Mobile Health-Based Approaches for Smoking Cessation Resources

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Smoking accounts for about one in five deaths in the United States, and the economic cost of smoking was estimated at $193 billion in 2004 (American Lung Association, 2011). Although the prevalence of American adult smokers has decreased by 1.6% from 2005–2011, the proportion of daily smokers smoking from one to nine cigarettes per day increased from 16% to 22% (Centers for Disease Control and Prevention [CDC], 2011). Tobacco use contributes to multiple health issues such as heart disease and cancers and is the single largest preventable cause of death and disease in the United States (CDC, 2011).

Guidelines recommend that every patient who smokes should be counseled by a healthcare provider to quit smoking (Fiore et al., 2008). The Joint Commission (2010) requires healthcare organizations to implement a smoke-free environment. Encouraging smokers to quit is one of the most effective interventions known to reduce smoking-related morbidity and mortality and to improve patients' health. Providing advice on smoking cessation to smokers by healthcare providers improves cessation rates (Doolan & Froelicher, 2006; Lancaster & Stead, 2005; Mahon, 2005; Sarna et al., 2000). For instance, in cases in which a nurse offered smoking cessation advice, the likelihood of quitting increased by about 50% compared to smokers without nursing interventions (Doolan & Froelicher, 2006). Despite the effectiveness, the interventions are still widely underused (Cokkinides, Ward, Jemal, & Thun, 2005). Annually, about 80% of smokers are seen in primary care settings (Doolan & Froelicher, 2006); however, a low number of patients reported that they received advice on smoking cessation from healthcare providers (Lancaster & Stead, 2005).

Nursing interventions have been more focused on assessment than smoking cessation interventions (Sarna et al., 2009). In a national survey on nurses' delivery of tobacco cessation interventions, 73% of

Purpose/Objectives: To describe how the National Cancer Institute's Cancer Information Service (CIS) smoking-related resources on a mobile health (mHealth) platform were integrated into the workflow of RNs in advanced practice nurse (APN) training and to examine awareness and use of CIS resources and nurses' perceptions of the usefulness of those CIS resources.

Design: Descriptive analyses.

Setting: Acute and primary care sites affiliated with the School of Nursing at Columbia University.

Sample: 156 RNs enrolled in APN training.

Methods: The integration was comprised of (a) inclusion of CIS information into mHealth decision support system (DSS) plan of care, (b) addition of infobutton in the mHealth DSS, (c) Web-based information portal for smoking cessation accessible via desktop and the mHealth DSS, and (d) information prescriptions for patient referral.

Main Research Variables: Use and perceived usefulness of the CIS resources.

Findings: 86% of nurses used the mHealth DSS with integrated CIS resources. Of the 145 care plan items chosen, 122 were referrals to CIS resources; infobutton was used 1,571 times. Use of CIS resources by smokers and healthcare providers in the metropolitan area of New York City increased during the study period compared to the prestudy period. More than 60% of nurses perceived CIS resources as useful or somewhat useful.

Conclusions: Integration of CIS resources into an mHealth DSS was seen as useful by most participants.

Implications for Nursing: Implementation of evidence into workflow using an mHealth DSS can assist nurses in managing smoking cessation in patients and may expand their roles in referring smokers to reliable sources of information.

Knowledge Translation: mHealth DSS and information prescriptions may support smoking cessation interventions in primary care settings. Smoking cessation interventions can be facilitated through informatics methods and mHealth platforms. Nurses' referrals of patients to smoking-related CIS resources may result in patients' use of the resources and subsequent smoking cessation.

nurses asked and assisted with smoking cessation, 24% recommended pharmacotherapy, and 22% referred to community resources and 10% recommended use of the Quitline (Sarna et al., 2009). Similarly, a large number of home care nurses asked smoking status and advised their patients; however, only a small number of nurses assisted smoking cessation or arranged follow-up (Borrelli et al., 2001).

Research studies reported that although healthcare providers were familiar with the guidelines for smoking cessation interventions and willing to adhere to them, they were unfamiliar with resources about smoking cessation (Chan, Sarna, Wong, & Lam, 2007; Marcy, Skelly, Shiffman, & Flynn, 2005). Although nurses want to provide appropriate information for their patients, lack of time and knowledge for counseling and lack of familiarity with resources for smoking cessation discourage nurses from advising patients about smoking cessation (Marcy et al., 2005; McCarty, Hennrikus, Lando, & Vessey, 2001; Pringle, 2002; Sarna et al., 2000). For instance, nurses in a hospital setting reported that they were competent in teaching and advising but less competent in certain interventions, such as nicotine replacement therapy (Chan et al., 2007). The effort to improve healthcare providers' adherence to the guidelines needs to include approaches to increase knowledge of smoking cessation resources (Cokkinides et al., 2005; Sarna et al., 2009).

The National Cancer Institute's (NCI's) Cancer Information Service (CIS) provides the public with the latest, most accurate information about cancer prevention behaviors, screening recommendations, and cancer diagnosis and treatment, including smoking-related information service (Perocchia et al., 2011). Smoking cessation service is provided through multiple communication channels such as a real-time instant messaging program called LiveHelp and the Smoking Quitline toll-free number. Those services assist in setting a quit date, providing medication information to help with quitting, and help manage quitting-related health issues such as withdrawal and stress (Bright, 2007). CIS information specialists assist healthcare providers in the provision of smoking cessation information and education to various populations including racial and ethnic minorities (La Porta, Hagood, Kornfeld, & Treiman, 2007). However, these resources are underused by healthcare professionals (Perocchia et al., 2005). In the 2003 Health Information National Trends Survey, only 33% of respondents reported that they had heard of the CIS and 6% of respondents were referred by healthcare providers (La Porta et al., 2007).

Several studies have shown that computer-based systems influenced healthcare providers' adherence to guidelines regarding various health issues (Berry et al., 2011; Burack et al., 1996; Lobach & Hammond,

1994; McPhee, Bird, Fordham, Rodnick, & Osborn, 1991; Sheldon, Hong, & Berry, 2011; Vas et al., 2004). In a randomized, controlled trial of an intervention for smoking cessation, patients in the computer-assisted care reminder arm received significantly more smoking cessation advice and interventions than patients in the usual care arm (Wolfenden et al., 2005).

The purposes of the current study are to describe how smoking-related CIS resources on an mHealth platform were integrated into the workflow of RNs in advanced practice nurse (APN) training and to examine use of CIS resources and nurses' perceptions on usefulness of those.

Integration of Resources Into Student Workflow

In 2002, the School of Nursing at Columbia University implemented an APN student clinical log that supported documentation of encounter data, medical and nursing diagnoses, and nursing interventions on an mHealth platform and integrated it into the curriculum to support evidence-based practice (Bakken et al., 2004). Subsequently, a guideline-based decision support system (DSS) for smoking cessation was integrated into the mHealth clinical log and a randomized, controlled trial was conducted to compare adherence to guideline-based care between those randomized to mHealth DSS versus no DSS for smoking cessation. The mHealth DSS involves a reminder to screen for tobacco use and guideline-based documentation templates for plans of care. The plans of care are automatically tailored for a patient based on the screening results (Bakken et al., 2007).

Smoking-related CIS resources also were integrated into the workflow in four ways: (a) inclusion of CIS information into mHealth DSS plan of care, (b) addition of infobuttons (context-specific links to information resources) within the mHealth DSS, (c) Web-based information portal for smoking cessation accessible via the mHealth DSS, and (d) information prescriptions for patient referral. The research team comprised experts in nursing and informatics, a system developer, a Web designer, and the New York CIS contact center manager who selected relevant information and information resources from the CIS and then classified them for integration.

Plans of Care

The mHealth DSS guided RNs in APN training on plans of care in five categories: diagnostics, medication, procedure, patient teaching, and referrals. Twenty-three plans of care were identified as relevant to tobacco use and smoking cessation from the CIS information and included in the mHealth DSS. Example items from the

Table 1. Characteristics of Encounters Including Amount of Care Plan Items (N = 9,262)

Semester	Eligible Encounters		Screened Encounters		Tobacco Dependence		Willing to Quit		Care Plan Items	
	n	%	n	%	n	%	n	%	n	%
Fall 2007	2,691	29	2,143	23	244	3	94	9	31	21
Spring and summer 2008	6,571	71	5,546	60	834	11	314	29	114	79
Total	9,262	100	7,689	83	1,078	14	408	38	145	100

plans of care included "remove tobacco products" and "tell family, friends, coworkers."

Infobuttons

By provision of context-specific links through infobuttons, healthcare providers can find relevant information in an efficient way (Bakken et al., 2007). One of the features of the infobuttons is that the resources of the information are Web-based and updated by their developers (Cimino, 2006).

Care plan items in the category of patient teaching and referrals were linked to pertinent information resources. For instance, when the RN chose "set a quit date within two weeks" as a plan of care for tobacco dependence, she/he could get to related information resources by tapping the infobutton on the screen. Other categories (i.e., diagnostics, procedures, and medications) were not included because a number of resources already were available and frequently used.

Information Portal

The information portal provided access to the CIS resources through desktop computers and mobile technology. The information portal was composed of three menus: for patients, for clinicians, and information prescriptions.

For patients: The "for patients" menu provided information resources tailored to serve four different populations: English-speaking adults, Spanish-speaking adults, English-speaking youth, and Spanish-speaking youth. The resources were organized into more specific categories. For example, an English-speaking patient may attain information by navigating categories such as general information (e.g., Online Guide to Quitting), targeted information (e.g., Smokers Over Aged 50), and handling special situations without smoking (e.g., Handling Cravings).

Information resources in Spanish were displayed with an English title as well as a Spanish title so that an English-speaking nurse could navigate and find resources in Spanish when needed.

For clinicians: The "for clinicians" menu provided additional information about smoking cessation. These included the Agency for Healthcare Research and Quality, American Psychological Association, Cochrane Reviews, National Centers for Chronic Disease Prevention, Health Promotion-Tobacco Information and Prevention Source, and the World Health Organization, with a brief description of each of those resources.

Information prescriptions: The "information prescriptions" menu was created to refer patients to CIS resources following a clinical encounter with an RN in APN training. The New York CIS contact center manager selected the content, and the design layouts were refined through multiple iteration processes by the research team.

The authors created three types of information prescriptions (i.e., tailored selection of information resources) to meet the various information needs of the different populations seen in this practice setting: English- or Spanish-speaking adults, and English- or Spanish-speaking youth. Print versions of information prescriptions were made available for RNs as well as electronic versions that were available for download from the information portal. RNs provided the information prescriptions to their patients during the clinical encounter as they would a medication prescription.

Methods

Research Questions

Evaluation of the CIS smoking-related resources integrated into mHealth DSS focused on the aspects of awareness, use, and perceived usefulness.

- What percentage of RNs in APN training were aware of and used smoking-related CIS resources prior to project training about CIS resources?
- What was the usage of the mHealth smoking-related CIS resources (plan of care items, infobuttons, and information prescriptions) by RNs in APN training?
- What was the usage of smoking-related CIS resources by smokers and healthcare providers in the New York City metropolitan area pre- and post-study period?
- What were the perceptions of RNs in APN training regarding the usefulness of the mHealth smoking-related CIS resources (infobuttons, CIS information portal, and information prescriptions) following resource use?

Study Design

The primary study was a randomized, controlled trial, and study analyses focused on RNs in APN training who were randomized to receive mHealth DSS for smoking cessation and included preintervention-only measures (CIS awareness and use), CIS resource use during study period, and postintervention (use and satisfaction). In addition, pre- and post-study period comparisons were conducted to assess the use of smoking-related CIS resources by smokers and healthcare providers in the New York City metropolitan area.

Setting and Sample

Study participants were RNs enrolled in APN training in the School of Nursing at Columbia University. The APN students fulfilled their clinical training at more than 200 sites in the New York City metropolitan area, including medically underserved neighborhoods.

Use of the mHealth DSS was voluntary, but use of the clinical log into which the DSS was integrated was part of the APN curriculum. The Columbia University Health Science institutional review board (IRB) approved the study protocol with an opt-out strategy (i.e., students who did not wish to participate were given an APN student clinical log without DSS). The approved IRB protocol did not consider patients to be study participants.

Data Sources

Training sessions were provided to RNs in APN training to encourage screening for tobacco use and subsequent use of the CIS resources. RNs' awareness and previous use of CIS resources were assessed using a survey in a training session.

For evaluation of use and perceived usefulness, data were collected from four data sources: (a) system database, (b) system log, (c) CIS Electronic Contact Record Form (ECRF) data, and (d) survey of RNs in APN training. The authors examined the use of smoking-related CIS resources with data from the system database and system logs. In addition, the ECRF data that covered the APN clinical training sites were analyzed for CIS Quitline or LiveHelp use by smokers and healthcare providers to determine if referrals resulted in CIS access following an encounter. The ECRF data were aggregated by zip codes and data collection was managed by New York CIS staff.

RNs' perception of usefulness of the resources was assessed using a self-report survey on the completion of the program. The surveys were voluntary and no identifier was recorded. The data were analyzed using descriptive statistics. Pre- and post-study period comparisons of CIS use were made using frequencies and percentages.

Table 2. Characteristics of Patient Encounters During Study Period (N = 9,262)

Characteristic	Eligible Encounters n	%	Screened Encounters n	%	Tobacco Dependence n	%	Willing to Quit n	%	Care Plan Items n
Gender									
Male	3,437	37	2,791	36	568	53	189	46	63
Female	5,814	63	4,891	64	508	47	219	54	82
Missing	11	< 1	7	< 1	2	< 1	–	–	–
Total	9,262	–	7,689	–	1,078	–	408	–	145
Age (years)									
Younger than 22	2,662	29	2,007	26	92	9	30	7	7
22–49	3,896	42	3,368	44	624	58	239	59	89
Older than 49	2,704	29	2,314	30	362	34	139	34	49
Total	9,262	–	7,689	–	1,078	–	408	–	145
Race or ethnicity									
African American	2,037	22	1,735	23	309	29	120	29	41
Hispanic	3,704	40	2,955	38	456	42	160	39	37
White, non-Hispanic	2,729	29	2,323	30	245	23	102	25	55
Other	792	9	676	9	68	6	26	6	12
Total	9,262	–	7,689	–	1,078	–	408	–	145
Health insurance									
Private	2,458	32	2,211	33	187	21	87	28	49
Medicaid or Medicare	3,544	46	3,002	45	463	52	148	48	30
Uninsured	629	8	564	8	118	13	39	13	20
Other	1,152	15	871	13	114	13	36	12	12
Total	7,783	–	6,648	–	882	–	310	–	111

Note. Because of missing data, totals are less than N.

Results

During the fall 2007 and spring/summer 2008 semesters, 156 APN students received the mHealth DSS with integrated CIS resources.

For the assessment survey on RNs' awareness and previous use of CIS resources, 51% of participating RNs (n = 39) had heard of the NCI's CIS; however, few of them had either accessed or referred to CIS in regard to smoking cessation. In terms of future intention to use the resources, most participants responded that they were likely to access (88%) or refer (92%) to the CIS for assistance with smoking cessation.

Plans of Care

Eighty-six percent (n = 134) of the RNs randomized to DSS for smoking cessation used the mHealth DSS. In total, 9,262 clinical encounters were documented from fall 2007 to summer 2008. In 83% (n = 7,689) of the encounters, smoking status was screened; 14% (n = 1,078) of cases screened positive for smoking. Among those who were diagnosed with tobacco dependence, 38% (n = 408) of individuals indicated that they were willing to quit. The total number of care plan items used by the RNs was 145 (see Table 1). The number of items specific to referrals to CIS resources was 122. The most frequently documented item was Quitline (40%), followed by SmokeFree.gov (17%), information prescriptions (15%), quit kit ordered for patient (11%), cancer.gov/publications (11%), and patient told to order quit kit (6%).

Table 2 shows demographics of patients in clinical encounters. Among patients with tobacco dependence, 53% were male and most were Hispanic and insured through Medicaid or Medicare.

Infobuttons

The infobutton was used 1,571 times during the research period. The five most frequently used infobuttons were CIS information prescription (16%), cancer.gov/publications (13%), set a quit date within two weeks (13%), develop coping skills/anticipate temptation (5%), and Quitline (5%).

Information Prescriptions

Among 156 participants, 56 (36%) responded to the item regarding information prescriptions. Among those who responded to questions regarding information prescriptions, 16 (29%) respondents provided 1–5 prescriptions, seven (12%) provided 6–10 prescriptions, five (9%) provided 11–20 prescriptions, and four (7%) provided more than 20 prescriptions to patients during clinical encounters throughout the study period.

During the study period, 116 smokers accessed the CIS Quitline, which is an increase of 4.5 times the prestudy period. The numbers of users is summarized in Table 3. The majority of smokers were first-time users of the CIS. Seven users identified the source of referral as health professional. Among those, three (43%) explicitly specified "my Columbia nurse" (see Table 4). Determining if other individuals contacted CIS as a result of the study is not possible.

Forty-one, 49, and 51 RNs responded to the questions regarding usefulness of infobuttons, the information portal, and information prescriptions, respectfully. Sixty-one percent (n = 28 of 41) of respondents thought that infobuttons were at least somewhat useful, 69% (n = 34 of 49) perceived the information portal was at least somewhat useful, and 73% (n = 37 of 51) perceived information prescriptions were at least somewhat useful. Infobuttons were perceived to be the least useful of the resources. One of the reasons may be that the wireless connection was not stable in several practice areas because of limited access to cell phone technology. Additional evaluation is needed to understand barriers to use and to inform strategies for improving use and usefulness of CIS smoking-related resources.

Discussion

In a national survey of CIS users, about 72% of individuals who had contacted CIS for information about smoking replied that the experience influenced their thinking about smoking (La Porta et al., 2007). Fourteen percent of individuals responded that they had quit, and 35% had cut back (La Porta et al., 2007). However, public awareness of the CIS is low (33%) (Bright, 2007). In the current study, the majority of the RNs in APN training responded that they never had accessed CIS (95%), nor referred patients to CIS for assistance with smoking cessation (97%); however, 51% responded that they had

	Prestudy Period (n = 26)		Study Period (n = 116)	
Variable	**n**	**%**	**n**	**%**
Called Quitline before				
Yes	2	8	27	23
No	24	92	88	76
Language				
English	25	96	110	95
Spanish	1	4	6	5
Does the caller have lung cancer?				
Yes	2	8	11	9
No	24	92	105	91
Does the caller smoke or use tobacco?				
Yes	25	96	116	100
No	1	4	–	–

Table 3. Characteristics of Quitline Callers (N = 142)

Note. Because of missing data, totals are less than N. Because of rounding, not all percentages total 100.

Table 4. Comparison of Electronic Contact Record Form Sources of Information (N = 142)

Source of Information	Pre-Intervention (n = 26)		Post-Intervention (n = 116)	
	n	%	n	%
Ask CIS	–	–	1	1
Did not ask	–	–	1	1
Healthcare professional	1	4	7[a]	6
I just know it.	1	4	5	4
Internet	6	23	27	23
Magazine	–	–	1	1
NCI publications	2	8	2	2
Newspapers	1	4	–	–
Other	–	–	3	3
Other printed source	5	19	28	24
Organization or community group	6	23	14	12
Telephone book or directory assistance	3	12	13	11
Television	1	4	2	2
Word of mouth	–	–	12	10

[a] Three of seven answered "my Columbia nurse."

CIS—Cancer Information Service; NCI—National Cancer Institute

Note. Because of rounding, not all percentages total 100.

heard of CIS, which is consistent with the findings reported in previous research (Perocchia et al., 2005). After training, the RNs responded that they would access CIS in regard to smoking cessation and refer patients to CIS for assistance with smoking cessation.

The literature shows the role of healthcare providers in smoking screening and smoking cessation interventions that significantly influence patients' willingness to quit. However, lack of knowledge or familiarity with resources and technology to access the resources limit their ability to integrate smoking cessation interventions into practice (Chan et al., 2007; Pringle, 2002; Sarna et al., 2000). A meta-analysis of clinical trials reported that having a smoking screening system in place increased healthcare provider interventions by three times (Doolan & Froelicher, 2006).

Eighty-six percent chose to use the mHealth DSS, and smoking was screened in 83% of the encounters. This is significantly greater than that reported in a national survey (64%) by Sarna et al. (2000). However, the proportion of smokers (14%) was lower than the overall proportion (21%) reported in a national survey (Sarna et al., 2000). This lower proportion may reflect New York City's strong policies toward smoking cessation, including high taxes on cigarettes (CDC, 2007).

Smoking has shown a higher prevalence in the poor and less educated (CDC, 2009). The metropolitan New York City area encompasses multiple underserved population communities, two of the largest being Hispanic or African American. To increase the use of CIS smoking-related resources for the underserved, language and readability level were taken into account. Seventy-one percent of the clinical encounters for nurses who were randomized to the mHealth DSS intervention arm were with patients who were Hispanic or African American, and 68% of those were willing to quit. Therefore, study findings may provide some sense of the effectiveness of evidence-based smoking cessation interventions among underserved populations.

Providing adequate resources at the point of need is critical. In a health information national trend survey in 2005, 37% of patients responded that they had difficulty in finding cancer information that they needed and 27% felt frustrated during their search (National Cancer Institute, 2007). In addition, 48% of patients were concerned about the quality of information found and 23% had difficulty understanding the information they found (National Cancer Institute, 2007). The current researchers' CIS ECRF data show that the number of smokers who used Quitline and LiveHelp dramatically increased during the study period compared to the pre-study period, although it cannot be directly attributed to the study because of other tobacco-related initiatives in the region of interest (see Table 5).

Nurses have expressed the desire for additional training for smoking cessation interventions (Chan et al., 2007; Sarna et al., 2000), and nurses' smoking cessation interventions may be optimized with effective strategies that incorporate evidence-based smoking cessation interventions into clinical practice to better assist smokers in quitting (Hall, Vogt, & Marteau, 2005; Sarna et al., 2009). Numerous studies show that informatics-based methods may assist evidence-based practice at the point of care; however, most studies have focused on physicians rather than other healthcare providers, such as APNs (Lobach et al., 2007; Wells et al., 2008).

The integration of CIS resources into the clinical work flow through an mHealth DSS, and information prescriptions illustrate a strategy for training at the point of need. mHealth-based applications facilitate educational communication between the healthcare provider and the patient and provider feedback on patient progress, and

Table 5. Cancer Information Service (CIS) Used

Use of CIS	Prestudy Period (N = 382)		Study Period (N = 615)	
	n	%	n	%
Quitline use by smokers	26	7	116	19
Quitline use by healthcare providers	352	92	482	78
LiveHelp	4	1	17	3

can be provided effectively in a timely manner (Blake, 2008; Handel, 2011; Smith & Schatz, 2010). In spite of its potential, the impact of mHealth on quality of care and patient outcomes has still not been systematically studied (Akter & Ray, 2010; Clifford & Clifton, 2012; Krishna, Boren, & Balas, 2009). Data are needed on the effectiveness of mHealth technologies. The current study examined the aspects of use and perceived usefulness of the mHealth DSS integrated with CIS resources. The study findings may contribute to gaining knowledge of the impact of the increasing use of mHealth.

Limitations

The current data are from one single academic institution; therefore, interpretation of the study results may be limited. However, the authors' approach may inform strategies for improving smoking cessation interventions by better supporting nurses and their patients through informatics methods and mHealth platforms. In addition, starting this implementation in graduate nursing education may encourage APNs to initiate smoking cessation counseling and referrals during patient encounters.

Conclusion

Smoking is a critical health problem. CIS resources integrated into an mHealth DSS were used and perceived to be useful by most participants. mHealth-based approaches such as the ones described in the current study have the potential to facilitate smoking cessation in underserved populations. Based on the evidence of healthcare providers' influence on patient willingness to quit smoking, nurse referrals of patients to smoking-related CIS resources may result in patient use of the resources.

Implications for Nursing

Implementation of evidence into workflow using an mHealth DSS can assist nurses in managing smoking cessation and may expand their roles in referring smokers to reliable information resources. Smoking-cessation interventions can be facilitated through informatics methods and mHealth platforms. Nurses' referrals of patients to smoking-related CIS resources may result in patients' use of the resources and subsequent smoking cessation.

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