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Increasing adolescent immunization by webinar: A brief provider intervention at federally qualified health centers

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ABSTRACT

Objective: To evaluate a brief intervention to increase provision of adolescent vaccines at health centers that reach the medically underserved.
Method: In April 2010, clinical coordinators from 17 federally qualified health centers (serving 7827 patients ages 12–17) participated in a competition to increase uptake of recommended adolescent vaccines: tetanus, diphtheria, and pertussis booster; meningococcal conjugate; and human papillomavirus. Vaccination coordinators attended a webinar that reviewed provider-based changes recommended by the CDC's Assessment, Feedback, Incentives, and eXchanges (AFIX) program and received weekly follow-up emails. Data on vaccine uptake came from the North Carolina Immunization Registry.
Results: Uptake of targeted adolescent vaccines increased during the one-month intervention period by about 1–2% (all $p < .05$). These small but reliable increases were greater than those observed for non-targeted vaccines (measles, mumps, and rubella; hepatitis B; and varicella).
Conclusion: This AFIX webinar led to small increases in provision of targeted adolescent vaccines over a one-month period. Similar, sustainable programs at healthcare facilities, including federally qualified health centers that function as safety net providers for medically underserved populations could help reach populations with great need.

Childhood vaccination is one of the success stories of the twentieth century [1]. In the past decade, three vaccines have received approval for children ages 11–12 years, with catch-up vaccination appropriate through adolescence: tetanus, diphtheria, and pertussis booster (Tdap); meningococcal conjugate; and human papillomavirus (HPV) [2]. Among adolescents ages 13–17 years, Tdap vaccine uptake is the highest of the three (69%), in part because some jurisdictions require it for school attendance [3]. Uptake of meningococcal conjugate is lower (63%), possibly due to fewer states having school mandates [3]. Uptake of HPV vaccine among adolescent girls is the lowest (49% for dose 1 and 32% for dose 3) [3], partly because of its recent introduction and partly because it requires three doses. The number of adolescents who have received all three recommended vaccines is lower still: between 17% [4] and 26% [5].

To increase provision of childhood vaccines, the CDC encourages the use of the Assessment, Feedback, Incentives, & eXchanges (AFIX) program [6]. AFIX centers on provider-based approaches that are effective in increasing vaccination rates (e.g. [7,8]). AFIX visits usually involve a public health worker collaborating with staff at the practices and offering an evaluation of medical records to ascertain immunization levels (Assessment); sharing the results of the assessment with the practice and suggesting methods for improvement (Feedback); negotiating formal and informal incentives for increasing immunization levels (Incentives); and facilitating communication among practices so that they can discuss success strategies (eXchanges) [9]. The AFIX program was developed in Georgia, where immunization rates for children ages 21–23 months increased from less than 40% to greater than 90% between 1987 and 2001 [6,10]. Based on this success, many other states and localities adopted the AFIX model, and the federal government requires jurisdictions receiving immunization funds to assess vaccination levels in 25% of local health departments [11]. In 2010, there were 2135 AFIX visits, and 14,847

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visits combining AFIX and the Vaccines for Children program (http://www.cdc.gov/vaccines/programs/vfc/default.htm), conducted at provider sites around the country [12]. Of these visits, 762 and 2400, respectively, focused on adolescent immunization. Practices implementing parts of the AFIX program increase their vaccination rates by a median of 5% per year [7], compared to 1.5% attributable to annual secular trends [11].

These provider-based AFIX interventions have focused on in-person interventions with public clinics, including the more than 1000 federally qualified health centers that function as safety net providers for underserved communities at 6000 sites around the country [13–15]. While vaccination rates for adolescents attending federally qualified health centers are not available, vaccination rates for underinsured children are lower than those with adequate healthcare coverage [16]. To our knowledge, no published studies have examined AFIX interventions focusing on adolescents or specifically at federally qualified health centers. Our study evaluated a brief intervention to increase adolescent immunization provision at federally qualified health centers in North Carolina. We focused on a webinar platform as a way to potentially increase the reach of the intervention.

Table 1
Typical AFIX intervention components.

Typical AFIX activity	Included in this study
Assessment	
Evaluation of medical records to get immunization level	x
Use CoCASA to analyze immunization trends	x
Evaluate record-keeping	x
Classify patients as active or inactive	x
Record observed, qualitative data about the practitioner's office	
Feedback	
Report results of assessment to providers	x
Focus on a couple of areas for improvement	
Help providers create goals for improvement	x
Follow-up with providers after feedback session	x
Incentives	
Provide informal incentives (e.g. information, education, etc.)	x
Discuss possible formal incentives (e.g. plaques, luncheons)	x
Providers design incentives for all staff for improving coverage	
eXchange	
Identify immunization champion	x
Share information on immunization practices	x
Compare provider rates to national/state/local levels	
Compare provider rates to other practices (ranked list)	
Providers share success stories or strategies that did not work	x

1. Methods

1.1. Participants and recruitment

The North Carolina Community Health Center Association and the North Carolina Immunization Branch partnered to develop and implement an AFIX intervention to increase adolescent immunization. We conceived of a one-month immunization competition among federally qualified health centers, with a free dinner for the staff of the center with the highest increase in overall adolescent vaccination during April 2010. Participation was open to all of the 131 federally qualified health centers in the state, and 18 clinics opted to participate. We excluded data from a small clinic because their baseline data were incomplete.

1.2. Procedures

As federally qualified health center staff members typically have many demands on their time and few additional resources, we designed an intervention that would be brief and simple to implement. The clinic coordinator from each participating center attended a one-hour one-on-one webinar AFIX visit by a staff member from the Immunization Branch (AD), who discussed adolescent vaccines, reviewed and explained each clinic's vaccination rates, and provided examples of strategies the clinics could implement that could improve immunization rates, such as reviewing and flagging charts, decreasing missed opportunities to vaccinate, and establishing center guidelines for immunizations, including using standing orders. Coordinators also learned how to use the North Carolina Immunization Registry to generate reminder letters for patients who were not up-to-date with one or more recommended vaccine and to use automated reminder phone calls. We intended for the clinic staff to view the AFIX practices in this intervention as easy to implement; therefore, clinics were free to choose one or more methods they wanted to use to increase adolescent immunization rates, allowing staff to select strategies best suited to their clinic's needs. Further, we did not ask staff to provide reports of their activities, to minimize participant burden.

As illustrated in Table 1, this intervention contained most of the major components of a typical AFIX intervention. The one-hour webinar was able to incorporate many of the activities recommended by the AFIX implementation guide [17].

The competition occurred from April 1 to May 1, 2010, with a staff member from the North Carolina Community Health Center Association sending weekly encouraging emails to clinic staff. Immunization coordinators at each clinic received standardized emails that included links to online vaccination resources, information on immunization levels for different counties, and reminders to focus on adolescent immunization. The Institutional Review Board at the University of North Carolina at Chapel Hill determined that this study did not require approval.

1.3. Measures

Immunization Branch staff generated site-specific vaccination reports at baseline (April 1, 2010) and following completion of the intervention (May 1, 2010) using data from the statewide immunization registry imported into the CDC's Comprehensive Clinic Assessment Software Application. More than 90% of public clinics in North Carolina use the registry, which contains information on an estimated 54% of adolescents [18]. Each clinic's population was based on patients with an active status in the registry for that particular practice. Reports included the number and percentage of patients ages 12–17 who were up-to-date on targeted adolescent vaccines: Tdap, meningococcal conjugate, and HPV (doses 1–3; females only). For comparison purposes, the reports also included non-targeted vaccines: hepatitis B; measles, mumps, rubella (MMR); and varicella (doses 1 and 2). As the AFIX visit was provided to one staff person at each clinic, we measured these outcomes at the clinic level.

1.4. Data analysis

We compared pre- and post-intervention vaccination rates for targeted adolescent immunizations (Tdap, meningococcal conjugate, and HPV) relative to non-targeted immunizations (hepatitis B, MMR, and varicella) using a generalized estimating equation to account for clustering of patients within clinics. We conducted a sensitivity analysis by rerunning these models excluding data from the clinic with the largest increase in vaccination rates. Data analyses used SAS Version 9.2 (Cary, NC). Statistical tests were two-tailed with a critical alpha of .05.

Table 2
Vaccine uptake among patients ages 12–17.

	Pre-intervention, *n* (%)	Post-intervention, *n* (%)	*p*
Total patients population	7827	7833	.911
Total female patients	3664	3673	.719
All vaccines	2435 (31.1%)	2524 (32.2%)	.001
Targeted vaccines			
Tdap	5021 (64.2%)	5086 (64.9%)	.001
Meningococcal conjugate	3633 (46.4%)	3710 (47.4%)	.001
HPV, initated 3-dose series[a]	1919 (52.4%)	1983 (54.0%)	.029
HPV, second dose[a]	1281 (35.0%)	1326 (36.1%)	.001
HPV, completed 3-dose series[a]	768 (21.0%)	809 (22.0%)	.001
Non-targeted vaccines			
MMR, completed 2-dose series	5570 (71.2%)	5605 (71.6%)	.087
Hepatitis B, completed 3-dose series	6128 (78.3%)	6160 (78.6%)	.123
Varicella, initiated 2-dose series	5001 (63.9%)	5026 (64.2%)	.232
Varicella, completed 2-dose series	3036 (38.8%)	3087 (39.4%)	.016

Note: Patients included adolescents aged 12–17 clustered in 17 federally qualified health centers. Tdap, tetanus, diphtheria, and pertussis; HPV, human papillomavirus; MMR, measles, mumps, and rubella.

[a] HPV vaccination rates are only for female patients.

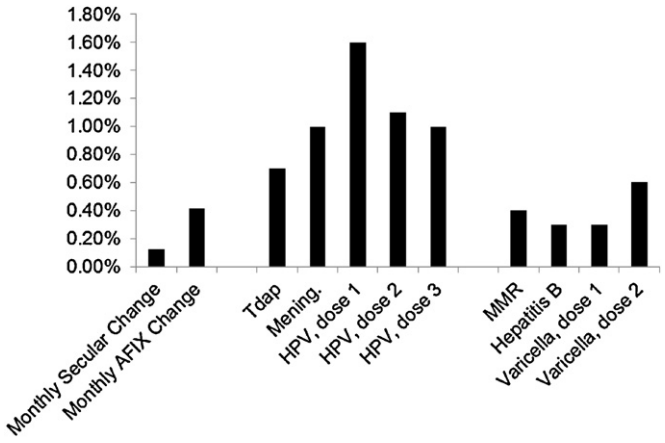

Fig. 1. Changes in vaccination rates for a one-month follow-up period.

2. Results

The 17 clinics served about 7800 patients ages 12–17 years (baseline population: 7827; follow-up population: 7833). The mean number of adolescent patients seen at each clinic at baseline was 460 (interquartile range [IQR], 94–470), with an average of 216 (IQR, 53–218) females (at follow-up, each clinic had an average of 461 patients (IQR, 94–473), with 216 females (IQR, 55–219)).

Vaccine uptake increased over the one-month follow-up period ($p < .001$, Table 2). Prior to the intervention, 31.1% (IQR, 13–33%) of each clinic's adolescent population was up-to-date on targeted and non-targeted vaccines, while after the intervention, 32.2% (IQR, 14–34%) was up-to-date (Chi-square = 27.34, $p < .001$).

The increase vaccine uptake was larger for targeted adolescent vaccines (an average of 17.2 more vaccines administered, per clinic) than for non-targeted vaccines (8.4 more vaccines administered, per clinic) (interaction of vaccine type with time, Chi-square = 34.82, $p < .001$). Among the targeted vaccines, average immunization level across practices at baseline was 64.2% (IQR, 55–75%) for Tdap; 46.4% (IQR, 28–57%) for meningococcal conjugate; 52.4% (IQR, 50–68%) for HPV initiation and 21.0% (IQR, 16–28%) for HPV completion among females. At follow-up, average immunization rate across practices increased significantly to 64.9% (IQR, 58–75%) for Tdap; 47.4% (IQR, 29–58%) for meningococcal conjugate; 54.0% (IQR, 50–68%) for HPV initiation and 22.0% (IQR, 16–28%) for HPV completion.

Among vaccines not targeted by the intervention, uptake increased significantly only for the second dose of varicella vaccine (Chi-square = 5.81, $p = .02$). A sensitivity analysis found the same pattern of findings after dropping data for the clinic with the greatest increase, except the change in the first dose of HPV vaccine lost statistical significance ($p = .07$).

3. Discussion

A brief intervention by webinar with providers at federally qualified health centers in North Carolina resulted in a small increase in adolescents receiving targeted vaccines. This intervention demonstrated an effective effort to increase immunization coverage in an age group that is often underserved [3]. A strength of this study is the use of web-based technology to administer the AFIX intervention components. While studies have shown that the AFIX program has relatively low costs [11], employing webinars and emails reduces the costs associated with in-person visits.

The intervention effect of our webinar was quite small; however, even such small increases could be meaningful to public health, if they come as the result of brief and widely disseminated interventions. The 1–2% increases in rates of uptake for targeted vaccines that we saw over one month are potentially important when compared to the 1.5% annual secular increase in vaccination, and 5% annual increase in vaccination attributable to AFIX interventions (Fig. 1) [7,11]. Furthermore, one month is a short period in which to ask clinics to implement changes in their vaccination strategies and nonetheless see increases in their vaccination rates. However, one month of follow-up may be appropriate to capture the greatest changes in vaccination rates associated with exposure to the webinar, and effects of the webinar may diminish after that time. In addition, intervening at federally qualified health centers, which may be especially burdened providers, could have led to a smaller impact than may have been seen in more well-resourced settings. Efforts to encourage providers, both at federally qualified health centers and at other clinics, to increase vaccination using the AFIX techniques by webinar could help reduce disparities in teenage vaccination rates, given that these centers reach diverse populations [19].

A limitation to our study is that it did not have a control arm, as this would not have been acceptable to the community partners; however, our use of an instrumental comparison (non-targeted vaccines) allowed us to treat clinics as their own controls. If clinics applied the strategies they learned in the AFIX webinar to also increase uptake of non-targeted vaccines, this would have led to an underestimation of the impact of the visit on immunization levels for targeted compared to non-targeted vaccines. The non-targeted vaccines were imperfect controls, because they had higher levels of baseline coverage, indicating that they had less room for improvement.

Examination of the effect of the intervention on the instrumental control showed a statistically significant interaction effect, such that targeted vaccines had greater increases in uptake than did non-targeted vaccines. Self-selection of clinics into the intervention makes the generalizability of the intervention to other medical practices unknown. It is possible that clinics opting not to participate were burdened by competing priorities or not motivated by the incentive offered (i.e. free dinner). We saw minor changes in the size of some clinic populations over the month of the intervention, either through new patients visiting the clinics or because data cleaning eliminated non-active records from the population (16 of the 17 clinic populations changed by less than 5%).

Because new patients entering the practice could have a variety of vaccine histories, it is unclear how they might have affected the results.

As participating clinics did not report the strategies they used to increase vaccination rates, we cannot determine which of the suggested approaches was most effective. In addition, because the program had multiple components (i.e. webinar, competition, and reminder emails), it is unclear which components drove the changes in immunization rate. It is possible that some clinics were not able to implement any of the strategies suggested by the AFIX webinar. However, it appears that participating clinics did change their practices, since there was a significant increase in uptake rates for the targeted vaccines.

Future research should investigate which strategies to increase adolescent immunization are the most successful in the shortest period of time. In addition, future studies should evaluate how sustainable these changes are over longer periods, or whether repeating this intervention in the same clinics leads to comparable increases.

4. Conclusion

AFIX is a national program that can improve adolescent vaccination. While previous research on AFIX has focused on increasing childhood vaccination, state immunization programs now use the program to boost adolescent vaccination, as well. The short-term AFIX intervention by webinar described here demonstrated small but significant changes in vaccination rates and offers a novel way to improve adolescent immunization rates.

Conflict of interest statement

Authors have received research grants and/or served on advisory boards for Merck Sharp & Dohme Corp. (NB, PR) and GlaxoSmithKline (NB), makers of HPV vaccine.

References

[1] Centers for Disease Control and Prevention (CDC). Vaccine-preventable diseases: improving vaccination coverage in children, adolescents, and adults. A report on recommendations from the Task Force on Community Preventive Services. MMWR Recomm Rep 1999;48(RR-8):1–15.

[2] Centers for Disease Control and Prevention (CDC). Vaccination coverage among adolescents aged 13–17 years—United States, 2007. MMWR Morb Mortal Wkly Rep 2008;57(40):1100–3.

[3] Centers for Disease Control and Prevention (CDC). National and state vaccination coverage among adolescents aged 13 through 17 years—United States, 2010. MMWR Morb Mortal Wkly Rep 2011;60(33):1117–23.

[4] Reiter PL, McRee AL, Gottlieb SL, Brewer NT. Correlates of receiving recommended adolescent vaccines among adolescent females in North Carolina. Hum Vaccin 2011;7(1):67–73.

[5] Stokley S, Cohn A, Dorell C, Hariri S, Yankey D, Messonnier N, et al. Adolescent vaccination-coverage levels in the United States: 2006–2009. Pediatrics 2011;128(6):1078–86.

[6] Centers for Disease Control and Prevention (CDC). AFIX (assessment, feedback, incentives, and eXchange); 2011, http://www.cdc.gov/vaccines/programs/afix/index.html.

[7] Briss PA, Rodewald LE, Hinman AR, Shefer AM, Strikas RA, Bernier RR, et al. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. The Task Force on Community Preventive Services. Am J Prev Med 2000;18(1 Suppl.):97–140.

[8] Dexheimer JW, Talbot TR, Sanders DL, Rosenbloom ST, Aronsky D. Prompting clinicians about preventive care measures: a systematic review of randomized controlled trials. J Am Med Inform Assoc 2008;15(3):311–20.

[9] Centers for Disease Control and Prevention (CDC). Core elements for AFIX training and implementation; 2004.

[10] Dini EF, Chaney M, Moolenaar RL, LeBaron CW. Information as intervention: how Georgia used vaccination coverage data to double public sector vaccination coverage in seven years. J Public Health Manag Pract 1996;2(1):45–9.

[11] LeBaron CW, Mercer JT, Massoudi MS, Dini E, Stevenson J, Fischer WM, et al. Changes in clinic vaccination coverage after institution of measurement and feedback in 4 states and 2 cities. Arch Pediatr Adolesc Med 1999;153(8):879–86.

[12] National Center for Immunization and Respiratory Disease. VFC reporting menu—CY 2010: grantee program requirements and VFC provider enrollment; 2011, http://www2a.cdc.gov/nip/irar/grantee/qryVFC2010.asp.

[13] Department of Health and Human Services. Federally qualified health center; 2011, http://www.cms.gov/MLNProducts/downloads/fqhcfactsheet.pdf.

[14] Doty MM, Abrams MK, Hernandez SE, Stremikis K, Beal AC. Enhancing the capacity of community health centers to achieve high performance: findings from the 2009 Commonwealth Fund National Survey of Federally Qualified Health Centers. The Commonwealth Fund 2010, July 9; 2011.

[15] Zakheim M, McNamara K, Joseph J. Partnerships between federally qualified health centers and local health departments for engaging in the development of a community-based system of care; 2010.

[16] Smith PJ, Molinari NA, Rodewald LE. Underinsurance and pediatric immunization delivery in the United States. Pediatrics 2009;124(Suppl. 5):S507–14.

[17] Centers for Disease Control and Prevention (CDC). AFIX guide to the core elements for training and implementation; 2011, http://www.cdc.gov/vaccines/programs/afix/core-elements.html.

[18] North Carolina Immunization Branch. Regarding the 2010 annual report for North Carolina submitted to the centers for disease control and prevention, 2012, submitted for publication.

[19] Pickering LK, Baker CJ, Freed GL, Gall SA, Grogg SE, Poland GA, et al. Immunization programs for infants, children, adolescents, and adults: clinical practice guidelines by the Infectious Diseases Society of America. Clin Infect Dis 2009;49(6):817–40.