RESEARCH ARTICLE

Implementation of an Inpatient Electronic Referral System (Opt-to-Quit) From the Electronic Health Record to the New York State Smokers' Quitline: First Steps

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ABSTRACT

OBJECTIVES: (1) To implement a new policy-driven referral program, Opt-to-Quit, using electronic data transfer from the electronic health record (EHR) to the New York State Smokers' Quitline (NYSSQL) and (2) to improve referrals to the NYSSQL for smoking caregivers of children admitted to a children's hospital.

METHODS: Smoking caregivers of pediatric patients were referred to the NYSSQL through a standardized template built into the EHR, during the child's hospitalization or emergency department encounter. Direct data exchange was based on a point-to-point protocol, without dependence on any external centralized processing service. Input and oversight were provided by a multidisciplinary task force, which included physician and nursing leadership, information technology specialists, Health Insurance Portability and Accountability Act compliance personnel and legal counsel, and NYSSQL staff. The process was refined through several iterative plan-do-study-act cycles, using a single-armed, prospective cohort study design, including surveys of nursing staff and continued input of information technology experts on both hospital and Quitline sides.

RESULTS: In 2013, 193 smokers were identified in 2 pilot units; 62% (n= 119) accepted referral to the NYSSQL. In 2014, after expansion to all inpatient units and the emergency department, 745 smokers were identified, and 36% ($n = 266$) accepted referral. Over the 2 years, overall increase in referrals was 124%; as of the first quarter of 2015, referral rate was sustained at 34%.

CONCLUSIONS: Hospital-wide implementation of the Opt-to-Quit program through our EHR was feasible and sustainable and has significantly improved referrals to the NYSSQL.

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Smoking rates have significantly decreased over the past 20 years. Despite advances, 14.5% of adults in New York State are smokers, and more than 1 000 000 children are exposed to secondhand smoke (SHS) each year.[1,2] Physicians and other health care workers play an important role in promoting evidence-based smoking cessation treatments, such as motivational interviewing, counseling, nicotine replacement therapy, and referrals to a smoking cessation quitline. Several studies have demonstrated that hospitalization provides a "teachable moment" for smoking parents of hospitalized children.[3–6] More generally, the inpatient setting provides an opportunity to address smoking cessation and SHS by incorporating interventions into hospital admission or discharge plans with all hospitalized smokers or families.[7] Using nursing staff has been shown to be feasible and effective in both adult and pediatric inpatient settings.[7–11]

Quitlines are a key component of tobacco control by providing telephone counseling, nicotine replacement therapy, and Web-based resources and support. Quitlines have been shown to be a highly cost-effective intervention, delivering high value relative to cost when compared with other common disease prevention interventions and medical treatments.[12]

A "fax to quit" model for referrals has been shown to improve referral rates to quitlines[13–15] by providing a proactive approach. However, the task of faxing may require significantly more time for staff.[16] The emergence of the electronic health record (EHR) presents unique opportunities for streamlining the process of referral to a quitline. One recent study showed increased referral rates when prompts for referrals were built into the EHR.[17] In a randomized controlled trial of 10 adult clinics in Texas, electronic referral facilitated by licensed vocational nurses showed a 13-fold increase in the percentage of smokers referred to the quitline, compared with standard (paper) referral.[18] In another pilot program, a built-in "eReferral" to a quitline within the EHR increased referrals from 0.3% to 14%.[19]

Stony Brook Children's Hospital is an academic, tertiary care hospital located in Suffolk County, NY, with a county population of 1.5 million people. Twenty-four percent of the population is under age 18 years. The smoking prevalence of adults within the county is 12%.[20] Before 2012 educational materials were provided to smokers, but no referrals were received by the New York State Smokers' Quitline (NYSSQL) from our hospital.

METHODS

In 2012, Stony Brook Children's partnered with the NYSSQL, administered by Roswell Park Cancer Institute in Buffalo, New York, to implement a new policy-driven quitline referral program, Opt-to-Quit (OTQ). In a children's hospital, OTQ supports health care providers' cessation interventions by the adoption of a system-wide proactive approach to identifying all tobacco-using caregivers and, unless consent is specifically denied, referring them to the NYSSQL, ideally using direct electronic transfer of contact information from the EHR. Implementation of OTQ was piloted in our newborn nursery and NICU and then applied to all units within the Stony Brook Children's Hospital with the goal of improving referrals for NYSSQL services. Surveys and Strengths, Weaknesses, Opportunities, and Threats (SWOT) analyses of nursing staff were conducted as part of another related research study[21] and were approved by our institutional review board.

Planning the Intervention

As the first step of this initiative, we identified key stakeholders and created a multidisciplinary task force including physicians, nurses, information technology (IT) specialists, Health Insurance Portability and Accountability Act compliance personnel, and legal counsel. This task force worked with NYSSQL staff to design a process to identify caregivers who smoke and electronically make referrals to the NYSSQL through Cerner, our EHR (Cerner Corporation, North Kansas City, MO, USA). A statement was created for caregivers to give consent for referral to the NYSSQL. A single-armed, prospective cohort study was designed to evaluate how we incorporate referrals into daily workflow. All caregivers of admitted children (mothers, fathers, family members/caregivers) over age 18 years, who were identified as smokers, were eligible for enrollment for quitline services. Data were collected via compliance reports that were requested and run from Cerner by our IT department to help identify additional opportunities to improve the process. Data were collected in monthly time periods using Excel software (Microsoft, Redmond, WA) and included documentation of task completion and referral information sent to the NYSSQL. Two multiple-choice surveys (at beginning and 9 months) and SWOT analyses (at 21 months) were performed with nursing staff to assess attitudes and workflow issues.

Improvement Activities

Nurses were tasked with completing the OTQ referral because of their presence at the bedside during all shifts. Information regarding the OTQ program was provided to nursing staff, and educational sessions were conducted for staff before implementation. Caregivers who were smokers were identified by the admitting nurse as part of the standard questionnaire asked of all caregivers on admission. If a smoker was identified, the nurse was granted access to a referral window functioning directly within the EHR. The nurse read a short statement within the window to the smoker, which explained the referral process and NYSSQL services. The statement served as consent for collection and electronic transmission of information to be sent to the NYSSQL. The NYSSQL contacted caregivers by phone within 24 to 72 hours to complete enrollment.

A major step in the implementation process was the coordination of information processing, both at the hospital and at NYSSQL. Web services were developed to enable our EHR to send data to the NYSSQL on a 24/7 basis using a self-defined standard format. The minimum necessary information for electronic transmission was directly entered into the referral window: first and last name, date of birth, address, phone number, and best time to call. Data were transmitted from the Stony Brook patient data system to a secure Web service

TABLE 1 SWOT Analysis: Nurses' Feedback on the OTQ Program

Strengths of OTQ	Weakness/Threats	Opportunities (Suggestions)
Offered to all smokers	Discussing smoking is perceived as uncomfortable	Involve other personnel (social worker, dedicated counselors)
As part of EHR, referral is streamlined	Referral to NYSSQL inadequate (need to do on-site counseling as well)	Start process prenatally (involve obstetrician)
Cost-effective and convenient	Lack of buy-in to referral process	Improve understanding of the program among staff and patients; better promotional materials, include videos
	Lack of understanding of quitline services	Provide nicotine replacement therapy for referred individuals
		Dedicated self-referral stations

Roswell Park Cessation Service created for the NYSSQL, where it was securely stored and managed by the NYSSQL. The data were formatted in an XML file to meet the NYSSQL OTQ data format requirements. The NYSSQL also provided a secure password-protected Web site where outcome data on all patients (eg, medications mailed, number of counseling sessions) was made available in real time to designated Stony Brook personnel. This data exchange is based on a point-to-point protocol without dependence on any external centralized processing service, requiring little additional cost to sustain this process in the future. The IT staff at Stony Brook Children's Hospital and the NYSSQL worked together to set up this process and clean up the initial issues over a period of a few months. With the referral window in place caregivers were referred directly through the child's chart without the need for a separate encounter for the caregiver within Cerner.

Because all caregivers are not necessarily present or receptive to smoking cessation recommendations on admission, the option for referral through the EHR was made available to staff as an ad hoc function to be completed at any time during the hospital stay. After admission, if a smoker wished to enroll in quitline services, any physician or nurse was able to access the referral window and transmit the information to the NYSSQL, allowing for enrollment at any time during a child's hospitalization.

Measurement Plans and Analysis

Compliance with referral to the NYSSQL, based on Cerner reports, was assessed on an ongoing basis by our Quitline Task Force, comprising inpatient unit nursing champions, nurse and physician leadership, and IT specialists. On the basis of nursing feedback and information on referral rates from the NYSSQL, changes were made to the process through several iterative plan-do-study-act cycles.

Surveys at the beginning and 9 months after implementation and SWOT analyses at 21 months after implementation were administered and collected for a 2-week period by a research assistant. For the multiple-choice surveys, relationships were examined using the χ^2 test of independence. All tests of significance were done using a 2-tailed α at the level of $P < .05$. Analyses were conducted using the SPSS software (version 21; IBM SPSS Statistics, IBM Corporation, Armonk, NY). For the SWOT surveys, themes were identified using qualitative analysis.

Histograms were created to represent data collected during the initial implementation period, the roll out throughout the Children's Hospital, and after finalization of the process in the EHR. The data points represented are the total number of children identified as exposed to SHS and the number of smokers who accepted referral to the NYSSQL.

RESULTS

In the 20 months before our implementation of the OTQ referral process, the NYSSQL received a total of 263 referrals from all of Suffolk County, with zero referrals from the Stony Brook area (zip code 11794). In 2013, we saw an absolute and immediate increase with 193 smokers identified in the pilot units and 119 referrals made to the NYSSQL (62%). We attribute this success, in part, to the daily presence of a research assistant on our pilot units. This presence served as a reminder to nursing to complete the referral and for parents to request quitline services. Compliance was strong for the first 12 months of the project.

In May 2013, the OTQ referral function was expanded to all inpatient pediatric units. Two anonymous self-report surveys were given to nursing staff, the first at the time of hospital-wide initiation of the program (T1) and the second at 9 months (T2). Of 212 total nurses employed at that time, 44 (21%) completed the survey at T1, and 39 (18%) completed the survey at T2. Questions focused on attitudes toward smoking, counseling of patients, referral of patients and families to OTQ, and workflow. At both times, 97% of respondents believed it was their responsibility to advocate for their patients, and almost all respondents reported that they asked about parental or patient smoking. There was an upward trend in asking about other relatives' smoking over the survey periods (T1, 34% vs T2, 47%; $P > .05$). From T1 to T2, the proportion of respondents reporting

TABLE 2 Compliance With Referral Tasks Completion

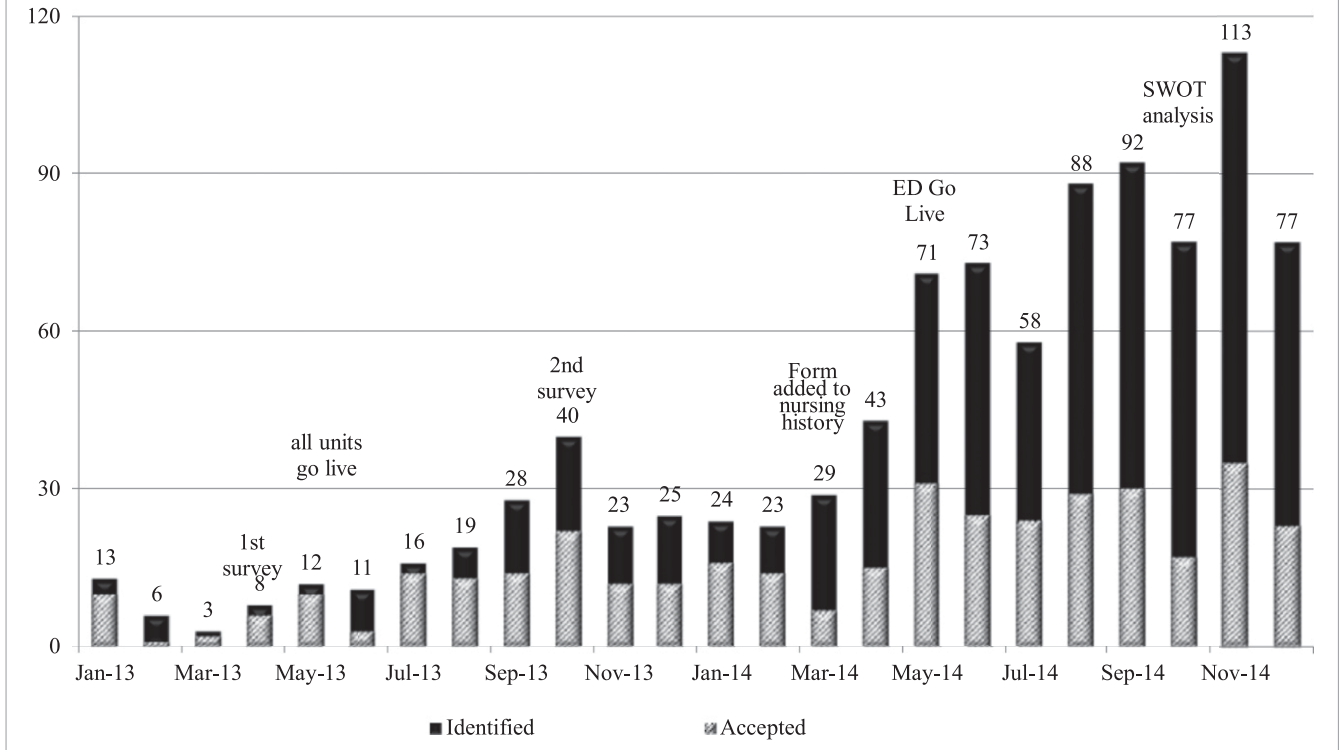|	Aug 14	Sep 14	Oct 14	Nov 14	Dec 14	Jan 15
Pediatrics overall referral tasks	1892	2209	2263	2024	2304	2268
Referral tasks completed	982	1005	1009	895	1000	923
Referral tasks completion rate (%)	51.9	45.5	44.6	44.2	43.4	40.7

FIGURE 1 OTQ: total identified in 2013–2014. ED, emergency department.

referring for smoking cessation services increased (T1, 57% vs T2, 80%; *P* = .024). There were also trends toward improvement in referring other relatives for smoking cessation services (ie, OTQ) and offering nicotine replacement therapy (T1 34% vs T2, 42%; *P* > .05). Nurses reported no change in their ability to complete all tasks during a shift.

In October, 2014, nurses were asked to participate in a SWOT analysis by completing an open-ended questionnaire. Responses (*n* = 26) elucidated continued issues and opportunities for improvement, specifically tailoring the timing of referral completion to minimize redundancy in workflow, the need for continued education of staff regarding SHS and third-hand smoke, and the programs offered by the NYSSQL (Table 1).

Initial compliance data from the EHR reviewed for a 6-month period (August 2014–January 2015) revealed that only ~40% to 50% of the referral tasks were completed each month (Table 2). To increase compliance, work was done in the EHR to improve the process and eliminate workarounds. It was noted that there were 2 ways within the EHR to refer smokers to the NYSSQL, and the compliance report needed to be modified to reflect both methods. Additionally, staff members were able to bypass the process by exiting the referral screen before completing all of the necessary steps for transmission of information to the quitline.

After a review of the workflow with front-line staff, the OTQ section of the Pediatric Nursing History was changed to mandated fields as appropriate, which increased

compliance with screening completion to 100%. Despite an apparent drop in OTQ acceptance rates, our identification of appropriate referrals increased nearly threefold over the 2 years (2013–2014), correlating with an overall increase in OTQ referrals of 124% (Fig 1).

Data were not collected during the first quarter of 2015 because of ongoing changes to the EHR. Data collected in 2015 for the second and third quarters (April 15–September 15) supported our continued improvement after a brief rollout period. After modifications to the EHR (first quarter 2015), we maintained a 34% acceptance rate (Fig 2). Follow-up data from the NYSSQL showed that of those referred, 44% were reached. Twenty-two percent of all referred (49% of those reached) were enrolled in quitline services (Fig 3).
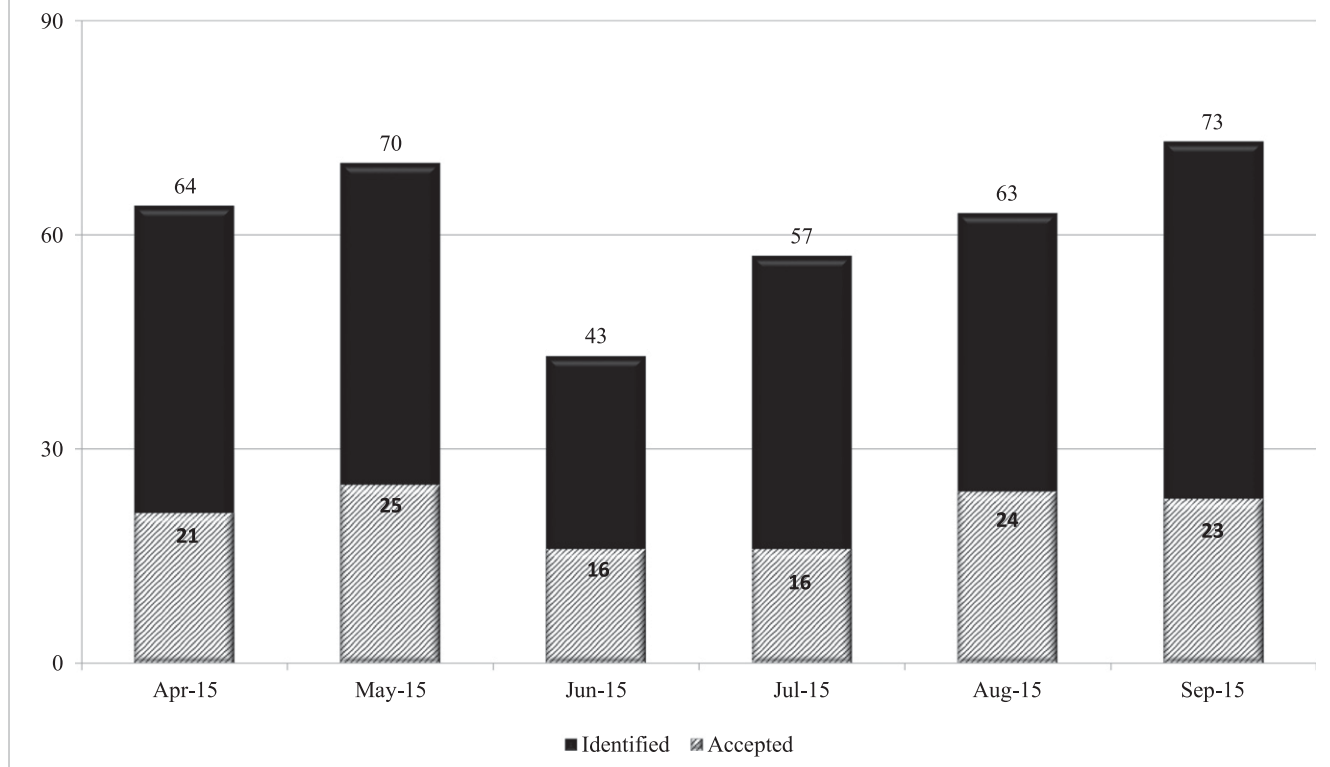
Opt to Quit - 2015 Total Identified

**FIGURE 2** OTQ: total identified in 2015.

DISCUSSION

Hospital-wide implementation of the OTQ program through our EHR has significantly improved referrals to the NYSSQL. The program's success can be attributed to many factors. Systematizing the process removed the variability inherent in a provider-dependent model, in which referrals are made by those practitioners with more interest or experience in smoking cessation. Incorporation of the referral within nursing workflow with mandated completion of required fields helped to streamline the process and maximize efficiency. Continued input from staff and educational modules rolled out throughout the process improved buy-in.

Adopting a systems-based approach to offering quitline referrals to all smokers is not a new concept. The fax-to-quit model has been widely used and has demonstrated success in several studies, especially when adequate education and training are provided. Bernstein et al showed a marked increase in health care providers' faxed referrals with a program emphasizing "systems change" through training and technical assistance.[14] In Wisconsin, the number of faxed referrals increased by a factor of 5 when training and on-site technical assistance and performance feedback were provided.[16] The advent of the EHR provides opportunities to standardize smoking cessation efforts by improved documentation of tobacco status and by providing prompts for referrals or counseling services.[22] In Massachusetts, QuitWorks is a robust program that facilitates the linking of health care

organizations, health care providers, and their patients to the quitline through multiple approaches, including education, program promotion, provision of nicotine replacement therapy, and electronic referral options.[23]

In implementing this novel program, we faced several challenges. Although we had buy-in from a core group of early adopters, consistent compliance with referral completion required oversight, continued education, and a culture shift on the part of the staff. Workarounds had to be identified and corrected. Reported widely in the literature, workarounds have been described as "clever methods for getting done what the system does not let you do easily." In hospitals, they are often viewed as blocks that prevent the accomplishment of tasks, which may be temporary but if

Opt to Quit - 2015 NYSSQL Stony Brook Referrals
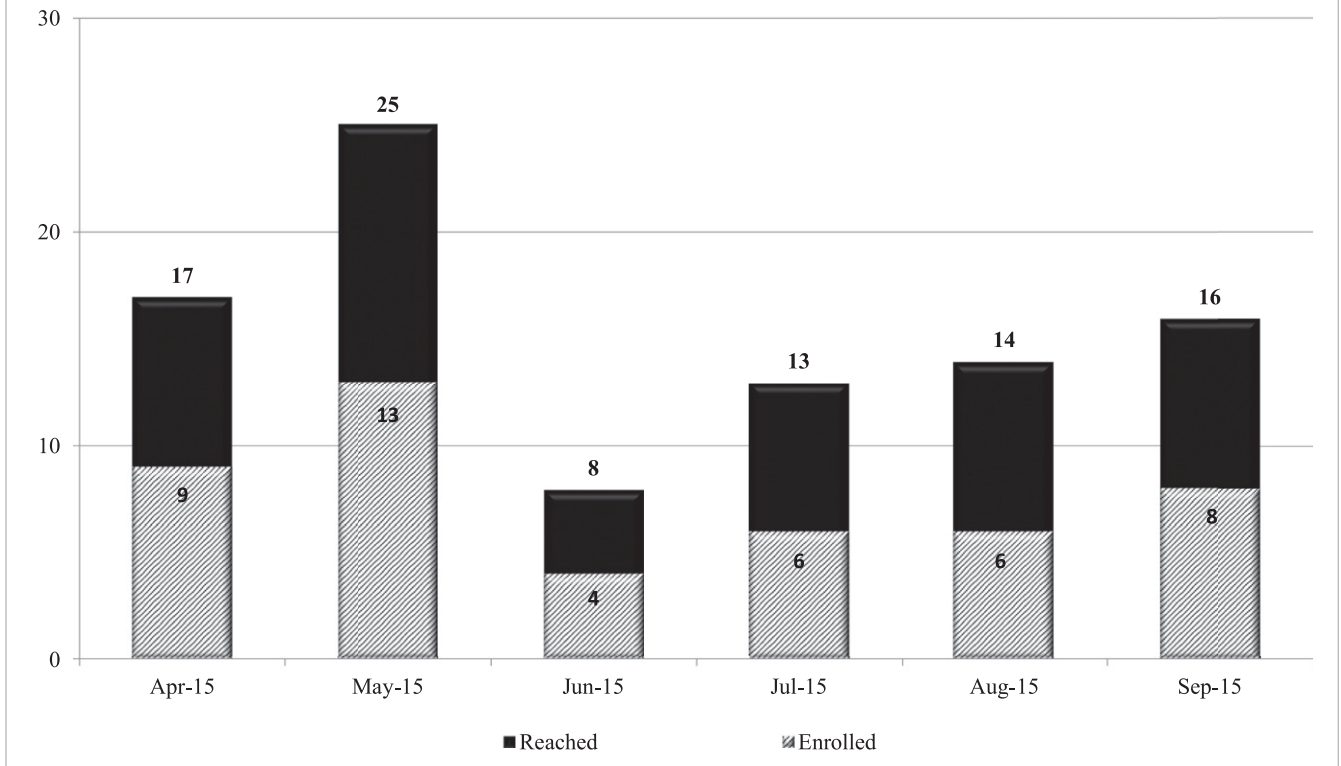
FIGURE 3 OTQ: NYSSQL Stony Brook referrals in 2015.

sustained have the potential to be adopted as routine practices.[24,25]

In our process, correct completion of all required fields was hard to enforce through systems change. For example, if a telephone number was not entered with the correct configuration of numbers and spaces, the data were not transferred, and within our EHR, there was no way to enforce this with an error message or hard stop. Ideally, required information, such as name and contact information, would auto-populate from the patient's chart, saving time and preventing transcription errors. This would be possible if the smoker being referred were the patient; however, in our case, we were referring caregivers whose contact information might differ from that in the chart. Furthermore, because of the potential difference between caregiver contact

information and the patient's information, generating compliance reports was challenging. Electronic transmissions needed to be consistently monitored at the site of transmission and receipt requiring regular communication with NYSSQL staff.

CONCLUSIONS

To our knowledge, we are the first children's hospital to establish an electronic referral system in collaboration with a quitline. Although we did not have a fax-to-quit model at our institution for comparison, one can assume that streamlining the process through the EHR would compare favorably because fewer steps are required to transmit information. Our success is evidenced by the continued increase in referrals to the NYSSQL. With the infrastructure and IT support in place on

both ends, this program is sustainable. Next steps include the incorporation of on-site cessation counseling and provision of nicotine replacement therapy to improve referral rates and promote cessation from the time of hospitalization.

Acknowledgments

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