; 5 (10%) completed both surveys. There were no differences between the responders and non-responders for all but one of the demographic variables. Graduate or professional students made up the largest percentage of respondents with 11(40.7%)

compared to 6(22.2%) Freshman, 2(7.4%) Sophomores, 4(14.8%) Juniors and 4(14.8%) Seniors ($\chi^2=16.45$, $p=0.002$).

No differences in demographic characteristics were detected between the comparison and intervention groups at baseline (**Table C1**). Participants were on average 22 years old. There were slightly more males than females. Most were undergraduate students with 49% juniors or seniors. Although the majority had a negative medical history, 25% reported depression, anxiety, bipolar disorder or other psychiatric illness, reflecting common co-morbidity in young adult smokers.^{64, 81}

There were not significant differences between groups for most of the tobacco variables. Overall, 95.2% smoked cigarettes in the prior 30 days with average use of 10 cigarettes per day (cpd) (**Table C2**), consistent with light use in this population.^{5, 45, 46} Similar to other studies, polyuse was 13% overall.^{10, 82} Most were daily users of tobacco with moderate nicotine dependence; 56% smoked their first cigarette between 6-60 minutes after waking. The majority was in the preparation phase. They rated importance to quit high with an average of 8 out of 10, but confidence lower at 6 out of 10.

Significant differences were found in two of the tobacco variables. Participants in the iQuit group were more likely to have smoked hookah in the past year (18 vs. 5.9%, $p=0.02$) and smoked more cpd (12.3 vs. 9.5, $p<0.01$).

Engagement and satisfaction

According to computer records, 24 participants (48%) responded to at least one of the emails. On the 3-month survey, 67% reported reading most/all of the emails and 89% felt the number of emails was “just right.” They were ambivalent about their value however, with over half neither agreeing nor disagreeing on their helpfulness.

Effects on tobacco use at 3-months

Of the 14 iQuit participants completing the 3-month survey 28.6% reported 7-day abstinence and 21.4% reported 30-day abstinence. Using ITT, rates were 8% and 6% for 7- and 30-days. All of those tobacco-free had replied to at least one of the emails and 3(75%) had one or more clinic visits. They were mostly male with negative medical history (75%) and had a mean age of 23 years. All of those responding made at least one quit attempt; 61.5% made ≥ 3 attempts. Those that were still smoking decreased usage by five cpd.

Effects on tobacco use at 6-months

Table 3C presents results for self-reported 30-day abstinence at six months post-enrollment; there was no difference between 30-day and 7-day abstinence rates for either group. Overall, 25.9 % of the responders reported 30-day abstinence at the 6-month evaluation. This included six participants in usual care and one in iQuit. Due to the small sample size, there was no statistically significant difference between groups. Using ITT, rates decreased to 3.7% overall.

There were no statistically significant differences in baseline characteristics between those tobacco-free and those still using tobacco at 6-months. Those tobacco-free were 57% male with a mean age of 24 years. Although the majority were upperclassmen and graduate students, two (28.6%) were freshman. Half had indicated more severe nicotine dependence, smoking within five minutes of waking and 5(71.4%) had close friends and family members who smoked. Most of those abstinent at 6-months (86%) were in the preparation phase at baseline ($\chi^2=0.84$, $p=0.66$) and had a negative medical history (71.4 vs. 28.6%, $\chi^2=0.77$, $p=0.68$).

Over 80% of participants had exposure to at least one treatment for tobacco dependence (**Table C4**). Over half used a combination of two or more strategies. Approximately 70% used one or more of the FDA-approved medications without a significant difference between groups.

Among those responding to the 6-month survey, more participants in iQuit reported having individual counseling in the clinic without a significant difference (66.7 vs. 50.0%, $\chi^2=0.68$, $p=0.68$). When analysis was repeated using data from EMR review for all participants more statistically significant differences were revealed. Overall, 24.5% of the 188 study participants had at least one clinic visit for tobacco treatment. Participants in iQuit were more than twice as likely to be seen compared to those in the usual care group (44.0% vs. 17.4%, $\chi^2=14.1$, $p<0.001$).

Some form of treatment was predictive of abstinence at the 6-month evaluation. Of the seven tobacco-free participants, 85.7% were exposed to at least one treatment; 71.4% were exposed to a combination of two or more. Only one abstainer indicated no treatment exposure. Overall, for those with at least one clinic visit, 33.3% reported 30-day abstinence.

While reviewing responses, researchers noted that five members (27.8%) of the usual care group indicated that they had email coaching through UHS during the study period. Subsequent EMR review validated this response. All five had at least one clinic visit for tobacco dependence with had some additional communication/follow-up via email with a CTTS. When analyses were repeated using any email contact as a treatment indicator, effectiveness was 35.7% (**Table C5**). The one abstainer in the iQuit arm had no treatment

other than email coaching; he was not seen in the clinic for tobacco dependence and did not use any medication with this quit attempt.

Secondary outcomes

Most (88.9%) of the participants made at least one quit attempt including all of those in iQuit group and all but three in usual care. One-third made two attempts including 44.4% in iQuit and 27.8% in usual care and over 20% made three or more attempts (**Table C6**).

Participants in both groups felt fairly confident in their ability to resist temptations to smoke, but importance decreased almost two points from baseline.

Among those still using tobacco, there was a statistically significant difference in the number of days since last use. Usual care members used tobacco on the day of the survey while those in iQuit last used tobacco on average 1.9 days prior ($p=0.03$). Although not statistically significant, there was a clinically significant reduction of 6.6 cpd for participants in iQuit compared to a reduction of 2.1 cpd in usual care among those still smoking. Three participants (two in iQuit and one in usual) who had been smoking between 10-20 cpd at baseline were not smoking cigarettes at follow-up. However, they had switched to other tobacco products including cigars, snus, smokeless, e-cigarettes or hookah; two were using a combination of products.

COMMENT

Young adults have the highest prevalence rates for tobacco use yet remain understudied regarding effective treatments. This evaluation adds to the literature by providing evidence regarding potential strategies. It is based on a clinical sample rather than a research sample, which adds value in the “real world” application of research recommendations. Participants represented typical students presenting to college health

centers, including all students seeking medical care with varied medical histories. Light and intermittent smokers, polyusers and those with co-morbid psychiatric conditions commonly found in this population were also included.⁸²

Due to cross-contamination, some participants in the usual care group also received email coaching, although at lower intensity. Both of the CTTS were involved in this evaluation with bias toward email communication. Although lacking statistical significance, the majorities of those in the intervention group or those with any email contact were smoking fewer cpd, made at least two quit attempts and used an FDA-approved medication. This might prime them for success with a future quit attempt; longer follow-up would be important to assess for this effect.⁴⁵ Significantly more iQuit participants sought treatment in the clinic, suggesting that perhaps the value of an email intervention is in encouraging use of additional evidence-based practices and repeated quit attempts. One participant in the iQuit arm who was still smoking at the end of the study came back to UHS for treatment one year later. This time at 6-month follow-up he was tobacco-free for 175 days. Other participants have also subsequently sought additional treatment. Young adults often do not seek or see value in treatment for tobacco dependence.^{29, 65, 69} College health centers have the opportunity to educate about this value, encourage students to make quit attempts and recruit students into treatment when they present for preventive health visits or common complaints such as upper respiratory infections, abnormal pap results, etc. The provision of free NRT products and publicity generated by a campus-wide tobacco-free policy undoubtedly increased awareness and interest about services provided for the treatment of tobacco dependence at UHS, but the importance of asking every patient at every visit about tobacco use and advising them to

quit cannot be understated. Referral to E-health resources may be a useful adjunct to brief advice from providers.

Eighty percent of those with a history of depression, anxiety or other co-morbid psychiatric conditions were still smoking at follow-up, emphasizing the need to tailor interventions and address mood management strategies. Stress or a specific stressful incident was cited as the main trigger for 55% of all participants who were still smoking at follow-up. Inclusion of information and techniques on mindfulness or meditative practices in future emails might be valuable.

Limitations

Limitations minimize the ability to generalize findings from this evaluation to the larger young adult population. First, this was a convenience sample without random assignment at a single university with a predominantly white population. The sample size was small and lacked power to find statistically significant differences.

Although students with co-morbid psychological conditions were included, other sub-populations such as lesbian-gay-bisexual-transgender groups who might be at higher risk for tobacco dependence were not specifically recruited or included in analyses.^{53, 83}

Randomized controlled trials with large sample sizes that include young adults from a variety of backgrounds and settings, including those not enrolled in higher education, are needed.

The majority of subjects were in the preparation stage of change, limiting the ability to assess the effect of treatment on those in pre-contemplation, action or other stages. The university comprehensive tobacco-free policy makes it more difficult for students to

smoke and may help to increase quit attempts;^{67, 84} this may have increased participants' motivation to quit and use of more than one product.

Self-report of quitting was not biochemically verified, although this requirement has been debated in the literature and is impractical in clinical settings. The U.S. Public Health Service's *Clinical Practice Guideline for the Treatment of Tobacco Use and Dependence*¹⁹ suggests validation of self-report of abstinence via measurement of salivary cotinine or exhaled carbon monoxide, but according to the Society for Research in Nicotine and Tobacco (2002)⁵⁴ this may not affect outcomes with adults when data are collected with limited face-to-face contact. However, some studies with young adults have found significant rates of over-reporting of quit status, strengthening the argument for biochemical validation in this population.^{35, 36, 71}

Behavior of those in the iQuit arm might have been affected by the addition of the 3-month survey and not the intervention, as prior research has demonstrated that simply asking someone about their smoking behavior may cause short-term modifications.⁸⁵

Over half of those completing the 6-month survey had treatment in the clinic, which may have skewed results, as lack of treatment is more the norm in this population. Those with face-to-face coaching might be more likely to over-report quit status and may have felt a greater obligation to complete the survey, as there was no incentive provided for those completing follow-up. This lack of financial incentive may have impacted attrition rates. The high rate of attrition in this study threatens internal validity, although those completing follow-up were similar to those not completing at baseline. Fewer than 20% of participants in the intervention group and 15% in usual care completed follow-up. High attrition rates (up to 50%) are common with Internet studies, even with adults and

when financial incentives are provided.⁸⁶ A number of experts in the field have advocated for reporting rates based on those whom follow-up data is obtained rather than the more stringent ITT analysis as a more accurate reflection of success rates.⁸⁷ Among young adults, loss to follow-up may be related to a variety of reasons not associated with continued tobacco use.^{23, 88} Sending additional reminder emails, informing participants that others have responded and including a picture in the email invitation might increase response to electronic questionnaires and decrease attrition.⁸⁹

Conclusions

Although there was not a statistically significant improvement in quit rates with the iQuit Tobacco intervention, there were some clinically significant improvements such as reduction in usage and increased quit attempts. Practitioners in “real-world” settings, attempting to translate research into practice without funding to provide incentives that encourage follow-up, face challenges in providing evidence of effectiveness of interventions. The lack of power in small numbers of responders and lack of randomization limits these efforts. However, this evaluation provides insight into potential strategies with the young adult population.

Recruitment into proven treatments like in-person counseling and use of medications were unexpected findings with encouraging implications. Sending emails from both peers and experts appears beneficial. Students responded to the peer coach’s questions about triggers and reasons for quitting and replied to the CTTS with treatment seeking questions regarding medications and clinic services.

Integrating email coaching for the treatment of tobacco dependence into clinical practice may allow providers to capitalize on “teachable moments” during busy clinic visits.

Interfaces that incorporate coaching emails into the EMR provide feedback to providers so they can further encourage their patient’s quit attempts with brief advice during subsequent visits. Similar to the dose response seen with successful behavioral counseling in person, using a combination of formats with college students including email, text messages and mobile phone applications might better impact their tobacco use. Daily and non-daily college smokers expressed interest in technology-based behavioral interventions as treatment strategies in a recent study,⁹⁰ but additional research is needed.

As Howard Koh, Assistant Secretary for Health remarked “The simple fact is that we cannot end the tobacco epidemic without focusing our efforts on young people.”⁶⁷ Those of us working in college health have a unique opportunity to do our part using comprehensive, multi-component interventions that include tobacco-free environments that make it harder for students to smoke and providing accessible, effective treatment services.

Figure C1. Evaluation Procedure demonstrating differences between Usual Care and Treatment (iQuit Tobacco) group

Usual Care	Both Groups	iQuit Tobacco
	Asked about tobacco use during intake. Offered Quit Kit. Baseline Questionnaire completed.	
<i>Contacted by email with invitation to come to UHS for counseling.</i>		<i>Invited to participate in study. Informed consent completed. Sent 10-12 emails over 12 weeks.</i>
	May participate in other tobacco treatment services: face-to-face counseling and/or medications (prescription and non-prescription).	
	Free NRT products available.	
	Email with link to on-line survey sent six months after receipt of Quit Kit.	<i>Email with link to on-line survey sent at completion of 12-week intervention.</i>

Figure C2: Sample of coaching e-mails

Are you ready?

Looking at the things you dislike and like about smoking can help sort out your feelings about quitting. Be honest about what you'll miss about smoking, like relaxing with friends on the patio. What are the "good things" about smoking? Use this list to help make your best plan for quitting. Then think about what you don't like or the "not so good things" about smoking, like the smell on your clothes or the cost. This list will help remind you of what you will have to deal with if you smoke again – look it over when you have the urge to smoke.

After looking at the "good things" and "not so good things," where does that leave you now?

Pick a day to save your life –set a quit date.

Email back and let me know your top two "good" and "not so good" things about smoking. We are here to help when you decide to quit – you don't have to do it alone!

Table C1. Personal characteristics of participants by intervention group at baseline

	Overall (N=188)	iQuit (n=50)	Usual Care (n=138)	p- value
Age, mean ± SD	21.9±3.2	21.7±3.2	22.0±3.1	0.59
Gender, n (%)				0.89
Male	105(55.9%)	27(54.0%)	78(56.5%)	
Female	83(44.1%)	23(46.0%)	60(43.5%)	
^Ethnicity, n (%) (n=29)				1.00
Non-white	4(15.4%)	2(20.0%)	2(12.5%)	
Academic status, n (%)				0.32
Underclassmen	67(35.8%)	20(40.0%)	47(34.3%)	
Upperclassmen	91(48.7%)	20(40.0%)	71(51.8%)	
Graduate/Professional	29(15.5%)	10(20.0%)	19(13.9%)	
Medical History, n (%)				0.35
Negative	125(66.8%)	34(68.0%)	91(66.4%)	
Depression, anxiety, bipolar, other psychiatric illness	47(25.1%)	10(20.0%)	37(27.0%)	
Asthma, abnormal pap, other chronic illness	15(8.0%)	6(12.0%)	9(6.6%)	

^Ethnicity measured at follow-up

Table C2. Distribution of tobacco variables by intervention group at baseline

	Overall (N=188)	iQuit (n=50)	Usual Care (n=138)	p- value
Number of cigarettes per day, mean ± SD*	10.3±6.6	12.3±8.7	9.5±5.5	0.01*
Non-daily use, n (%)	32(17.0%)	10(20.0%)	22(15.9%)	0.66
Minutes to first tobacco, n (%)				0.09
< 5 minutes	22(13.3%)	5(10.6%)	17(14.4%)	
6-30 minutes	65(39.4%)	14(29.8%)	51(43.2%)	
31-60 minutes	28(17.0%)	13(27.7%)	15(12.7%)	
> 60 minutes	50(30.3%)	15(31.9%)	35(29.7%)	
Hookah use in past year, n (%)*	17(9.1%)	9(18.0%)	8(5.9%)	0.02*
Polyuse in past year, n (%)	24(12.8%)	10(20.0%)	14(10.1%)	0.12
Stage of change, n (%)				0.60
Preparation	137(74.9%)	39(78.0%)	98(73.7%)	
Contemplation	20(10.9%)	6(12.0%)	14(10.5%)	
Precontemplation	26(14.2%)	5(10.0%)	21(15.8%)	
Importance, mean ± SD	8.0±1.5	8.0±1.4	8.0±1.5	0.96
Confidence, mean ± SD	6.3±2.5	6.3±2.4	6.3±2.5	0.96
Plan to use medication, n (%)	123(67.2%)	38(76.0%)	85(63.9%)	0.17

*Significance at alpha level .05.

Table C3. Self-reported 30-day abstinence rates at 6 months by intervention group.

	Overall (n=27)	iQuit Tobacco (n=9)	Usual Care (n=18)	p-value
30-day abstinence, n (%)	7(25.9%)	1(11.1%)	6(33.3%)	0.44
30-day abstinence (missing assumed smoking)	3.7%	2.0%	4.3%	0.75

Table C4. Exposure to tobacco treatment at 6-months by intervention group.

	Overall (n=27)	iQuit (n=9)	Usual Care (n=18)	p-value
Used FDA approved medication to assist with quit attempt, n (%)	19(70.4%)	7(77.8%)	12(66.7%)	0.68
Individual counseling in clinic, n (%)	15(55.6%)	6(66.7%)	9(50.0%)	0.68
Individual counseling in clinic for all participants, n (%) (n=188)*	46(24.5%)	22(44.0%)	24(17.4%)	<0.001*
Any email coaching, n (%)*	14(51.9%)	9(100%)	5(27.8%)	0.001*

*Significance at alpha level .05.

Table C5. Distribution of select variables at 6-months by any email coaching.

Variable	Any email (n=14)	No email (n=13)	p-value
30-day point prevalence abstinence, n (%)	5(35.7%)	2(15.4%)	0.39
Change in # of cpd, mean ±SD	-8.2±7.2	- 4.0±7.7	0.17
Quit Attempts, n (%)			0.25
None	0(0%)	3(23.1%)	
1	5(35.7%)	4(30.8%)	
2	6(42.9%)	3(23.1%)	
3 or more	3(21.4%)	3(23.1%)	

*Significance at alpha level .05.

Table C6. Secondary outcomes at 6-months by intervention group

	Overall (n=27)	iQuit (n=9)	Usual Care (n=18)	p-value
Number of quit attempts, n (%)				0.57
None	3(11.1%)	0(00.0%)	3(16.7%)	
1 quit attempt	9(33.0%)	3(33.3%)	6(33.3%)	
2 quit attempts	9(33.3%)	4(44.4%)	5(27.8%)	
3 or more	6(22.2%)	2(22.2%)	4(22.2%)	
Number of days since last tobacco use ± SD (those still using tobacco)*	0.75±1.5	1.88±1.96	0.0±0.0	0.03*
Change in average number of cpd ± SD (those still smoking)	-3.9±6.4	-6.6±6.0	-2.1±6.2	0.12
Importance, mean ±SD	6.1±2.5	6.6±2.2	5.7±2.8	0.42
Change in importance, mean ±SD	-1.9±2.5	-1.0±2.5	-2.5±2.5	0.20
Self-efficacy score, mean ±SD (range 9-45)	29.7±8.1	28.9±9.0	30.1±7.8	0.72

*Significance at alpha level .05.

CONCLUSION

As noted in the first manuscript, use of technology such as the Internet, email or text messages may be effective tools for tobacco treatment interventions, especially with college students. There is great potential to reach large numbers of students, many who may not identify themselves as smokers or seek traditional methods for treatment. Using a guide such as Rosswurm and Larrabee's model for evidence-based practice helps Nurse

Practitioners develop effective, innovative strategies to impact the future health of individuals.

Although there were no statistically significant differences in quit rates for the intervention evaluated, those with email contact were more likely to have in-person coaching, use medications to assist with quitting and made more quit attempts. Email coaching may be a useful adjunct to brief advice in clinical practice in encouraging use of evidence-based strategies for tobacco treatment, but additional research is needed.

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