

Increasing HPV Vaccination Series Completion Rates via Text Message Reminders

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ABSTRACT

Human papillomavirus (HPV) is the most frequently diagnosed sexually transmitted infection in the United States. It is associated with the development of cervical, anal-genital, and oral-pharyngeal cancers. The rate of HPV infection among adolescents and young adults in the United States remains high, and completion rates of an HPV vaccine series remain low. At an urban pediatric clinic, adolescent and young adult participants aged 11 to 22 years ($n = 37$) received text message reminders for their second and third dose of HPV vaccine over an 8-month study period. Of the participants receiving text message reminders, 14% completed the vaccine series at the optimal time, whereas 0% of an interested group ($n = 43$) and only 3% of a standard care group ($n = 232$) completed the vaccine series at the optimal time. Findings support the use of text message reminders to improve HPV vaccine series completion rates in a pediatric practice. *J Pediatr Health Care.* (2014) 28, e35-e39.

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KEY WORDS

Human papillomavirus, human papillomavirus vaccine, reminder systems, text messages

According to the Centers for Disease Control and Prevention (CDC) National Youth Risk Behavior Surveillance (CDC, 2011), nearly 50% of U.S. high school seniors have had sexual intercourse, and 15% of adolescents have had sex with four or more partners during their lifetime. Any form of sexual contact can transmit an infection. Among all sexually transmitted infections in the United States, genital human papillomavirus (HPV) is the most common, affecting an estimated 6.2 million people annually, with prevalence rates as high as 40% in teens aged 14 to 19 years (Knudtson, Tiso, & Phillips, 2009).

Because of the association of HPV with the development of cancer, the significance of HPV infection reaches beyond adolescence. Approximately 70% of cervical cancers worldwide are caused by HPV (CDC, 2007). The American Cancer Society reports that in 2013 in the United States, 12,340 new cases of invasive cervical cancer will be diagnosed and 4,030 deaths will occur as a result of cervical cancer. In addition, HPV infection is known to be associated with later development of oral-pharyngeal and anal-genital cancers (Saslow et al., 2007).

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In June 2006, the U.S. Food and Drug Administration approved the quadrivalent HPV vaccine targeting HPV types 6, 11, 16, and 18 (CDC, 2007). The vaccine consists of three doses administered at 0, 2, and 6 months. In 2007, the Advisory Committee on Immunization Practice recommended routine HPV vaccination of girls starting at 11 to 12 years of age, with catch-up vaccination of girls and women ages 13 to 26 years (CDC, 2009). In October 2011, the Advisory Committee on Immunization Practice recommended routine vaccination of boys starting at 11 to 12 years of age, with catch-up vaccination of boys and men ages 13 to 21 years.

Since the introduction of the HPV vaccine, an estimated 45 million doses have been distributed in the United States, but vaccine completion rates remain low (Conroy et al., 2009). Recent national data estimate that of the 37% of female adolescents who have initiated the HPV vaccine series, only 18% received all three doses (CDC, 2009). North Carolina is performing better than national estimates with regard to completion of the HPV vaccine series. Data from the North Carolina Immunization Registry (NCIR) reveal that between June 2006 and October 2009, 55% of females completed the HPV vaccine series, but only 28% of female initiators completed the series on time (Tan et al., 2011). This lapse in vaccine adherence constitutes a significant public health problem because of the high incidence of HPV infection and because of the oncogenic potential of the virus (Knudtson et al., 2009; Saslow et al., 2007).

A landmark article published in 2000 by Szilagyi et al. speaks to the efficiency of reminder/recall systems to improve immunization rates. The authors found that patient reminder/recall was an effective method for improving immunization rates for children in all types of medical settings, for universally recommended vaccinations such as routine childhood vaccines, as well as for targeted vaccines (Szilagyi et al., 2000). Wireless telephone networks have penetrated nearly 100% of the total U.S. population (International Telecommunication Union, 2011), and cellular phones provide an up-to-date method for implementing reminders/recalls. Text messaging has already been used for health promotion and disease prevention programs. One program, text4baby, is a maternal and child health promotion program available through the Virginia Department of Health. The program is based on behavioral theory and delivers text messages to traditionally underserved pregnant women and new mothers throughout their pregnancy. A recent evaluation of the text4baby mobile health program found that participants' receipt of text messages was associated with changes in specific health beliefs targeted by the messages (Evans, Wallace, & Snider, 2012).

Kharbanda and colleagues (2011) implemented and evaluated text message reminders for the second and third HPV vaccine in nine pediatric sites in New York

City and found them to be an effective intervention to increase on-time receipt of HPV dose number two or three. Stockwell and associates (2012a and b), in two separate studies, found that text messaging improved immunization rates in a low-income, urban population.

PURPOSE

The objective of this quality improvement (QI) project was to evaluate if text message reminders sent to patients or parents of patients at a busy urban pediatric practice would improve patients' HPV vaccine series completion rates. The project was approved through the Duke University Institutional Review Board.

METHOD

This QI study was conducted at a busy urban pediatric practice in North Carolina. The practice provides comprehensive care for more than 15,000 patients each year, ranging in age from birth to 22 years. Practice providers include seven board-certified pediatricians and one certified pediatric nurse practitioner. Patient encounters in 2012 totaled 38,000, during which time 28,000 doses of various vaccines were administered. Included among these 28,000 doses were 1,560 doses of HPV vaccine. All vaccines that are administered are entered into the NCIR, a well-validated, secure immunization information system. To enhance vaccine completion rates, the practice enables patients to schedule "vaccine only" appointments with clinical staff. Prior to implementation of this QI project, no reminder/recall system existed for the practice's HPV vaccinations. Although the practice can send e-mail reminders to patients for existing appointments, it had no mechanism for texting patients.

A variety of patient reminder innovations were explored for delivery of text messages to patients and families. After thorough consideration of cost, convenience, and availability, a third-party Web-based reminder system called Call-Em-All (www.call-em-all.com) was identified to pilot the delivery of text messages.

Prior to implementation of the innovation, the project coordinator conducted educational sessions with clerical and clinical groups during a staff meeting and with the provider group during a provider meeting. A Microsoft PowerPoint presentation was used to review HPV disease, HPV's association with later development of cancers, vaccine immunity, and vaccine safety, as well as vaccine series completion rates at the state, national, and practice level. The flow of the QI project, and each person's role in it, was also presented. The coordinator distributed a project information sheet to providers along with instructions for how patients could opt in to receive text message reminders; she also explained providers' responsibilities for recruitment of participants into the project during patients' clinic visits. The clinical staff was presented with the

same information as the provider group, and their role (identifying potential participants) was reviewed. The coordinator met with providers and key personnel throughout the project to review specific roles and responsibilities and seek feedback on the flow of the project.

According to usual clinical practice, providers offered HPV vaccine to eligible patients: males and females between the ages of 11 and 22 years. At the designated implementation date and for a period of 3 months, clinical staff and providers identified eligible patients prior to patient visits in a daily planning huddle. These planning huddles occur each morning and give clinical staff and providers the chance to plan each patient's visit on a given day. During clinic visits for eligible patients, clinical staff provided patients and parents with an HPV vaccine information sheet. Providers discussed HPV infection and the HPV vaccine with patients and parents. If the family initiated the vaccine, the text message reminder opportunity and enrollment sheet was offered.

Patients or parents agreeing to receive text message reminders were asked to complete an enrollment form while in the examination room; this form included the date of the first HPV vaccine, due dates for vaccine number 2 and 3, the patient's name, and the preferred cell phone number for receipt of text message reminders. In addition to completing this form in the office, participants had to use their designated cell phone to complete the opt-in process so that they could receive the reminder text messages. Participants who completed the enrollment form were given an instruction sheet that outlined a simple two-step process to complete the enrollment process.

A Plan-Do-Study-Act (PDSA) was conducted 6 weeks into the project to assess the effectiveness of the opt-in process. This PDSA showed that although patients or parents expressed interest in receiving text messages, they often failed to complete the opt-in process on their phone and therefore could not receive the text message reminders. Accordingly, the enrollment process was changed after the PDSA so that patients or parents were encouraged to complete the opt-in process on their phones while still in the examination room. This change in process increased the number of completed enrollments; the patients or parents who intended to enroll but did not complete the process became our interested group.

Completed enrollment forms were delivered to a clerical administrative staff member for entry into the Web site of the Call-Em-All system. The due dates for each patient's second and third HPV dose were entered into the online system for delivery of text message reminders. Each participant received three text message reminders per dose: one message 7 days prior to each HPV vaccine due date, one on the vaccine due date, and one 7 days after the due date. The reminder

message was always the same: "You are due for your next vaccine dose. Please call our office at xxx-xxx-xxxx if you have not yet completed a vaccine-only appointment."

The clinical staff followed practice protocol and entered vaccine administration information into the NCIR. Each month the clerical administrative staff member abstracted participant data from the NCIR and entered the data into a Microsoft Excel spreadsheet to track vaccine series completion rates.

Sample

Participants were a convenience sample of HPV vaccine-eligible patients and their caregivers who initiated the HPV vaccine series. Participants were enrolled into the text-message reminder system and followed up over an 8-month study period. The intervention group, called the text message group, included patients or parents who completed the opt-in process and received text message reminders. The interested group included patients or parents who enrolled in the project during a clinic visit but did not complete the opt-in process to receive text message reminders once they left the clinic. The standard care group included all patients who initiated the HPV vaccine series during the 8-month project period but were either not asked by their provider to participate in the text-messaging project or were asked and declined to participate.

Data Collection

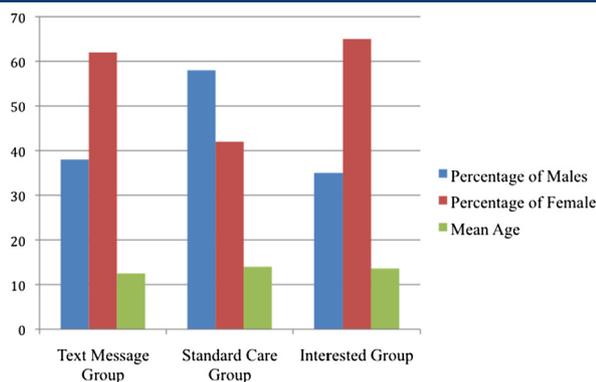
Data on vaccine series completion for the text message group and the two nonintervention groups (interested and standard care group) were collected from July 1, 2012, to February 28, 2013, via query of the NCIR. The clerical staff member was responsible for data entry for the text message group and the interested group. The nurse manager was responsible for data entry for the standard care group. Demographic data included, age, sex, insurance status, and status as a text message recipient.

Comparisons were made between the text message group and the standard group and between the text message group and the historical comparison group. The Fisher exact test was used to test the significance of relationships between the group (text message, interested, and standard care) and four separate outcomes: completion of HPV vaccine series 2, completion of HPV vaccine series 2 at the optimal time, completion of HPV vaccine series 3, and completion of HPV vaccine series 3 at the optimal time.

RESULTS

Demographics are presented in [Figure 1](#) for all three subsample groups. The mean age was similar across subsamples, with females making up the majority of participants in the text message and interested group and males making up the majority of participants in

FIGURE 1. Demographic characteristics for each subsample. This figure appears in color online at www.jpeds.org.



the standard care group. Analysis revealed significant differences between the text message group and the interested group on three of the four outcomes, including completing the HPV vaccine series 2, completing the HPV vaccine series 3, and completing HPV vaccine series 3 at the optimal time (all $p < .05$). To further validate the findings, we compared completion rates for the standard care group to those of the text message group over the same 8-month period. Significant differences were found between groups for all 4 outcomes (all $p < .05$; see [Table](#)).

DISCUSSION

The project goal was to improve adherence to vaccine guidelines and increase HPV vaccine series completion rates through the innovation of a text message reminder system. Text messaging appears to be an effective reminder/recall system for HPV vaccine series completion among patients or parents of patients who choose to enroll. [Greenhalgh \(2005\)](#) and colleagues' conceptual model was applied to analyze barriers and facilitators to the implementation of this innovation. The model examines the attributes of relative advantage, complexity, compatibility, trialability, and observability. All stakeholders agreed on the importance of HPV vaccine series completion and shared frustration regarding the current series completion rates at the practice. The use of text message reminders offered promise in terms of improving series completion rates in a timely

fashion. The increased use of smart phones was perceived as a potential facilitator for success.

A major strength of the intervention was its simplicity. Providers were asked to provide enrollment instructions to patients for opting-in to text messaging during the initiation of the HPV vaccine series. Patients or parents choosing to enroll needed only to text a secure number and enter the provided code. The cost of the third-party system to deliver text messages was nominal. Clerical staff time was reallocated to enter dates of receipt of text message reminders in the third-party Web site.

Another benefit of the intervention was the approval and enthusiasm expressed by patients or parents when introduced to text message reminders. Many parents reported they would prefer text messages over e-mail or telephone reminders. Adolescents confirmed our belief that text messaging was their preferred method of communication and reported that they check their smart phones frequently. Both parents and adolescents stated that they have easy access to their phones and find it convenient to send and receive communication via their phones. Although the intervention was geared toward adolescents, more parents than adolescents self-selected to receive text message reminders. Our intervention was specific to the HPV vaccine series, but the intervention could be easily adapted to other immunizations that are given in a series for children, adolescents, and adults.

Limitations/Barriers

A number of barriers to the project were identified. Full integration of this innovation was a challenge. One barrier was our initial enrollment process, during which patients or parents who expressed interest in participating "forgot" or delayed opting in to the text messaging system after departing the clinical site. Because we looked at the process early during implementation, the opt-in process was changed to encourage completion of enrollment while still in the examination room.

Timing of the project occurred during a major transition at the practice from paper to electronic medical records, causing significant distraction from the text message reminder system innovation. This distraction resulted in the inconsistent distribution of enrollment forms to patients. Therefore the majority of vaccine

TABLE. Subjects in the study sample for each outcome by group

Outcome	Text message versus standard care group				Text message versus interested group			
	Text message <i>n</i> (%)	Standard care <i>n</i> (%)	Exact test	Effect size (ϕ)	Text message <i>n</i> (%)	Interested <i>n</i> (%)	Exact test	Effect size (ϕ)
HPV 2	27 (73)	78 (27)	$p = .000$	.310	27 (73)	14 (33)	$p = .000$	.403
HPV 2 on time	14 (38)	59 (21)	$p = .035$	.131	14 (38)	9 (21)	$p = .137$	.186
HPV 3	6 (16)	14 (5)	$p = .018$	.149	6 (16)	0 (0)	$p = .008$	.307
HPV 3 on time	5 (14)	7 (3)	$p = .007$	.186	5 (14)	0 (0)	$p = .018$	.278

initiators were not given the opportunity to participate in the intervention, as evidenced by the large number of subjects in our standard care group.

Finally, the time constraints for required project completion dictated that enrollment stop during the first 3 months of the 8-month study period. Because the timing of the vaccine series requires 6 months from initial vaccine to completion, even allowing 8 months to complete the project was ambitious. Many patients were only able to complete HPV vaccine series 2 within that time frame. Late-enrolling patients who initiated the vaccine series within the study window but did not complete the series within 6 months of initiation could not be included in the data set.

In conclusion, the HPV vaccine is an important vaccine that provides immunity from HPV infection when the vaccine series is completed. Therefore low completion rates pose a challenge for pediatric patients and practitioners. Text message reminders were effective in promoting on-time receipt of the HPV vaccination series. This project rewarded and invigorated our staff by not only improving completion rates but also accomplishing the improvement via use of up-to-date technology. The results of this project can assist other pediatric practices in implementing text message reminders as a means to improve HPV vaccine series completion. The practice is committed to increasing HPV vaccine completion rates and plans to implement text message reminders as a standard recall/reminder system for both HPV vaccine and other vaccinations.

Text message reminders were effective in promoting on-time receipt of the HPV vaccination series.

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