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Immunization Reminder for Caregivers of Young Children

Jessica Scritchfield Wooten

Doctoral Research Project submitted to the School of Nursing at West Virginia University

in partial fulfillment of the requirements for the degree of

Doctorate in Nursing Practice

Mary Jane Smith, PhD, RN, Chair

Stacey Culp, PhD

Teresa Ritchie, DNP, FNP-BC

Ronald E. Greer III, MD

Department of School of Nursing

Morgantown, West Virginia

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ABSTRACT

Immunization Reminder for Caregivers of Young Children

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Background: Vaccines are one of the most successful and easily accessible prevention tools available to clinical practitioners in the United States. Falling levels of immunity in the entire population amplify concern for increases in preventable childhood diseases, making improving vaccination rates an important goal for current clinical practitioners (Omer et al., 2009).

Purpose: The purpose of this intervention was to increase the percentage of vaccinated children 0-6 years of age by sending a reminder letter to parent/guardians of children who are unvaccinated and under-vaccinated per the CDC's current immunization recommendations at a rural health center in West Virginia

Project: The project plan was to (1) determine the percentage of children age 0-6 years in a rural family practice who are and are not fully immunized per the CDC's current immunization schedule; (2) develop an immunization reminder letter for caregivers of the children who are not fully immunized; (3) mail the immunization reminder letter to identified caregivers; (4) determine if the mailed reminder letter increased the number of children who are fully immunized per the CDC's current immunization schedule.

Summary of Findings: The project goal of increasing the number of children whose immunizations were up to date per the CDC's current immunization schedule was met. At the beginning of the intervention, 56% (n=130) of children age 0-6 at the rural health center were up to date per the CDC's current immunization recommendations. At the conclusion of the intervention 67% (n=156) of the eligible population were up to date, a 25% increase. This result was statistically significant ($p < 0.001$).

Implications: This project models a simple intervention rural family practices can implement to increase immunization rates among the pediatric population. In the future, the project can be used by other family practice settings to increase immunization rates

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Immunization Reminder for Caregivers of Young Children

Vaccines are one of the most successful and easily accessible prevention tools available to clinical practitioners in the United States. Since the invention of the first vaccine in 1796, the incidence of many diseases has been reduced and some have been totally eradicated (Facts about Childhood Vaccines, 2009). Vaccines are necessary to prevent common infections such as influenza and pertussis, infections that are prevalent in other parts of the world, and suppressed diseases that could easily reemerge, (Department of Health and Human Resources, 2010).

Background and Significance

In the United States, public policy interventions have led to high levels of vaccine coverage and low levels of vaccine preventable diseases (Omer, Salmon, Orenstein, DeHart, & Halsey, 2009). Omer et al. (2009) described the goal of vaccination programs as “herd immunity”. In herd immunity, the population that is vaccinated provides a certain degree of protection for those who are not vaccinated. The greater number of people who are immunized, the smaller the probability that a susceptible individual will encounter the disease.

The disappearance of many childhood diseases, however, has led some parents/guardians to question whether childhood immunizations are still necessary (Facts about Childhood Vaccines, 2009). Some believe that vaccination may cause diseases such as autism, hyperactivity, attention deficit disorder, and developmental delays.. These concerns have caused some parents/guardians to delay vaccines or withhold them altogether (Facts about Childhood Vaccines, 2009). Conversely, some parents/guardians cannot overcome barriers to healthcare access to get their children vaccinated.

The Center for Disease Control and Prevention (CDC) supports that the current childhood immunization schedule increases quality of life and life expectancy (DHHS, 2010). Currently, the

CDC promotes the 4:3:1:3:3:1:4 vaccine schedule (DHHS,2011). This schedule consists of four or more doses of diphtheria, tetanus, and pertussis (DTaP), three or more doses of poliovirus vaccine (IPV), one or more doses of any measles, mumps, and rubella (MMR) vaccine, the full series haemophilus influenzae type B (Hib), three or more doses of hepatitis B (HepB) vaccine, one or more doses of varicella vaccine (VAR), and four or more doses of pneumococcal vaccine (PCV). Acute illnesses caused by vaccine preventable diseases may have sequelae that include paralysis, loss of limbs, organ damage, and a permanently diminished quality of life (DHHR, 2010). Additionally, unvaccinated children are more susceptible to contracting viral and bacterial illnesses that cause death and disability (Facts About Childhood Vaccines, 2009). Unvaccinated children also put those around them at increased risk for exposure to vaccine preventable illnesses. People who contract suppressed diseases may transmit them to children who are too young to receive the vaccine, or to those whose vaccines were ineffective, increasing illness and disability within communities (Facts About Childhood Vaccines, 2009).

The CDC lists 14 diseases that are preventable by routine childhood immunizations. In 2002, the World Health Organization (WHO) reported that 1.4 million children under the age of five died from diseases that are preventable by routine vaccination. The Vaccine Education Center at the Children's Hospital of Philadelphia (2009) estimates that without vaccines, the United States would see 10,000 children paralyzed by polio, 15,000 children with permanent brain damage from haemophilus influenza type B, and thousands of infant deaths from pertussis each year.

Problem

Falling levels of immunity in the entire population amplify concern for increases in preventable childhood diseases, making improving vaccination rates an important goal for

current clinical practitioners (Omer et al., 2009). The purpose of this intervention was to increase the percentage of vaccinated children 0-6 years of age by sending a reminder letter to parent/guardians of children who are unvaccinated and under-vaccinated per the CDC's current immunization recommendations at a rural health center in West Virginia.

Change Model

Kotter's 8 step change model was used to guide this intervention. During the 1990's John Kotter, a professor of leadership at Harvard University, studied over 100 business companies organizational change efforts. Through his studies, he determined that more than half of all major organizational changes fail (Kotter International, 2012). In light of this, Kotter identified strategies to manage change, noting that factors key to facilitating change included identifying why the organization resists change, determining what process can be used to overcome the resistance, and understanding what role the leader plays in driving change. Using the findings from his studies, Kotter (1995) developed eight stages to facilitate the change process:

1. Creating a sense of urgency
2. Forming a powerful coalition
3. Creating a vision for change
4. Communicating the vision
5. Removing obstacles
6. Generating short-term wins
7. Continuing the change
8. Maintaining the change

Creating Urgency

In Kotter's first step, he stressed that to initiate change, it is imperative to create a sense of urgency to overcome complacency. In this model, crisis is considered a positive impetus for change. The current organizational culture lacks focused leadership and the change environment has become stagnant. Within this organization the urgency for change comes with the knowledge that the agency's funding is dependent on meeting core measures, one of which includes increasing vaccine uptake in children. The problem of undervaccination and non-vaccination must be addressed within the facility, and there is no current action plan outside of the proposed change project. Data obtained during the initial chart reviews will be used to strengthen the sense of urgency for this change. By knowing the percentage of children within the practice who are not up to date, the staff are expected to be stimulated to improve the rates within the practice.

Forming a Coalition

The second step calls for creating a coalition that will guide the change process. Successful coalitions are led by individuals with position, power, credibility, expertise, and leadership skills. Within the organization this coalition has been created through buy-in of support staff and the provider team. The change project was presented to the staff of the medical center through email correspondence and support for the intervention was requested by the change leader. The medical director has been chosen as a clinical expert and champion for the change project due to his knowledge of vaccine administration and current evidence based immunization administration guidelines and recommendations. Additionally, the medical director has a special interest in increasing the vaccination status of the pediatric population as a step toward meeting certified medical home designation. Other project stakeholders include

other providers at the clinic, the nursing staff, pediatric patients of the clinic, and their parents/guardians.

Vision

In the third step, a clear vision is developed to guide the change. The project facility does not currently have its own vision statement, but the proposed project is in line with the organizations current mission and values. With the fourth step, the leader communicates the vision in a simple, clear message and in step five, a broad action plan and clear structure for change helps to remove obstacles. The vision for this project is to increase vaccine uptake in the facilities' pediatric population. The vision is clear and has been communicated to the entire staff at the rural health center. All organization staff have been advised of the important role they play in the project's success. Additionally, the benefits to the organization, including meeting Universal Data Set requirements, were clearly communicated both verbally and through email communication with the facility staff.

A clear action plan and timeline was presented to all employees of the rural health center. An open line of communication with the project manager was highlighted and staff were encouraged to ask questions at any point in the intervention. Recent in-house training included review of the current vaccine schedule, the catch-up schedule, vaccine administration guidelines, and frequently asked immunization questions. Pre-planning, clear communication, and comprehensive staff education facilitated the implementation of the intervention.

Short Term Wins

Steps six, seven, and eight were conducted during the intervention and in the immediate post-intervention phase. Step six focuses on short term successes that provide the impetus to continue through the change process. An established performance based incentive program

examined each providers UDS measures, including the percentage of pediatric patients who are up to date with the current immunization schedule. This fiscal reward program, while not a part of the intervention, continually brought awareness to the practices vaccination rates. Kotter (1995) stressed that it is important to encourage team players to follow through with the proposed changes. A short term win for the rural health center was the immediate improvement in the overall vaccination rate of the patient population. Staff was advised of the progression of the intervention and encouraged to continue the efforts to assist increasing the immunization rate of the selected population.

Continuing Change

With step seven the change leader builds on successes and identifies areas to improve. Each child that returned to the clinic to receive his/her vaccination visually reinforced the need for a continuing change. At the end of the intervention period, the results and statistical analysis of data wereshared with the staff of the rural health center and the organizations' Quality Improvement committee. Program successes were highlighted and staff input was requested regarding program flaws and areas that can be improved for future expansion of the project.

Maintaining the Change

Finally, in step eight of the model, the change is solidified into the organizational culture. After the project was complete, the change leader and organizational leaders examined ways to expand the intervention and make improving vaccination rates part of the organizations' routine practice standards. Review of the change process combined with staff recommendations for improvement led to the development of a plan for succession. Program flaws can then be addressed and corrected as a team effort. UDS and PCMH requirements for increasing

immunization rates, which are directly tied to the rural health center's grant funding, create an impetus to continue the change and further improve immunization rates.

Kotter, an innovator in business change, has made his linear model easily applicable to any change situation, including healthcare. A business model was chosen to guide change this project due to simplicity and the ease in which principles can be communicated to key project participants and support staff. The most recognizable use of Kotter's change model was its application by the U.S. Army to prepare troops for new forms of asymmetrical threats (Kotter,2005). Its use has also been heralded by the Eastman Kodak company, who used Kotter's principles to align their supply and demand, increasing their productivity and improving relationships between administrators and other employees (Kotter, 1995).

One strength of Kotter's model is that the steps can be used as a checklist to monitor the changes progress. The model is also flexible and multiple steps often occur simultaneously during major organizational change. It is easy to understand and the ease of application allows the model to fit into most organizational structures, including that of the rural health organization. One disadvantage of the model is that all of the steps must be completed for the change to be successful, and once the project has started it is difficult to change directions. Another disadvantage is that individual needs are not always considered as the success of the change for the organization is made a priority.

Literature Review and Synthesis

The review of literature will be presented by the topics of vaccination of children, reminder-recall systems, effectiveness of reminder/recall systems, and West Virginia demographics.

Under-vaccination of Children

Caregiver characteristics and social demographics are important in understanding why children are not vaccinated, as children in this age range cannot make medical decisions on their own. Under-vaccinated children are more likely to be poor minorities with uneducated, single mothers (Omer et al., 2009). The same study found that unvaccinated children are likely to be Caucasian, from high economic class, and with an educated, married mother. Smith, Chu, and Barker (2004) had similar findings in a large, nationally representative probability sample of children 19 to 35 months of age during 1995-2001. Results from this work found that under vaccinated children were more likely to be black, have a young, unmarried mother with no college degree, live near the poverty level, and live in a central city. Unvaccinated children tend to be white, have a married mother who was a college graduate, and have an annual household income exceeding \$75,000 (Smith, Chu & Barker, 2004). Unvaccinated children commonly had parents/guardians who expressed their concerns regarding vaccine safety and also indicated that their medical provider had little influence over vaccination decisions for their children (Smith, Chu & Barker, 2004). The majority of unvaccinated children were male.

States that allowed philosophical exemptions to vaccinations for children entering school had significantly higher estimated rates of unvaccinated children. A philosophical exemption may be granted to individuals who object to immunizations because of personal, moral or other beliefs (The National Conference of State Legislatures, 2013). These states include California, Illinois, New York, Washington, Pennsylvania, Texas, Oklahoma, Colorado, Utah, and Michigan (Smith, Chu & Barker, 2004). West Virginia state code 16-3-4, entitled *Compulsory immunization of school children; information disseminated; offenses; penalties*, limits exemptions to vaccination within the state to documented medical exclusions only (The National Conference of State Legislatures, 2013).

Reminder Recall Systems

In a 2000 study, Deutchman, Brayden Siegel, Beaty, and Crane explored perceived barriers to childhood immunization uptake in rural family practices. Through a survey and response analysis the researchers proposed important barriers to immunization that were associated with both families and immunization delivery. Important family associated barriers included the cost to the patient, perceived importance of immunizations, language barriers, transportation, and belief in vaccinating. Significantly more delivery associated barriers were recognized. Delivery associated barriers included unavailable immunization records, inefficient vaccine screenings, reluctance to vaccinate during sick visits, difficulty stocking vaccines, and clinician misunderstanding of immunizations (Deutchman, Brayden, Siegel, Beaty & Crane, 2000).

Increasing the number of children who have up-to-date vaccinations could lower death and disease rates, however, gaps remain in how best to increase immunization rates. One way to increase vaccine uptake is to offer a reminder or recall for patients and their parents/guardians. Immunization reminder/recall systems are methods developed by practices, where children who are due for an immunization are contacted to return to their health care provider for the vaccine.

Effectiveness of Reminder Recall Systems

To identify the best evidence regarding vaccine reminder/recall systems, an in-depth search of the literature was performed. Inclusion criteria for the search were studies that addressed children, adolescents, reminder, immunization, vaccines, and recall. Databases searched included National Guidelines Clearinghouse, PUBMED, CINAHL, EBSCO, and the Cochrane Library. Key words used in the search were combinations of reminder, immunization, vaccine, and recall. The initial search of all databases yielded 1,203 hits. The search was narrowed to

articles from 2002-2012, English language, systematic reviews, clinical practice guidelines (CPG), randomized controlled trials (RCT), and peer-reviewed journal articles. Snowballing technique was used to identify two additional articles that met initial inclusion criteria.

The evidence base was narrowed by excluding articles that did not contain the search terms of vaccine, immunization, reminder, or recall, were adult populations, or evidence that was reported before 2002. The Cochrane search revealed one relevant systematic review, however, it was excluded due to the age of evidence examined. Ten initial documents were identified for inclusion. One study was excluded because it was a quality improvement project for an existing vaccine reminder system and not a primary study. Nine final documents were selected for inclusion in the systematic review, including a clinical practice guideline and eight research studies. The eight research studies compared the use of a vaccine reminder or recall system with usual care.

Each of the eight studies reviewed revealed some success in improving vaccination rates through reminder or recall. Three RCT's (Hambidge, Phibbs, Chandramouli, Fairclough, & Steiner, 2009; LeBaron, Starnes, & Rash, 2004; Szilagyi, et al., 2002.) found that a reminder/recall system that used a combination of contact methods was successful in increasing vaccination status. Specifically, Hambidge et al., 2009 and Szilagyi et al., 2002 found that a stepped intervention of reminder, recall, and outreach improved infant's immunization rates by 15-24 months of age.

In their RCT, Hambidge, Phibbs, Chandramouli, Fairclough, and Steiner (2009), tested a stepped intervention of reminder, recall, and case management to increase infant wellchild visits and immunization rates. The intervention was performed within Denver Health, a large integrated community health center with three associated community health centers. The sample

was predominantly poor, primarily Hispanic, Spanish-speaking, urban families. Using intent to treat analysis comparisons were made using bivariate techniques including Chi Square, t- test, and Wilcoxon tests. Using logistic regression modeling, the researchers determined that at 15 months, 44% of the intervention group were up to date on immunization ($p < .01$), compared to 33% of the control group ($p < .01$).

One RCT (LeBaron et al., 2004) found that a registry based reminder system which included autodialer, outreach, or a combination created a slight increase in immunization rates among a poorly vaccinated inner city population. The intervention used a large scale registry based reminder system in major hospitals, health centers, outpatient clinics, satellite clinics, and private practices. Analysis was performed with intent to treat, the 2-tailed Fisher exact test, and Wilcoxon rank sum test. A total of 260 (34%) of the 763 patients in the control group, 306 (40%) of the 763 in the autodialer group, 284 (37%) of the 760 in the outreach group, and 293 (38%) of 764 in the combination group completed the vaccination series. Increases in immunization rates in this study varied from 3-6%, and were statistically significant in dose specific coverage with the 4th dose of DTP (42% intervention v. 36% control, $p = .02$).

Szilagyi and colleagues (2002), assessed a community wide reminder, recall, and outreach program for childhood immunizations in their RCT. The program consisted of telephone and mail reminders as well as assistance with transportation to the center for vaccinations. The study was performed in the ten largest practices that serve Monroe County, NY. This expansive study examined three cohorts of children; 1993 before a reminder system was developed, 1996 when the reminder system was being implemented, and 1999 after the implementation of the reminder system. Strata software was used for analysis but specific methods were not described. The researchers found statistically significantly improvement in pediatric immunization rates during

(1996: 90% up to date at 12 months, $p=.001$) and after (1999: 90% up to date at 12 month of age, $p=.08$) implementation of the reminder system.

Two RCT's (Kempe et al., 2005; Irigoyen et al., 2006) and one retrospective control study (Hicks, P., Gillian, A., Tar, M., & Hicks, X., 2007) found that a mailed reminder postcard or letter was effective in increasing the percentage of children vaccinated in a timely manner. In Kempe et al., (2005) the researchers identified three objectives which included achieving maximal influenza immunization rates in pediatric patients, evaluating registry-based reminder/recall for immunization, and describe methods private practices could use to implement immunization recommendations. An intent to treat analysis was performed using Chi Square. The study was conducted in five pediatric populations in the Denver area and results by practice were provided with a high of 9.1% ($p= 0.002$) and a low of 1.0% ($p=0.68$). At the end of the intervention, 62.4% of the intervention group and 58 % of the control group received the recommended immunizations, an overall increase of 4.4% ($p =.001$).

Irigoyen et al., (2006) assessed the effectiveness of two serial registry reminder protocols on childhood immunization rates. This intervention looked specifically at DTaP administration. The RCT was carried out in five community based pediatric practices affiliated with a large academic health center in inner New York City. Outcomes were performed by intention to treat using t-test and multivariate logistic regression. Reminders significantly increased immunization coverage for both DTaP and the 4:3:1:3 series, but only for children sent continuous reminders (3 months: 51.2% continuous reminders vs. 44.9% controls, $p=.01$; 6 months: 44.1% continuous reminders vs. 39.2% controls, $p =.05$).

Hicks et al., (2007) is a historical control study carried out in a non-profit community health center that serves Latinos and the poor in rural, Northeastern Colorado. The intervention

combined parent vaccine reminder cards and posters in exam rooms reminding parents to vaccinate. Analysis was performed using the Fisher exact test. Use of the reminder cards increased immunization rates from 61.3% to 73.4% practice wide ($p = .004$). While increases were noted in all immunizations recommended by the CDC's vaccination schedule, only Hib vaccine increases were statistically significant ($p = .023$).

One RCT (Stockwell et al., 2012) found that a text based reminder system was successful in increasing vaccination status in adolescent populations. The study was divided into a pediatric and adolescent arm and was performed in a network of community based health centers affiliated with an academic medical center in New York City. These facilities primarily serve low-income, minority populations. The program compared a text reminder, a mailed letter reminder, and a combination of the two. The intervention was completed with intent to treat and analysis and included Chi Square and nested analysis of variables (ANOVA) for between site variability. In the adolescent arm, 15.4% of those allocated to the intervention group received MCV or Tdap vaccination within 4 weeks of the intervention ($p = .001$). At 12 weeks, 26.7% had received the immunizations ($p = .003$), and at 24 weeks 36.4% had received the immunizations ($p = .001$). In the pediatric arm, no significant difference was noted between the letter and text groups, but children who had the combined intervention had significantly higher uptake. Among the intervention group, 20.7% received a due Hib dose at 2 weeks post intervention ($p = .15$).

Finally, one RCT (Szilagyi et al., 2006) found that a telephone vaccine reminder/recall system was largely ineffective in improving total immunization rates but did find a statistically significant increase in Hepatitis B and Td uptake rates. The RCT, which was carried out in four, urban, primary care practices in New York used a phone call to remind parents of immunization and well child visits. Intent to treat analysis was performed using Chi Square for categorical

variables and t-test for numeric variables. At the study's conclusion, the intervention group had slightly higher hepatitis B coverage (62% intervention v. 57.8% control; $P=.02$), similar well child rates (53% intervention v. 54% control; $p=.50$), and similar Td vaccination rates (52% intervention v. 49.9% control; $p=.27$).

Synthesis of Effectiveness Data

None of the eight studies offered data regarding sustainability of the proposed interventions. Six of the studies were carried out in an urban population, somewhat limiting generalizability of the findings, however socioeconomic characteristics of the participants were similar to those of a rural West Virginia population. Hambidge et al., (2009) estimated the cost of the intervention to be \$23.30 per infant per month, which is a considerable expense to a small practice or federally funded practice. In the same study, the author's revealed that certain maternal characteristics, such as illicit drug use, resulted in more intensive intervention. Only LeBaron et al., (2004) specifically discussed the population that was lost during the trial.

The geographical location of each study differed, as did the setting for the intervention. Hicks, et al., (2007) conducted their study in a non-profit, community health center in rural Colorado. The other seven studies were conducted across multiple practices in urban settings (Hambidge, Phibbs, Chandramouli, Fairclough, & Steiner, 2009; LeBaron, Starnes, & Rash, 2004; Szilagyi, et al., 2002; Stockwell et al., 2012; Irigoyen et al., 2006; Kempe et al., 2005; Szilagyi et al., 2006). Six studies used retrospective record review and comparison for data collection (Hambidge, Phibbs, Chandramouli, Fairclough, & Steiner, 2009; LeBaron, Starnes, & Rash, 2004; Szilagyi, et al., 2002; Stockwell et al., 2012; Irigoyen et al., 2006; Kempe et al., 2005; Hicks, et al., 2007). Szilagyi et al., (2006) used double blinded medical record review with

randomized group assignment and multiple quality assurance checks. Sample size of the studies ranged from 263 to 5193.

The population of each study differed in terms of sociodemographics. Hambridge, et al., (2009) had a poor population with 99% being uninsured or having public health insurance. Parental participants were primarily Hispanic and Spanish speaking. Maternal alcohol, tobacco and drug use were more prevalent. In LeBaron, et al., (2004) minority children constituted nearly 93% of the studies population. In both studies lead by Szilagyi (2002 & 2006), demographics of the randomized groups were similar in terms of age, sex, insurance, and race.

The body of evidence from eight randomized control trials and one clinical practice guideline is strong. All eight studies found statistically significant improvement in some aspect of vaccine uptake following a reminder/recall intervention. One RCT (Stockwell et al., 2012) found that a text based reminder system was successful in immunization rates for children and adolescents. One RCT (Szilagyi et al., 2006) found that a telephone vaccine reminder/recall system was ineffective in improving total immunization rates, but did show improvement in Hepatitis B and Td rates. Three RCT's (Hambridge et al., 2009, LeBaron et al., 2004, & Szilagyi et al., 2002) found that a reminder system that used a combination of contact methods was successful in increasing vaccination status. Two RCT's (Kempe et al., 2005 & Irigoyen et al., 2006) and one retrospective control study (Hicks et al., 2007) found that a reminder/recall system that used mail to contact participants was successful in increasing vaccination status.

Despite the strong evidence base, gaps in the literature remain. The evidence does not identify one method of reminder/recall as the superior strategy. Most of the studies evaluated were carried out in urban populations, limiting generalizability to rural practices. Demographic data from the studies, however, reveal that populations may be similar to rural populations in

terms of education, socioeconomic status, and type of health insurance. Future research should be done to examine the effectiveness of similar interventions in rural populations. Additionally, future research should more closely scrutinize the costs associated with these types of interventions and their long term sustainability in practices.

West Virginia Demographics

Low socio-economic status is a barrier to health care access and a risk factor for delayed vaccination (Pickering et al., 2009). A recent Gallup poll rated West Virginia last in the country for future livability, ranking the state lowest in economic confidence, learning new and interesting things daily, ease of finding a safe place to exercise, obesity, and smoking (Witters, 2012). Life expectancy in West Virginia is lower than the national average, with an age of 75.4 for men and 80.1 for women (Washington Post, 2007). Additionally, 67.9% of West Virginia adults are obese, 28.6% use tobacco products, and 11.7% have a diagnosis of diabetes (Washington Post, 2007). The Kaiser Family Foundation reports that in 2007, less than three quarters of West Virginia children had access to both a medical and dental preventative visit in the calendar year.

The population of the specific FQHC where the study took place is predominantly white, impoverished, and has a high chronic disease burden. The current population of Jackson County is estimated to be 29,234 (CDC, 2012). Within this rural county, 22% of individuals live with poor or fair health. Sixteen percent of the people residing in this county in West Virginia are uninsured, 30% live in poverty, and 25% lack adequate social support (The Robert Wood Johnson Foundation, 2012). Of babies born in this county, 8.3% have low birth weight, placing them at higher risk for contracting a communicable disease or having insufficient defenses against communicable disease.

Despite the widespread availability of vaccinations and the relative ease of use, many states total immunization rates remain well under the recommended 90 percent. State laws requiring vaccination for school entry protect herd immunity. West Virginia is one of two states that does not allow vaccination exemptions for religious or philosophical reasons (DHHS, 2011). The state ruling to not accept religious and philosophical exemptions is based on the CDC's current health recommendations, including the assertion that lower rates of immunization correlate with higher rates of preventable infection among vaccinated children (CDC, 2011). For 2010, West Virginia ranked 8th in the United States for children age 19 to 35 months who had not received the vaccines recommended by the CDC. The 2011-2012 National Immunization Survey found that approximately 61.9 % of West Virginia children, age 19-35 months are fully immunized (Department of Health and Human Services, 2012). The same survey lists the national average for full vaccination coverage as 68.4%.

High rates of under vaccination correlate with the state's other health disparities, including high rates of poverty, lack of education, transportation barriers, and lack of access to health care (Robert Wood Johnson Foundation, 2012). Rural families face significant barriers in access to healthcare, placing rural children at risk for under immunization. Poorly educated guardians may lack the necessary reading skills to understand printed vaccine literature or may be unaware of free vaccination programs like West Virginia's Vaccines for Children (Niederhauser & Markowitz, 2007). Transportation to vaccination sites can be a significant barrier, with a lack of public transportation exacerbating the problem. Economic disparities within the population limit vaccination due to costs associated with traveling to a provider's office, direct injection fees, and insurance co-pays. Additionally, government funding for

vaccination of uninsured and indigent populations may be limited (Niederhauser & Markowitz, 2007).

Project Description and Design

The goal of this change project was to increase the percentage of vaccinated children 0-6 years of age by sending a reminder letter to caregivers of children who are unvaccinated and under-vaccinated per the CDC's current immunization recommendations. Specifically, the programs objectives were:

1. Obtain approval for the intervention from the Institutional Review Board of West Virginia University.
2. Identify the number of pediatric patient's age 0-6 years within the practice at River Valley Health and Wellness Center.
 - A system report was generated from the practices' existing electronic health record listing the total number of pediatric patients' age 0-6 years currently enrolled in the practice. This report, generated by the project manager, contained the names, birth dates, and guardians of each child age 0-6 years. A manual chart audit by the project manager revealed 248 patients among this age group who received primary care at the rural health center.
3. Perform a manual chart audit of each identified child's immunization record to determine if they are fully immunized per the CDC's current immunization schedule.
 - From the system report, the project manager manually audited each child's immunization record to determine vaccination status. The current health record at the practice displays each patient's vaccines in chart format, and alerts the provider to what immunizations are overdue by highlighting them in red. Each child who was

- deemed to have missed or lapsed vaccinations was documented on the approved data sheet (Appendix A). At the beginning of the intervention 130 of children age 0-6 at the rural health center were up to date per the CDC's current immunization recommendations.
4. Determine the percentage of children age 0-6 years who are fully immunized per the CDC's current immunization schedule and the percentage of children age 0-6 are not fully immunized per the CDC's current immunization schedule.
 - Using the data recorded on the approved data sheet and the number of patients in the initial sample, the project manager calculated the percentage of children who were fully immunized per the CDC's current immunization schedule as 52% (n=130). The percentage of children age 0-6 were not fully immunized per the CDC's current immunization schedule was 47% (n=118).
 5. Identify the parent/guardian of each child age 0-6 who is not fully immunized per the CDC's current immunization schedule.
 - The caregiver of each child age 0-6 who was not fully immunized per the CDC's current immunization schedule was determined by reviewing the demographic information in the child's electronic health record. The caregiver is the adult listed under "Parent/Guardian" during the most recent registration at the practice. The name and address of the caregiver was recorded on a separate data form at this time.
 6. Develop an immunization reminder letter for parents/guardians of children who are not fully immunized per the CDC's current immunization schedule.
 - An immunization reminder letter was developed for caregivers of the children who were not fully immunized per the CDC's current immunization schedule. This letter

(Appendix B) was developed using best evidence and collaboration from the project manager's capstone committee. The letter contains a brief description of the project, which vaccines the child needs, a brief statement about confidentiality, and how to contact the project manager with any questions. The letter was scanned into the EHR so that when it is mailed, it becomes a permanent part of the patients' medical record.

7. Mail immunization reminder letter to identified caregivers.

- The letters (118) were mailed to the caregivers identified in the previous step. The letter was a standard 8.5x 11 white paper on West Virginia University School of Nursing letterhead. The 118 letters were mailed using the local branch of the United States Postal Service.

8. Determine the number of children whose caregiver received the reminder letter and returned their child to the clinic for the required immunizations.

- One month after the initial letter was mailed, the first response was evaluated. The intervention reminder letter was initially mailed to 118 caregivers. At the one month interval, 14 letters were either returned to sender or the caregiver called the project manager to report that the rural health clinic was not their primary care provider. This brought the sample of children eligible to return to the clinic for immunization to 104, creating a total intervention sample to 234. Any caregiver who did not return his/her child to the clinic for immunization was again sent the reminder letter. After a two month intervention period, the total number of children who were returned to the clinic by the caregiver was determined using record review. Of the 104 children who were eligible to return to the clinic for immunization, 26 returned, received vaccinations, and are now up to date per the CDC's recommendations. The project

- manager used the previously mentioned data sheets to check each child's chart to see if they returned to the practice to receive immunizations. Current vaccination status was recorded on a new data sheet.
9. Determine the percentage of children whose parents received the reminder letter and returned their children to the clinic for the required immunizations.
 - The percentage of children whose parents received the reminder letter and returned their children to the clinic for the required immunizations was calculated using the total number of children whose vaccines were not up to date per the CDC's current recommendations, and the new data obtained in Step 7. Twenty-five percent (n=26) of the children whose parents received the reminder letter returned their children to the clinic for the required immunizations.
 10. Determine if the mailed reminder letter increased the number of children age 0-6 at River Valley Health and Wellness Center who are fully immunized per the CDC's current immunization schedule.
 - Analysis of the data was performed using McNemar's test to determine if the reminder letter increased the number of children age 0-6 at River Valley Health and Wellness Center who are fully immunized per the CDC's current immunization schedule. At the conclusion of the intervention 67% (n=156) of the eligible population were up to date on immunizations per the CDC's recommendations.

Timeline

The timeline for the intervention was divided into three stages: preparation, implementation, and evaluation. The development phase of the intervention was completed after HIPPA and human subjects review had been processed by the Institutional Review Board of

West Virginia University. Certain activities had to be completed before the intervention could be implemented at the rural health center. Preparation began with a review of the implementation plan by the providers at the facility. A standing order for vaccine follow-up and administration, an Excel spreadsheet containing tracking categories, and a recall letter were developed before the project was implemented.

The implementation phase of the intervention consisted of record review and the mailing of the vaccine reminder. The active intervention began Monday, January 20, 2014, with the mailing of the vaccine reminder letter. As vaccine records were updated, the project manager noted delayed or lapsed immunizations and sent the child's caregiver the reminder letter. This phase of the intervention lasted approximately one month and concluded February 17, 2014. At this date, the project manager reviewed those who responded to the letter and brought their child in for immunization. Any caregiver who had not returned his/her child to the clinic for immunization was again mailed the vaccine reminder letter.

Finally, the evaluation stage assessed the data gathered from the record review. At the end of the intervention, pre and post vaccine reminder immunization rates were compared through electronic record review. Final evaluation occurred on April 14, 2014, three months after the first letter was mailed. Dates in the projected timeline were adjusted based on unforeseen circumstances that arose for the project manager. Statistical analysis, interpretation, and preparation of the data collected during the intervention was finalized by September 2, 2014.

Evaluation

The project manager performed manual chart audits to obtain the number of children who were returned to the clinic by their caregiver for immunizations. Gathered data were analyzed statistically at the completion of the intervention. Collected data were analyzed using

McNemar's test, which is a Chi Square test for paired data. In this project, the question was "Does an immunization reminder letter increase vaccine rates in children ages 0-6 years?" The hypothesis for this intervention is that mailing an immunization reminder letter to caregivers will increase vaccination rates in the chosen population.

Results

This change project utilized a caregiver vaccine reminder letter to improve falling population immunity in children age 0-6 in a rural health center. A manual chart audit by the project manager revealed 248 patients among this age group who received primary care at the rural health center. At the beginning of the intervention, 118 children had immunizations that were not up to date per the CDC's current immunization recommendations. The intervention reminder letter was initially mailed to these 118 caregivers. At the one month interval, 14 letters were either returned to sender or the caregiver called the project manager to report that the rural health clinic was not their primary care provider. This brought the sample of children eligible to return to the clinic for immunization to 104, creating a total intervention sample to 234.

At the beginning of the intervention, 56% (n=130) of children age 0-6 at the rural health center were up to date per the CDC's current immunization recommendations. Of the 104 children who were eligible to return to the clinic for immunization, 25% (n =26) returned, received vaccinations, and are now up to date per the CDC's recommendations. At the conclusion of the intervention 67% (n=156) of the eligible population were up to date on immunizations per the CDC's recommendations. Using McNemar's test the overall increase in the number of children who were up to date on immunizations at the end of the intervention was determined to be statistically significant ($p = <0.001$).

**Table 1: Up-to-date (UTD) Status by Time
(n=234)**

			Time		Total
			Baseline	3 Months	
Status	Not UTD	Count	104	78	182
		% within Time	44.4%	33.3%	38.9%
	UTD	Count	130	156	286
		% within Time	55.6%	66.7%	61.1%
Total	Count		234	234	468
	% within Time		100.0%	100.0%	100.0%

Available demographic data were collected during the initial chart review, including patient gender and age. Of the 104 eligible to return for vaccination, there was no difference in UTD status by gender ($p = .568$). However, of the 104 who were eligible to return for vaccination, those who are now UTD were younger on average ($p = .018$).

**Table 2: t-Test for age by UTD Status at Time 2
(n=104)**

	Outcome	N	Mean	t	p-value
Age in Months	Not UTD	78	42.77	2.414	.018
	UTD	26	31.92		

In conclusion, the findings of this study are as follows:

- At the end of the intervention, the children currently immunized increased from 56% to 67%. This finding was statistically significant ($p = 0.001$).
- Twenty five percent of the caretakers who received the letter returned their child to the clinic to acquire up to date immunizations.
- Of the 104 eligible children, those who returned for immunization were younger.

- Of the 104 eligible children, there was no relation between gender and return.

Discussion and Recommendations

The intervention was successful in meeting the project manager's goal of increasing immunization rates within the rural health facility. Key facilitators of the projects success included the facilities nursing staff who administered the vaccines and the facilities physician who had a beneficial knowledge of the CDC's current immunization recommendations and is a super user of the facilities EHR. There were no unintended consequences of the intervention.

Barriers

Barriers were encountered during the development and implementation of this capstone project. Without a dedicated Information Technology (IT) specialist at the rural health clinic, data had to be hand extracted from the records through review. This made data collection cumbersome and could potentially limit the expansion of the project at this site and the applicability of the project to others sites without an IT specialist. The pediatric population at the rural health clinic also varied by level of care, not all patients age 0-6 who were seen at the clinic were seen for primary care. Patients seen for acute care only or those who reported they had other primary care providers had to be identified and excluded from the intervention by hand chart audit. Fourteen of the letters mailed were returned to the facility due to wrong addresses. This highlighted the potential of having inaccurate or incomplete patient records that limit the effectiveness of a mailed reminder.

Future Implications

This capstone project could be modified within a rural health center, as well as other health care centers, to further increase the number of children whose immunizations are UTD. The DNP is an ideal choice to lead continued efforts to increase the immunization rates within

the rural health center, but other stakeholders including the QI committee, other providers, and the nursing director could help promote the projects continuation. With assistance from an IT specialist, a standard query could be built into the facility's practice analytic software so that a report of patients whose immunizations are UTD could be easily generated at any time.

Other recommendations include integrating the reminder as an alert in the existing EHR and utilizing WVSIS to further update immunization records before mailing reminders. Additionally, the intervention could be expanded to examine why caregivers did not return their child to the clinic for vaccination, either through in person interview, phone interview, or mailed survey. Obtaining this data could allow providers and the organization identify and eliminate barriers like lack of transportation. Issuing immunization reminders would be considered a routine duty of the facilities care manager and would require no new staff to continue.

Due to the low cost and relative ease of implementation, the project is a feasible change for a variety of other family practice settings. The reminder letter could be built into other facility's existing EHRs or scanned into less advanced systems as a printed document. This intervention could also be a collaborative effort between primary care providers and school systems. Schools also have a vested interest in having their students vaccinated and could potentially have more accurate contact information for and access to caregivers.

Personal Leadership

The capstone experience assisted the project manager in experiencing and fulfilling the Essentials of Doctoral Education for Advanced Nursing Practice. By selecting an immunization reminder program, the DNP candidate utilized a foundation in clinical prevention and population health to promote health and risk reduction in the targeted population. During preparation and research, the project manager gained clinical expertise in current immunization

recommendations, trends, and administration. The intervention allowed the project manager to demonstrate advanced nursing practice and specialization through the design and implementation of evidence based change models that improved patient outcomes. Preparation for the capstone allowed the project manager to apply clinical scholarship and analytical methods to current practice. Analytical methods were used to critically evaluate existing literature and to design and direct quality improvement. The project also allowed the DNP candidate to use information systems/technology to manage population level data and improve patient care.

This capstone project also assisted the project manager in reaching personal leadership goals. Those goals included identifying practice specific care deficiencies, identifying relevant evidence based recommendations for change, and implementing those recommended changes successfully. The development of the project and dissemination of its successful results brought positive attention to value of the doctoral prepared nurse and the doctor of nursing practice degree. Completing the project has given the project manager the confidence to initiate change and lead collaborative change efforts. In the future, this knowledge and experience will be used to identify other care gaps and lead evidence based change efforts in practice.

Appendix B Participant Letter



Dear -----,

Regarding:------(child's name)

This letter is to request that you take part in a project titled Immunization Reminder for Parents of Young Children. This project is being conducted by me (Jessica Wooten). I currently practice as a nurse practitioner at River Valley Health and Wellness Center and am a student in the School of Nursing at WVU in the Doctor of Nursing Practice program. I am being supervised by Dr. Mary Jane Smith, a professor in the School of Nursing. This project is being conducted to meet Capstone requirements for a Doctor of Nursing Practice degree. The purpose of this project is to increase the immunization rate of children from birth to 6 years old in our county. As you know, it is important to keep children on schedule with recommended vaccinations. According to our records, it is time for you to bring your (son/daughter) to the clinic for ___ immunizations. These are _____ (vaccinations in lay language).

Your involvement in this project will be kept as confidential as legally possible. All data will be reported as group information. I will not ask any information that should lead back to your identity as a participant. Your participation is completely voluntary. West Virginia University's Institutional Review Board has acknowledgement of this project on file.

I hope that you will participate in this project by bringing your child to the River Valley Health and Wellness Center in order to have his/her vaccinations updated. We look forward to seeing you. No appointment is required for you to bring your child to receive the vaccinations.

Should you have any questions about this letter or the project, please feel free to contact Jessica Wooten at 304-273-1033 or jwooten@wchsa.com. If you have any questions about your rights as a research subject, you can contact the WVU Office of Research at 304-293-7555. Thank you for your time and help with this project.

Sincerely,

Jessica Wooten, MSN, FNP-BC

Mary Jane Smith, PhD, RN

MORGANTOWN DEPARTMENT

PO Box 9640 | 6400 Health Sciences South
Morgantown, WV 26506-9640
☎ 304.293.5446 ■ 304.293.6826

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