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Utilizing Educational Materials to Change Vaccine Compliance in Children Under 24 Months of Age

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Biographical Sketch:
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Abstract

Background: Childhood vaccinations are critical to preventative care for the pediatric population. The goal for the clinic's combination 10 insurance quality measure, which reflects the number of fully vaccinated children by 24 months of age, is to be greater than 68%.

Purpose: This quality improvement project sought to implement evidence-based interventions to improve childhood vaccine compliance by increasing the parent/caregiver's knowledge about vaccines and increasing the communication with their healthcare provider.

Methods: A parent friendly vaccine schedule, information pamphlet, interactive video, and survey were given to parents/caregivers during well-child visits. A total of 117 parent/caregiver surveys were collected. Vaccine compliance was monitored using combination 10 percentages and the number of fully vaccinated children under 24 months old and analyzed via a chi-square test.

Results: Implementation of educational materials did not demonstrate a statistically significant improvement in vaccine compliance. The chi-square analysis comparing fully vaccinated children produced a p-value of $0.3677 > 0.05$.

Conclusions: Although there was not a statistically significant change in vaccine compliance, parents/caregivers stated the educational materials helped improve communication about vaccines with their child's provider.

Implications: Future projects should trial a longer implementation period or alternative evidence-based interventions to fully appreciate long term vaccine compliance.

Keywords: childhood vaccinations, vaccine compliance, pediatric vaccine compliance, immunizations

Introduction

Vaccine compliance is a key contribution to prevention of disease in the pediatric population. The Centers for Disease Control and Prevention (CDC) states that the recommended vaccination schedule protects children under 24 months of age against 14 potentially serious preventable illnesses.[1] The CDC estimates vaccinations have prevented over 21 million hospitalizations and 732000 deaths in the past 20 years for all children through 18 years of age.[2] An estimated $295 billion are saved relating to avoided hospitalizations as well as $1.38 trillion saved in societal costs by vaccinating children.[2] Vaccinations provide immunity to the patient receiving the vaccine, as well as providing "herd immunity," or indirect protection,[3] when most of the population has been immunized. Despite the multiple benefits of vaccinations, the 2017 National Immunization Survey-Child found that roughly 1.3% of children had not received any vaccinations by 24 months of age, which is up 0.3% from 2001.[1] The XXX discovered as of June 30, 2020, 77.4% of children 19-35 months of age were fully vaccinated and the healthy people goal is 80%.[4] In 2019 the World Health Organization labeled vaccine hesitancy as one of the top ten threats to global health.[5] The cause for vaccine non-compliance or delayed scheduling can be multifocal. Ventola found that the most cited barriers to vaccine compliance is concern about side effects and the safety of vaccines.[3] Stockwell, et al. found that parents with safety concerns were four times more likely to miss a well child visit.[6] Also, parents that felt they could not freely communicate concerns with their child's provider were twice as likely to miss a well-child visit.[6]

An organizational assessment was completed in a rural primary care clinic utilizing the Burke Litwin Model of Performance and Change.[7] The clinic sought improvement on their insurance driven combination 10 vaccination metric. The combination 10 metric reflects the

number of children fully vaccinated by 24 months of age. The clinic's goal for the combination 10 metric is to be greater than 68%. A literature review was conducted using CINAHL Complete and PubMed databases, and gray literature to research evidence-based interventions to improve pediatric vaccine compliance. A total of 11 articles were included in the final literature review.

The results of this literature review identified three evidence-based categories including parent, provider, and system interventions. Parent interventions included utilizing reminder and recall systems via mail, telephone, and text that could show anywhere from 1.8-27.2% increase in compliance and combining interventions could show an average of 10.6% improvement.[8] Electronic medical record reminders (EMR) and combination reminder systems were found to be effective by increasing vaccine uptake by 12-47%.[9] Another parent intervention discovered was to improve communication and education between the parent and provider. McCauley, et al., found that the most common reason for not obtaining vaccines was fear of side effects.[10] The second category to improve vaccine compliance included provider interventions. The first provider intervention suggested improving education to parents. Connors, et al. found that provider education, along with a strong recommendation to vaccinate, was critical in improving vaccine compliance.[11] A second provider intervention included utilizing the EMR reminders to check vaccine status prior to the next well-child visit to prevent missed opportunities.[8, 9, 12, 13] The third category included system interventions. Kurosky, et al. discovered that compliance rates for children who received combination vaccines were significantly higher than those of single-antigen vaccines.[14] Wagner, et al. found that children at 24 months of age who received one or more combined vaccines were less delayed on the vaccine schedule.[15] Robison discovered giving vaccines at sick visits helped prevent children from getting delayed on their vaccine schedule.[16] The clinic already had multiple interventions implemented to increase vaccine

compliance. These interventions included combination vaccines, XXX (MCIRs) reports, giving vaccine information sheets, insurance groups that contact those not coming to well-child visits, and reminder calls/messages through their MyChart system. The MCIR is a tool to collect and analyze immunization information for children that can be accessed by providers in XXX.[17] The intervention that was identified for this quality improvement project was to increase communication and education between the provider and the parents/caregivers of the pediatric patients. The purpose of this quality improvement project was to improve vaccine compliance of children through 24 months of age by increasing the parent/caregiver's knowledge about childhood vaccines and to increase the communication about vaccines with their healthcare provider.

Methods

Project Design

This quality improvement project meets requirements for a quasi-experimental study because it is a randomized study that aims to evaluate a relationship between an evidence-based intervention and vaccine compliance. The quantitative data that was assessed included the combination 10 percentages and the number of children under 24 months of age coming into the clinic monthly. The quantitative data was followed pre-implementation for 2 months, 2 months during a DNP supervised implementation phase, and 1 month that was non-supervised implementation month by the DNP student. Qualitative data was collected via surveys from both the parents/caregivers during implementation as well as the staff, post-implementation.

Ethical Considerations

The Institutional Review Board for the Doctor of Nursing Practice (DNP) student's University and the clinic organization determined that this project was a quality improvement

project and did not contain human research. During the IRB meeting for the clinic, it was suggested to obtain marketing approval for the educational materials that were distributed. The educational materials were granted approval by the marketing team prior to educating the staff on the intervention. Combination 10 vaccine rates and the number of children seen at the clinic that were fully vaccinated each month were obtained from the clinic manager not including any patient identifiers. The parent/caregiver surveys asked for the patient's age and no other identifiers. There were no conflicts of interest for this quality improvement project.

Intervention

An interactive vaccine video was created by the DNP student that could be accessed via a QR code that was placed in each pediatric room. This interactive vaccine video includes an introductory voice explaining to the viewer that they can click on various items in the video that will lead them to further vaccination information on the CDC website. A parent/caregiver friendly vaccine schedule (Figure 1), vaccine information pamphlet (Figure 2), QR code for the interactive video, and survey were distributed by the Medical Assistants (MA) to all parents/caregivers of children from birth until 12 years of age. The CDC material was branded, and colors were changed with the clinic's identification per the request of their marketing team. The materials were given to this age range because the clinic's vaccine schedule listed all recommended vaccines until the age of 12.

Questions

The clinical practice question for this quality improvement project included: Will the utilization of a vaccine schedule, information pamphlet, and interactive video increase vaccine compliance in children under 24 months of age, as well as parent/caregiver's knowledge about vaccinations, and their communication with their child's provider?

Sample

Information was distributed to all children under the age of 12 for their well-child visits between January 1st through February 28th, 2021. All children of all different insurance types were included in this sample. Accidentally, the MA's handed out surveys to nine patients over the age of 12, but the information was included in the qualitative data. A total of 117 parent/caregiver surveys were collected during the implementation phase.

Setting

This DNP-led quality improvement project was implemented in a rural non-profit, Federally Qualified Health Center (FQHC) located in the Midwest. The clinic is affiliated with a larger healthcare system comprising a teaching hospital and over 56 locations throughout the state. The providers in the clinic included 5 physicians, 3 Family Nurse Practitioners, 2 Physician Assistants, and 1 Pediatric Nurse Practitioner.

Procedures

Key stakeholders and the quality improvement project topic were identified through an organizational assessment prior to implementation. The evidence-based materials created to increase parent/caregiver education and communication with their provider about childhood vaccines were approved by the organization's marketing department. Copies of the materials were printed and distributed to educate the MA's and providers about the project implementation. The MAs brought the patient and parent/caregiver into the room for their well-child visit, introduced the quality improvement project, and gave them the educational materials and survey. Prior to the parent/caregiver and patient leaving the visit, surveys were collected by the MAs and were placed in a designated folder. Every 1 to 2 weeks, these surveys were

collected from the folder by the DNP student. The project was continually monitored weekly or bi-weekly to assure compliance of the staff and to collect the surveys.

Data Collection

Quantitative data was obtained by email communication with the clinic manager about the combination 10 percentages, number of children under 24 months of age during each month of the project, as well as the total number of children seen in the clinic during this project compared to last year (pre-COVID).

Along with the educational materials, the parent/caregiver was given a 4-point Likert scale style survey that rates 2 statements from strongly disagree to strongly agree. The statements included that the materials were educational, and the materials assisted the parent/caregiver to talk about vaccines with their provider. The survey also asked the parent/caregiver to state if they had watched the educational video, if they have already received the information at another visit, or if they refused the materials. The responses from the survey were analyzed using descriptive statistics. The only demographic information that was obtained on this survey was the patient's age. A staff survey was given post-implementation to the MA's and Pediatric Nurse Practitioner involved in the implementation. Statements on the survey asked the staff about the ease of use of the educational materials, as well as if staff thought the materials helped them discuss vaccines with the parent/caregiver. The survey was a 4-point Likert scale style survey with the same rating scale as the parent/caregiver survey.

Data Analysis

Utilizing the number of children under 24 months of age seen at the clinic and the combination 10 percentages each month during this project, an estimated number of children that were fully vaccinated during each month at this clinic was calculated. A chi-square analysis was

conducted comparing count data of the number of children under 24 months of age seen in the clinic who were fully vaccinated from December (pre-implementation), to February (implementation with DNP student supervision), and to March (non-supervised implementation). The DNP student worked with a statistics graduate assistant and determined the best way to analyze this project was the chi-square analysis. This analysis compared the number of children who were fully vaccinated that had appointments at the clinic to pre-implementation, supervised implementation, and non-supervised implementation phases. The null hypothesis for this analysis is that no relationship exists between the number of children fully vaccinated and the implementation phase. The alternative hypothesis is that a relationship does exist between the number of children fully vaccinated and the implantation phase. The data received on the parent/caregiver and staff surveys were analyzed using descriptive statistics. The survey results will be visualized within a bar chart and discussed in the results.

Results

A total of 117 parent/caregiver surveys were collected during the implementation phase. Although the staff were instructed to hand out materials only to children under the age of 12, a few surveys collected included ages over 12. Since the surveys were analyzing the educational use of the materials and ability to help improve communication about vaccines with their provider, all surveys returned were used in the descriptive statistics data. Around 88.8% of parents/caregivers agree and strongly agree that the childhood vaccine schedule, vaccine information pamphlet, and interactive video were educational. Additionally, 83.7% of parents/caregivers agree and strongly agree that the educational materials helped them talk about vaccines to their provider. The survey also found that 24.8% of parents and patients watched the interactive video, 47% already received the information at another visit, and about 3.4% refused

the information (Table 1). One parent included a written statement on their survey that said, “I wish we would have gotten it sooner.”

The combination 10 percentages were followed for 2 months pre-implementation, 2 months of implementation with supervision from the DNP student, and 1-month of sustainable implementation that was not supervised by the DNP student. During the pre-implementation phase, November’s combination 10 percentage was 21.24% and December was 21.40%. During the supervised implementation phase, January’s percentage was 13.18%, and February was 14.56%. During the month the DNP student was not supervising the intervention, the combination 10 percentage for March was 17.18%. The chi-square analysis was conducted comparing the number of fully vaccinated children during each part of the project from December (pre-implementation), to February (supervised implementation), and to March (non-supervised implementation). The result of this chi-square analysis found a p-value of 0.3677 (Table 2). A p-value less than 0.05 indicates that we fail to reject null hypothesis. Thus, a relationship does not exist between the percentage of fully vaccinated children under 24 months of age and the implementation phases during the timeframe of this project.

Staff surveys were given post-implementation to the three MA's and the Pediatric Nurse Practitioner who were involved in the project. Results of this survey suggest, 100% of the staff agree and strongly agree that the educational materials were easy to use, and 50% agree the educational materials improved discussions with parents about vaccines. Sustainability suggestions and strengths and weaknesses were identified on the staff survey. The staff stated the project would be more sustainable if the educational materials were attached to the after-visit summary for the well-child visit. According to the staff, the strengths of this project included a great source of material for the parents, having a hard copy of the vaccine schedule and

information, and the interactive video was a great resource and tool. Some identified weaknesses included not having a long enough implementation time and that some of the parents coming in for visits already had chosen to vaccinate and didn't need materials.

Limitations

The first limitation encountered during this project was a limited time frame to implement the intervention. Secondly, initial meetings with the clinic's marketing department delayed the implementation by 2 months. During the COVID pandemic, the marketing team was overloaded with work and unable to meet promptly with the DNP student. A final limitation of this study is that the MAs were not handing out the materials at each visit regardless of reminders from the DNP student and the providers. The DNP student was present once every week at the beginning of implementation, and then once every 2 weeks to assure the staff had enough materials, monitor barriers to implementation, collect parent/caregiver survey, and give reminders to continue to hand out the materials to the parents.

Discussion

Childhood vaccine compliance is an essential preventative health care measure. Numerous evidence-based interventions have been discovered through research to assist with this global health care problem. This quality improvement project sought to improve pediatric vaccine compliance utilizing the evidence-based intervention of provider education and communication about vaccinations. The results of this project will help advance research about which interventions are beneficial to implement in practice, modify, or not utilize in practice.

The strengths of this quality improvement project include the feedback from the parent/caregiver surveys which discovered that many parents/caregivers found the materials to be educational and helped them to discuss information about vaccines with their provider.

Although a statistical significance was not demonstrated between implementation phases, anecdotal evidence suggests parents found the information helpful. This quality improvement project would greatly benefit for being implemented over a longer period of time. The timeline for this project was limited due to the COVID pandemic. Pre-COVID, the clinic saw 2807 pediatric patients from November 2019 to February 2020 compared to this year from November 2020 to February 2021 they only saw 2050. The restrictions from the COVID pandemic of seeing children in office could have a profound effect on obtaining childhood vaccinations on schedule.

It was anticipated that the combination 10 percentages would increase from pre-implementation to the post-implementation phase. Results from the survey suggest the educational materials had a positive impact on increasing the parent/caregiver's education and communication about vaccines with their provider. From pre-implementation to the DNP student supervised implementation phase there was a decrease in the combination 10 percentage. The combination 10 percentages increased slightly from the supervised implementation in January to February, to the non-supervised implementation in March. A possible reason for the initial decrease in the combination 10 percentages could be that the COVID pandemic has affected families bringing in their children for well-child visits. During this pandemic, many COVID initiated changes were initiated, which could have possibly caused fatigue to the staff of implementing yet another task into their daily work life. Another possible reason that the chi-square test did not show a significant difference between implementation phases is that the intervention was implemented over 2 months, and only able to be followed 1-month post-implementation. Many of the well-child visits prior to 24 months of age are spaced out anywhere from 2 to 6 months. During the period of collecting data, some of those same patients may have

not returned for a visit to see the true effects of the educational materials on overall vaccine compliance. Overall, the number of pediatric patients for this clinic from November through February was significantly less than the same timeframe pre-COVID, the year prior. The decrease in number of children attending well-child visits could have an impact on the combination 10 percentages and vaccine compliance.

The costs of implementing this project were slightly modified from the original proposed budget. Cost of printed materials for initial implementation was slightly more than the estimated budget. Staff created copies at no cost to the DNP student at the office if they ran out of the initial materials printed. The DNP student donated all time and materials in-kind for the implementation of this project. Because the clinic did not surpass the combination 10 goal of >86%, the reimbursement was not received during this project.

Conclusion

Although the combination 10 percentages did not reflect improvement of childhood vaccine compliance, the survey results indicated the educational materials were positively received by the parents/caregivers. This quality improvement project has provided insight to an intervention that could be beneficial if implemented over a longer period of time. According to the staff survey, sustainability of this quality improvement project could include attaching the educational materials to the after-visit summary printed at each well-child visit.

Implications for Practice

Future childhood vaccine quality improvement projects should trial alternative evidence-based interventions to improve vaccine compliance, or trial this intervention over a longer implementation period. Another quality improvement study could target those families who do not regularly present for their well-child visits. Parent/caregiver surveys conveyed benefits of

receiving this information at their early well-child visits as being beneficial. As vaccine hesitation continues to rise, it is important for pediatric providers to continue to educate and give their strong recommendation to vaccinate.

References

1. Centers for Disease Control and Prevention. Vaccine coverage among children aged 19-35 months- United States, 2017. October 2018. Accessed July 24, 2020. https://www.cdc.gov/mmwr/volumes/67/wr/mm6740a4.htm
2. Centers for Disease Control and Prevention. Report shows 20-year us immunization program spares millions of children from diseases. April 2014. Accessed July 24, 2020. https://www.cdc.gov/media/releases/2014/p0424-immunization-program.html
3. Ventola CL. Immunization in the United States: Recommendations, Barriers, and Measures to Improve Compliance: Part 1: Childhood Vaccinations. *P T*. 2016;41(7):426-436.
4. XXX. County quarterly immunization report card. Published September 30, 2020. Available at: https://www.XXX.gov/documents/mdhhs/State_Level_ReportCard_621826_7.pdf Accessed July 24, 2020
5. World Health Organization. Ten threats to global health in 2019. Updated 2021. Accessed July 24, 2020. https://www.who.int/news-room/feature-stories/ten-threats-to-global-health-in-2019.
6. Stockwell MS, Irigoyen M, Andres Martinez R, Findley SE. Failure to return: parental, practice, and social factors affecting missed immunization visits for urban children. *Clinical Pediatrics*. 2014;53(5):420-427. doi:10.1177/0009922814527497
7. Burke W, Litwin G. A casual model of organizational performance and change. *Journal of Management.* 1992; (18): 523-545. Accessed July 24, 2020. https://www.exeter.ac.uk/media/universityofexeter/humanresources/documents/learningdevelopment/understanding_drivers_for_change.pdf

8. Harvey H, Reissland N, Mason J. Parental reminder recall and educational interventions to improve early childhood immunisation uptake: A systematic review and meta-analysis. *Vaccine*. June 2015; 33(25):2862-2880. Accessed July 24, 2020. https://doi.org/10.1016/j.vaccine.2015.04.085
9. Frew PM, Lutz CS. Interventions to increase pediatric vaccine uptake: An overview of recent findings. *Human Vaccines & Immunotherapeutics*. November 2017; 13(11): 2503-2511. Accessed July 24, 2020. https://doi.org/10.1080/21645515.2017.1367069
10. McCauley MM, Kennedy A, Basket M, Sheedy K. Exploring the choice to refuse or delay vaccines: a national survey of parents of 6- through 23-month-olds. *Academic Pediatrics*. 2012;12(5):375-383. doi:10.1016/j.acap.2012.06.007
11. Connors JT, Slotwinski KL., Hodges EA. Provider-parent communication when discussing vaccines: A systematic review. *Journal of Pediatric Nursing*. November 2016;33:10-15. Accessed July 24, 2020. r
12. Bundy D, Persing N, Solomon B, et al. Improving immunization delivery using an electronic health record: The improve project. *Academic Pediatrics.* 2013;*13*(5), 458-465. https://doi-org.ezproxy.gvsu.edu/10.1016/j.acap.2013.03.004
13. Hofstetter AM, DuRivage N, Vargas CY, et al. Text message reminders for timely routine MMR vaccination: A randomized controlled trial. *Vaccine*. 2015;33(43):5741-5746. doi:10.1016/j.vaccine.2015.09.042
14. Kurosky SK, Davis KL, Krishnarajah G. Effect of combination vaccines on completion and compliance of childhood vaccinations in the United States. *Human Vaccine Immunotherapy*. 2017;13(11):2494-2502. doi:10.1080/21645515.2017.1362515

15. Wagner AL, Eccleston AM, Potter RC, Swanson RG, Boulton ML. Vaccination Timeliness at Age 24 Months in XXX Children Born 2006-2010. *Am J Prev Med*. 2018;54(1):96-102. doi:10.1016/j.amepre.2017.09.014

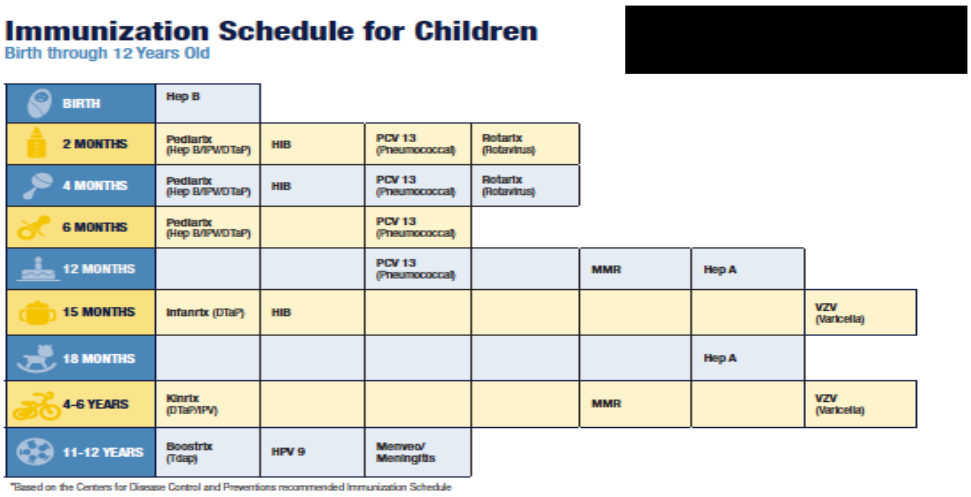
16. Robison S. G. Sick-visit immunizations and delayed well-baby visits. *Pediatrics*: 2013; 132 (1):44-48. https://doi.org/10.1542/peds.2012-3866

17. XXX Care Improvement Registry. About XXX care improvement registry, MCIR. Published May 1, 2020. Available at: https://www.mcir.org/category/about/. Accessed April 19, 2021

18. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*. 2009; 338:b2535 https://doi.org/10.1371/journal.pmed.1000097

Figures

Figure 1. Parent-Friendly Vaccine Schedule Handed to Parents during Well-Child Visits



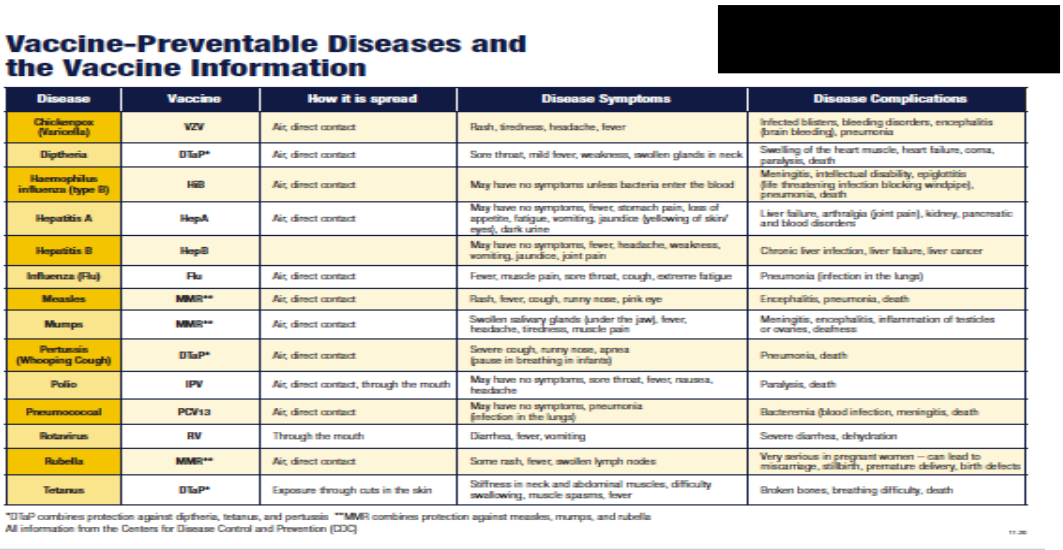
Immunization Schedule for Children

Birth through 12 Years Old

BIRTH	Hep B						
2 MONTHS	Pediarix (Hep B/IPV/DTaP)	HIB	PCV 13 (Pneumococcal)	Rotarix (Rotavirus)			
4 MONTHS	Pediarix (Hep B/IPV/DTaP)	HIB	PCV 13 (Pneumococcal)	Rotarix (Rotavirus)			
6 MONTHS	Pediarix (Hep B/IPV/DTaP)		PCV 13 (Pneumococcal)				
12 MONTHS			PCV 13 (Pneumococcal)		MMR	Hep A	
15 MONTHS	Infanrix (DTaP)	HIB					VZV (Varicella)
18 MONTHS						Hep A	
4-6 YEARS	Kinrix (DTaP/IPV)				MMR		VZV (Varicella)
11-12 YEARS	Boostrix (Tdap)	HPV 9	Menveo/ Meningitis				

*Based on the Centers for Disease Control and Prevention's recommended Immunization Schedule

Figure 2. Vaccine Information Pamphlet Handed to Parents during Well-Child Visits



Vaccine-Preventable Diseases and the Vaccine Information

Disease	Vaccine	How it is spread	Disease Symptoms	Disease Complications
Chickenpox (Varicella)	VZV	Air, direct contact	Rash, tiredness, headache, fever	Infected blisters, bleeding disorders, encephalitis (brain bleeding), pneumonia
Diptheria	DTaP*	Air, direct contact	Sore throat, mild fever, weakness, swollen glands in neck	Swelling of the heart muscle, heart failure, coma, paralysis, death
Haemophilus influenza (type B)	HiB	Air, direct contact	May have no symptoms unless bacteria enter the blood	Meningitis, intellectual disability, epiglottitis (life threatening infection blocking windpipe), pneumonia, death
Hepatitis A	HepA	Air, direct contact	May have no symptoms, fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice (yellowing of skin/ eyes), dark urine	Liver failure, arthralgia (joint pain), kidney, pancreatic and blood disorders
Hepatitis B	HepB		May have no symptoms, fever, headache, weakness, vomiting, jaundice, joint pain	Chronic liver infection, liver failure, liver cancer
Influenza (Flu)	Flu	Air, direct contact	Fever, muscle pain, sore throat, cough, extreme fatigue	Pneumonia (infection in the lungs)
Measles	MMR**	Air, direct contact	Rash, fever, cough, runny nose, pink eye	Encephalitis, pneumonia, death
Mumps	MMR**	Air, direct contact	Swollen salivary glands (under the jaw), fever, headache, tiredness, muscle pain	Meningitis, encephalitis, inflammation of testicles or ovaries, deafness
Pertussis (Whooping Cough)	DTaP*	Air, direct contact	Severe cough, runny nose, apnea (pause in breathing in infants)	Pneumonia, death
Polio	IPV	Air, direct contact, through the mouth	May have no symptoms, sore throat, fever, nausea, headache	Paralysis, death
Pneumococcal	PCV13	Air, direct contact	May have no symptoms, pneumonia (infection in the lungs)	Bacteremia (blood infection, meningitis, death
Rotavirus	RV	Through the mouth	Diarrhea, fever, vomiting	Severe diarrhea, dehydration
Rubella	MMR**	Air, direct contact	Some rash, fever, swollen lymph nodes	Very serious in pregnant women – can lead to miscarriage, stillbirth, premature delivery, birth defects
Tetanus	DTaP*	Exposure through cuts in the skin	Stiffness in neck and abdominal muscles, difficulty swallowing, muscle spasms, fever	Broken bones, breathing difficulty, death

*DTaP combines protection against diphtheria, tetanus, and pertussis **MMR combines protection against measles, mumps, and rubella
All information from the Centers for Disease Control and Prevention (CDC)

Tables

Table 1. Parent/Caregiver Statement Survey Results

Survey Statement	Count
I watched the educational video.	29
I have already received this educational information from another visit.	55
I refused the educational materials.	4
No response	29
Total:	**117**

Table 2. Chi-square Analysis Comparing Implementation Phase to Fully Vaccinated Children Under 24 Months

Table of implement by vaccinate				
		vaccinate		
		no	yes	Total
implement				
during	Frequency	29	5	34
	Percent	25.89	4.46	30.36
	Row Pct	85.29	14.71	
	Col Pct	32.58	21.74	
post	Frequency	31	7	38
	Percent	27.68	6.25	33.93
	Row Pct	81.58	18.42	
	Col Pct	34.83	30.43	
pre	Frequency	29	11	40
	Percent	25.89	9.82	35.71
	Row Pct	72.50	27.50	
	Col Pct	32.58	47.83	
Total	Frequency	89	23	112
	Percent	79.46	20.54	100.00

Statistic	DF	Value	Prob
Chi-Square	2	2.0011	0.3677
Likelihood Ratio Chi-Square	2	1.9787	0.3718
Mantel-Haenszel Chi-Square	1	1.8738	0.1710
Phi Coefficient		0.1337	
Contingency Coefficient		0.1325	
Cramer's V		0.1337	

Vaccine Compliance in Children through 24 Months of Age

Kelsey M. Arnold, BSN, RN

DNP Project Defense

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Acknowledgements

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  Dr. Kimberly Lohr, DNP, RN, NNP-BC, PPCNP-BC
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Objectives

1. Develop an understanding of the clinical impact of vaccine compliance.
2. Identify the opportunities for improvement in the setting.
3. Present evidence-based interventions that have been shown to improve vaccine compliance.
4. Review the methods and implementation of this project.
5. Discuss results of the quality improvement project.
6. Discuss sustainability and DNP essentials for this project.

Organizational Setting

- Rural, non-profit primary care facility
- Affiliated with a larger hospital system
- Providers

Clinical Phenomenon

- Centers for Disease Control and Prevention (CDC) vaccination schedule (CDC, 2018; CDC, 2014; Ventola, 2016)
- National Data (WHO, 2019; CDC, 2018)
- XXX Data (XXX, 2020)
- Multifocal causes for vaccine non-compliance (WHO, 2019; Stockwell et al., 2014)
- Evidence-based interventions to improve vaccine compliance

Organizational Assessment

- Stakeholder Interviews
- Phenomenon of interest discovered
- Motivation to change
- Current interventions in place

SWOT Analysis

Strengths	Weaknesses
• *Part of a large healthcare system in XXX* • *Clearly defined vision, mission, and strategic plan* • *Clear and concise goals* • *Interdisciplinary staff including administration, medical assistants, pediatric nurse practitioner, pediatrician, and office manager willing to work to improve identified goals* • *Community Connector through Medicaid* • *Clinically Integrated Network (CIN) Specialist*	• *Lack of time to research improvement measures for immunization compliance improvement* • *Different ways of obtaining updated list of patients on Medicaid and Blue Cross Blue Shield* • *Do not consistently have parents make next appointment at check-out*
Opportunities	**Threats**
• *Improved vaccine compliance* • *Insurance incentive for the office* • *Outreach to patients* • ***Increase education and communication with providers***	• *Differences in insurance companies* • *Parent researching immunizations prior to appointment (may not be scholarly or up to date)* • *Anti-vaccinators*

Literature Review

- Purpose: Identify evidence-based interventions for improving pediatric vaccine compliance among patients from birth to 24 months
- Aims:
  - Among pediatric patients under 24 months, what are the identifiable factors for vaccine non-compliance?
  - Among pediatric patients under 24 months, what evidence-based interventions improve vaccine compliance?

PRISMA Figure

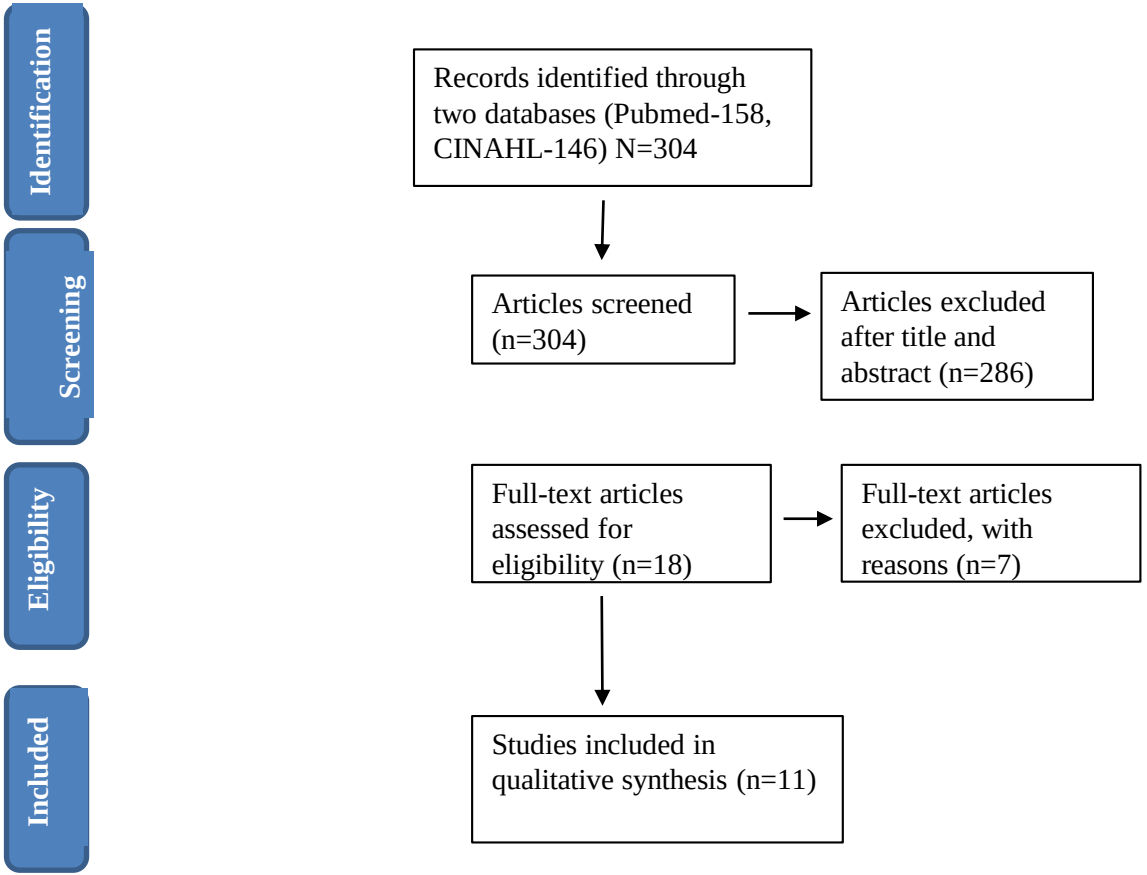


Figure 1. PRISMA Figure Adapted

Synthesis of Results

- Parent Interventions
  - Reminder/recall systems (postal, telephone, text, EMR, and combination) (Bundy et al., 2013; Frew & Lutz, 2017; Harvey et al, 2015; Hofstetter et al., 2015)
  - Education and Communication (Connors et al., 2016; Frew & Lutz, 2017; McCauley et al., 2012; Womack, 2020)
- Provider Interventions
  - Education (Connors et al., 2016; Frew & Lutz, 2017; McCauley et al., 2012; Womack, 2020)
  - EMR reminders (Bundy et al., 2013; Frew & Lutz, 2017; Harvey et al, 2015; Hofstetter et al., 2015)
- System Interventions
  - Combined vaccinations (Kurosky et al., 2017; Wagner et al., 2017)
  - Vaccines at sick visits/after hours (Robinson, 2020; Frew & Lutz, 2017)
- Gaps in literature

Conceptual Model for Phenomenon

- Pender's Health Promotion Model (All Answers Ltd., 2018)
  - Increase pediatric vaccine compliance (preventable problem)

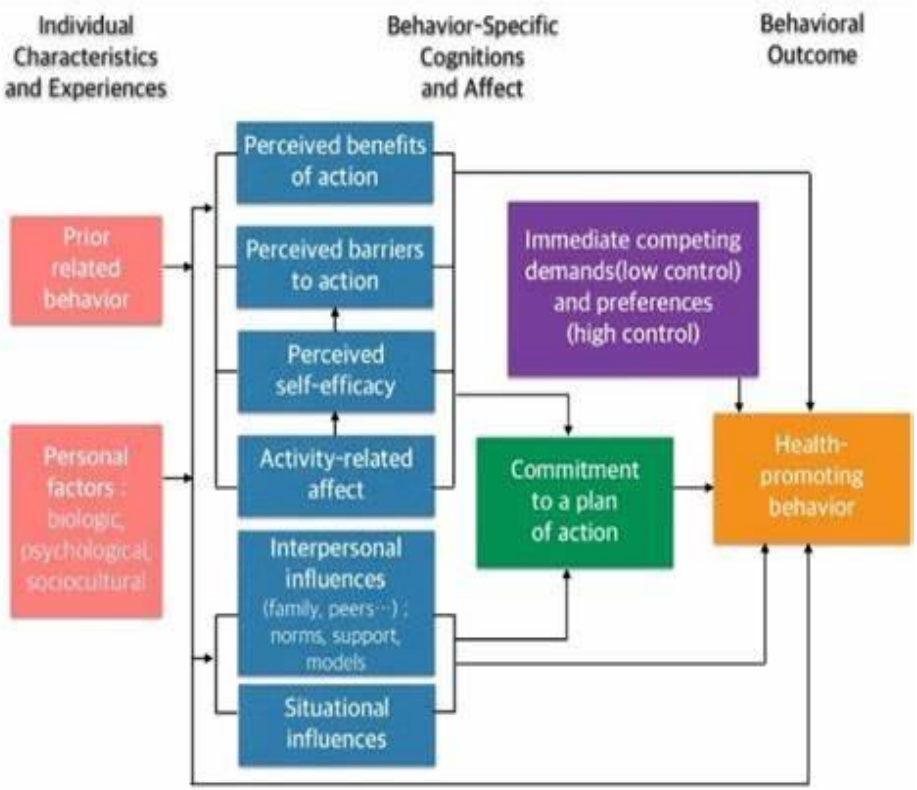


Figure 2. Pender's Health Promotion Model retrieved from http://blogthumb2.naver.net/MjAxNzA0MjhfMTMw/MDAxNDkzMzM4NzgyMTgx.UIlh1YRHWxlnRTVwsA4XGIAfNAcraBWCINkpHQ-ghSUg.DvxHusMOwCfDIbyRvpVXJYjwNGb5RibtgI3KMNPP3iEg.JPEG.mssim1987/se3_image_1200495351.jpg?type=w2

Clinical Practice Questions

- Will the utilization of a vaccine schedule/information pamphlet and interactive video:
  - increase vaccine compliance in children under 24 months of age,
  - increase parent/patient vaccine knowledge, and
  - increase parent/provider communication?

Purpose and Project Type

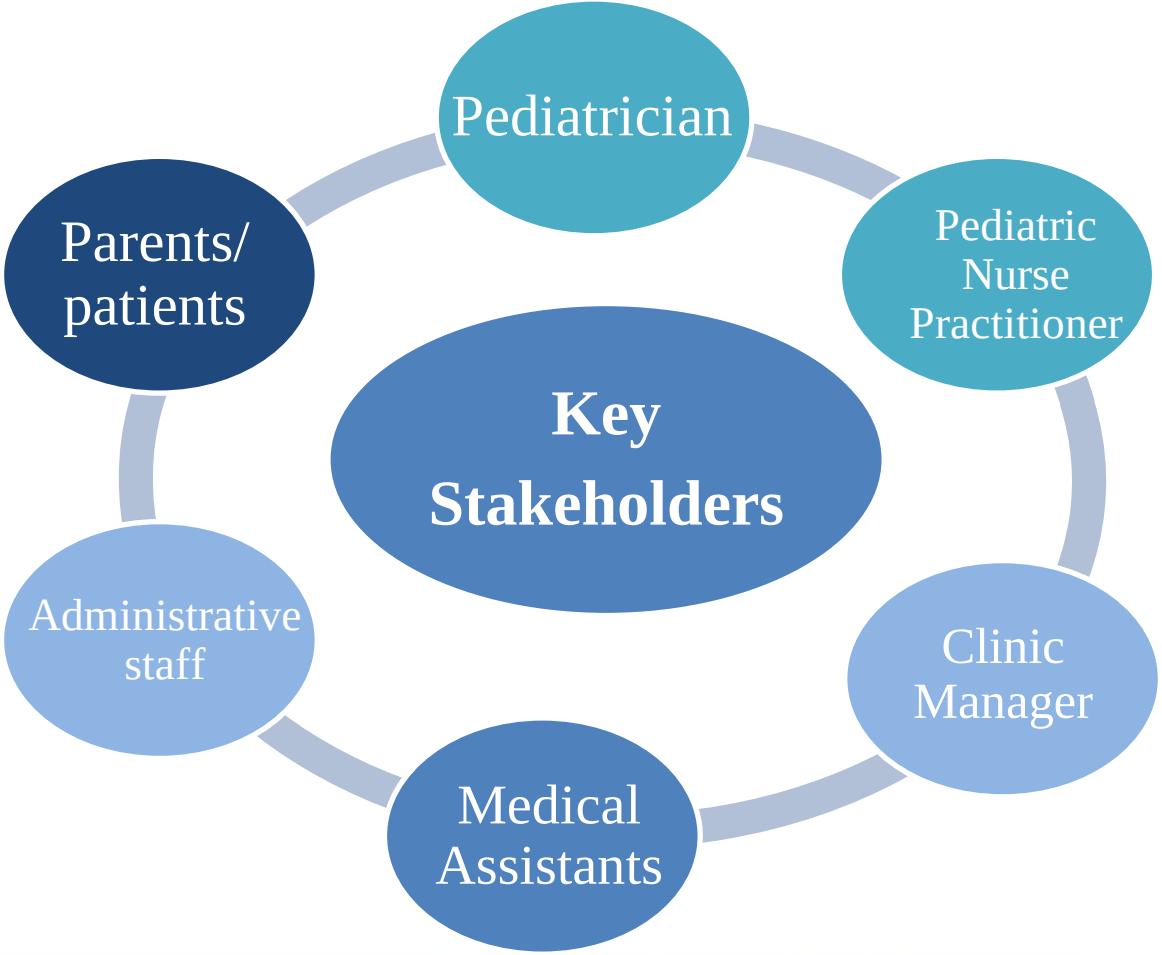
- Purpose:
  - Improve vaccine compliance in children under 24 months of age in a rural primary care clinic
  - Increase parent vaccine knowledge
  - Promote communication between parent-provider about vaccinations
- Project Type: Quality Improvement Project

Project Design

- Quality Improvement Project in a Midwest primary care clinic.
  - Improve pediatric vaccine compliance for patients at 24 months of age
    - Introduce parent friendly vaccine schedule and information pamphlet that includes an interactive educational video
  - Pre/During/Post Intervention Comparisons
    - Percentage of children at 24 months of age who are fully vaccinated
    - Parent/Staff survey data related to project

Current State of the Organization: Setting and Participants/Stakeholders

- Setting: Rural Primary Care Clinic
- Interest in quality improvement project
- Participants: Clinical staff, parents of children under 24 months of age
- Stakeholders: Pediatrician, Pediatric Nurse Practitioner, Medical Assistants, Office Manager, administrative staff and parents/patients


Pediatrician
Pediatric Nurse Practitioner
Clinic Manager
Medical Assistants
Administrative staff
Parents/ patients
Key Stakeholders

Implementation Model

- Plan, Do, Study, Act (PDSA) Model
- Process variables
  - Number of pamphlets, interactive videos and surveys given
- Outcome variables
  - Percentage change in immunization rates
  - Survey results from parents/staff

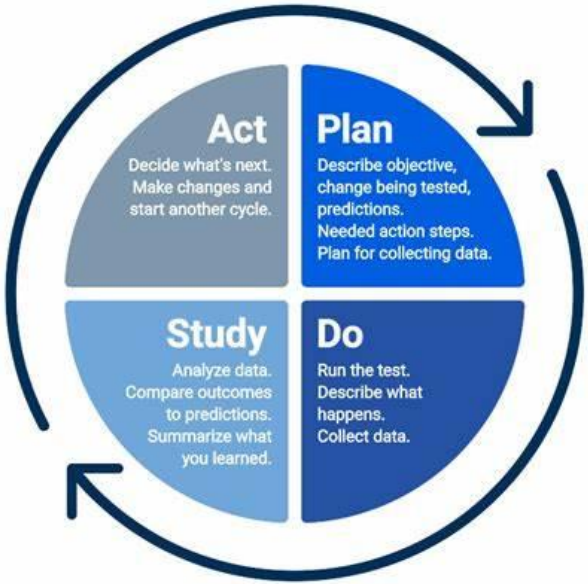


Figure 3.. Smartsheet. (2020). The essential guide to PDSA: Models, worksheets, and templates. Retrieved from https://www.smartsheet.com/content/plan-do-study-act-guide

Implementation Strategies (Powell et al., 2015)

1. Stakeholder engagement
2. Conduct local needs assessment
3. Distribute educational materials
4. Education of staff
5. Facilitation
6. Patient/Family engagement

Implementation Strategies (Powell et al., 2015)

Implementation Strategy	Description	Framework
Stakeholder Engagement	Staff questionnaire, staff interviews, project updates	Plan, Act
Conduct local needs assessment	Completed Organizational assessment, staff interview	Plan
Education of staff	Educational meeting, ongoing reminders	Plan, Do
Distribute educational materials	Distribution to parents (intervention)	Do
Facilitation	Interdisciplinary determination of need, ongoing support	Plan, Do, Act
Patient/Family Engagement	Education to parents, parent questionnaire	Do, Study

Methods

- Educational materials and survey were distributed by MA's when rooming the patients
- Training of Staff
- Collection of parent/caregiver surveys
- Collection of staff surveys

Evaluation and Measures

- Table of evaluation & measures
  - Combination 10 metric percentages
  - Patient/parent outcome measures
  - System outcome measures
- Tools:
  - Vaccine schedule, vaccine information pamphlet, QR code for interactive vaccine video
  - Parent survey
  - Staff survey

Evaluation & Measures

Topic	Concept	How Measured	When Measured	Who Measures
Implementation Strategies	Stakeholder Engagement/local needs assessment	Discussion, organizational assessment	Pre implementation	Student
	Facilitation	Discussion/development with project team and clinic manager	Pre implementation, implementation	Student
	Distribute Educational Materials	Amount of visits each day	During implementation (January 2021-February 2021)	Student, Medical Assistants, Providers
	Education to staff	Use of materials	Pre implementation (November-December 2020)	Student, providers
	Parent/Family Engagement	Parent Survey	After each clinic visit (well child/sick visit)	Student
Patient/Parent outcomes	Immunization Rates	Combination 10 metric vaccine rates	Pre (2 months prior) and post (1 months after) implementation	Student
	Use of educational materials	Parent/Caregiver Survey	After each clinic visit (well-child/sick visit)	Student
	Promotion of vaccine communication between the provider/parent	Parent/Caregiver Survey	After each clinic visit (well-child/sick visit)	Student
System Outcomes	Use of educational materials and promotion of vaccine communication with families	Staff Survey	Post implementation	Student
	Improving insurance reimbursement for office	Assessing each insurance's percentage of children vaccinated under 24 months	Post implementation (March)	Student
	Improved vaccine rates	Combination 10 metric vaccine rates	Post implementation	Student

Parent-Friendly Vaccine Schedule

Immunization Schedule for Children

Birth through 12 Years Old

[redacted]

BIRTH	Hep B						
2 MONTHS	Pediarix (Hep B/IPV/DTaP)	HIB	PCV 13 (Pneumococcal)	Rotarix (Rotavirus)			
4 MONTHS	Pediarix (Hep B/IPV/DTaP)	HIB	PCV 13 (Pneumococcal)	Rotarix (Rotavirus)			
6 MONTHS	Pediarix (Hep B/IPV/DTaP)		PCV 13 (Pneumococcal)				
12 MONTHS			PCV 13 (Pneumococcal)		MMR	Hep A	
15 MONTHS	Infanrix (DTaP)	HIB					VZV (Varicella)
18 MONTHS						Hep A	
4-6 YEARS	Kinrix (DTaP/IPV)				MMR		VZV (Varicella)
11-12 YEARS	Boostrix (Tdap)	HPV 9	Menveo/ Meningitis				

*Based on the Centers for Disease Control and Preventions recommended Immunization Schedule

Vaccine Information Handout

Vaccine-Preventable Diseases and the Vaccine Information

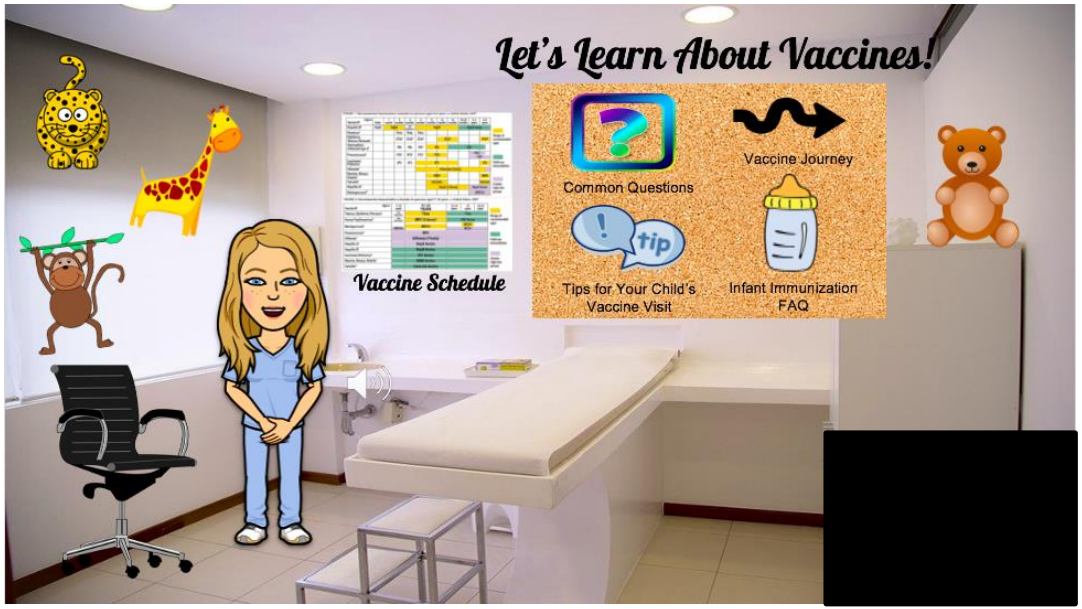
Disease	Vaccine	How it is spread	Disease Symptoms	Disease Complications
Chickenpox (Varicella)	VZV	Air, direct contact	Rash, tiredness, headache, fever	Infected blisters, bleeding disorders, encephalitis (brain bleeding), pneumonia
Diptheria	DTaP*	Air, direct contact	Sore throat, mild fever, weakness, swollen glands in neck	Swelling of the heart muscle, heart failure, coma, paralysis, death
Haemophilus influenza (type B)	HiB	Air, direct contact	May have no symptoms unless bacteria enter the blood	Meningitis, intellectual disability, epiglottitis (life threatening infection blocking windpipe), pneumonia, death
Hepatitis A	HepA	Air, direct contact	May have no symptoms, fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice (yellowing of skin/ eyes), dark urine	Liver failure, arthralgia (joint pain), kidney, pancreatic and blood disorders
Hepatitis B	HepB		May have no symptoms, fever, headache, weakness, vomiting, jaundice, joint pain	Chronic liver infection, liver failure, liver cancer
Influenza (Flu)	Flu	Air, direct contact	Fever, muscle pain, sore throat, cough, extreme fatigue	Pneumonia (infection in the lungs)
Measles	MMR**	Air, direct contact	Rash, fever, cough, runny nose, pink eye	Encephalitis, pneumonia, death
Mumps	MMR**	Air, direct contact	Swollen salivary glands (under the jaw), fever, headache, tiredness, muscle pain	Meningitis, encephalitis, inflammation of testicles or ovaries, deafness
Pertussis (Whooping Cough)	DTaP*	Air, direct contact	Severe cough, runny nose, apnea (pause in breathing in infants)	Pneumonia, death
Polio	IPV	Air, direct contact, through the mouth	May have no symptoms, sore throat, fever, nausea, headache	Paralysis, death
Pneumococcal	PCV13	Air, direct contact	May have no symptoms, pneumonia (infection in the lungs)	Bacteremia (blood infection, meningitis, death
Rotavirus	RV	Through the mouth	Diarrhea, fever, vomiting	Severe diarrhea, dehydration
Rubella	MMR**	Air, direct contact	Some rash, fever, swollen lymph nodes	Very serious in pregnant women – can lead to miscarriage, stillbirth, premature delivery, birth defects
Tetanus	DTaP*	Exposure through cuts in the skin	Stiffness in neck and abdominal muscles, difficulty swallowing, muscle spasms, fever	Broken bones, breathing difficulty, death

*DTaP combines protection against diptheria, tetanus, and pertussis **MMR combines protection against measles, mumps, and rubella
All information from the Centers for Disease Control and Prevention (CDC)

(CDC, 2019)

Interactive Vaccine Video

SCAN ME



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Parent/Caregiver Questionnaire

Parent/Caregiver Questionnaire

Age of Patient: _____

For each of the questions below, please mark the response that best signifies how you feel about each statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I found the Childhood Vaccine Schedule, information pamphlet, and interactive video educational.	O	O	O	O
2. The educational materials helped/will help me talk about vaccines with my provider.	O	O	O	O

Place an 'X' in the box if they apply:

- ☐ I watched the educational video(s)
- ☐ I have already received this educational information from another visit.
- ☐ I refused the educational materials.

Please leave the survey with the Medical Assistant prior to leaving your appointment.

Thank you.

Staff Questionnaire

Staff Questionnaire

For each of the questions below, please mark the response that best signifies how you feel about each statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. The parent-friendly vaccine schedule, vaccine information pamphlet and interactive video were easy to use/.	O	O	O	O
2. The Childhood Vaccine Schedule and Handout improved discussion with parents about vaccines.	O	O	O	O

What could be done to help you continue this intervention (handing out the schedule/information sheets) when the project is finished?

_____

_____

What are the strengths and weaknesses of this project?

_____

_____

- Please turn in to Kelsey Arnold by March 3, 2021

Analysis Plan

- Chi-square analysis
  - Comparing children fully vaccinated by 24 months pre/during/post intervention (combination 10 metric percentages)
- Parent/Caregiver Questionnaire
  - Descriptive statistics
  - 4-point Likert Scale
  - Results: Bar Chart
- Staff Questionnaire
  - Descriptive statistics
  - 4-point Likert Scale
  - Bar chart

Ethical Considerations

- IRB Determination/Approval
- Combination 10 vaccine rates and the amount of children under two were recorded pre/during/post implementation
- Parent/staff surveys will not ask for identifiers besides age of child
- No conflicts of interest

Final Budget & Resources

Doctor of Nursing Practice Project Financial Operating Plan	
Project Title	
Improving Vaccine Compliance in Children through 24 months of age in a Rural Primary Care Clinic	
In-kind donation/revenue	
Project Manager Time	16,200.00
Team Member Time:	
Clinic Manager	175.00
Nurse Practitioner/Site Mentor	530.00
Medical Assistant	170.00
Consultations	
Statistician (in-kind donation)	118.00
Reimbursement for Insurance for Immunizations	5,255.00
TOTAL INCOME	22,448.00
Expenses	
Project Manager Time (in-kind donation)	16,200.00
Team Member Time:	
Clinical Manager	175.00
Nurse Practitioner/Site Mentor	530.00
Medical Assistant	170.00
Consultations	
Statistician (in kind donation)	118.00
Laptop	1,300.00
Cost of prints (educational handouts, surveys)	26.95
PowerPoint	60.00
TOTAL EXPENSES	18,579.95
Net Operating Plan	3,868.05
Reimbursement	
Fully reimbursed immunization payout	10,235.00
Historical reimbursement-2019	4,980.00

2019 Insurance Rewards

Payer	Product Line	# Patients Met Criteria	# Eligibile Patients	Score	Target	Opportunity to Target	Reward Amount	Potential Reward	Lost Opportunity Amount	Payout Amount
Immunizations - Childhood Immunizations										
BCBSM	Commercial	15	23	65%	68%	1				
BCC	Medicaid	2	3	67%	64%	0				
BCN	Commercial	3	5	60%	65%	1	$200	$1,000	$800	$200
Meridian	Medicaid	6	17	35%	100%	11	$600	$1,700	$1,100	$100
Molina	Medicaid	4	5	80%	100%	1	$400	$500	$100	$100
PH	HMO/POS	10	12	83%	88%	1	$0	$2,100	$2,100	$175
	ASO/PPO	4	4	100%	88%	0	$700	$700	$0	$175
	Medicaid	8	11	73%	100%	3	$3,080	$4,235	$1,155	$385
Measure Summary		**52**	**80**			**18**	**$4,980**	**$10,235**	**$5,255**	

Timeline

Activity	Previous Semesters	August	September	October	November	December	January	February	March	April
Identify project site, team; create prospectus; OA, Literature review	X									
IRB			X	X						
Project Proposal				X						
Staff Training						X				
Pre-implementation data					X	X				
Implementation							X	X		
Post-implementation evaluation									X	
Final Defense										X
	Plan				Do			Study		Act

Results

Results

- Childhood Vaccinations
  - Combination 10 metric percentages
- Parent/caregiver(s) survey results
- Staff survey results

Results: Childhood Vaccinations

- Combination 10 Results
  - Pre-implementation (November, December)
  - Implementation (January, February)
  - Post-implementation (March)
- Number of children under 24 months of age seen at the clinic
- Calculated: Number of children fully vaccinated under 24 months
- Last year's pediatric patients versus this year during project timeline

Results: Childhood Vaccinations

	November	December	January	February	March
Combination 10 Percentage	26.32%	26.32%	13.18%	14.56%	17.18%
Number of Children under 24 months in clinic	42	40	39	34	38
Number of fully vaccinated children under 24 months	11	11	5	5	7

Chi-square Analysis

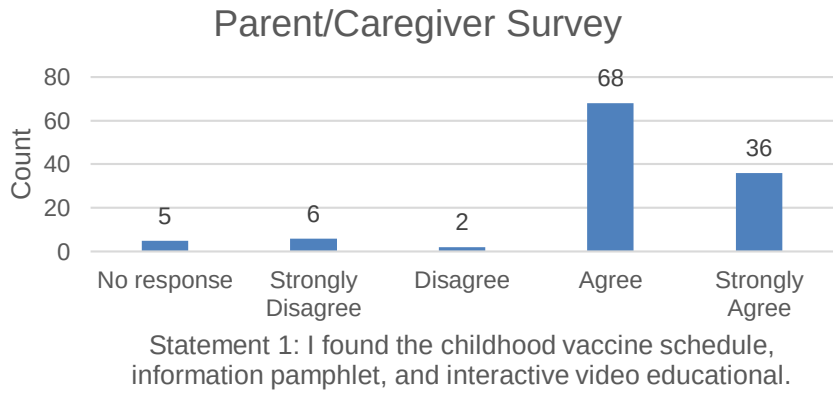
Table of implement by vaccinate				
		vaccinate		Total
		no	yes	
implement				
during	Frequency	29	5	34
	Percent	25.89	4.46	30.36
	Row Pct	85.29	14.71	
	Col Pct	32.58	21.74	
post	Frequency	31	7	38
	Percent	27.68	6.25	33.93
	Row Pct	81.58	18.42	
	Col Pct	34.83	30.43	
pre	Frequency	29	11	40
	Percent	25.89	9.82	35.71
	Row Pct	72.50	27.50	
	Col Pct	32.58	47.83	
Total	Frequency	89	23	112
	Percent	79.46	20.54	100.00

- Chi-square Analysis
- P-value: 0.3677 > 0.05

Statistic	DF	Value	Prob
Chi-Square	2	2.0011	0.3677
Likelihood Ratio Chi-Square	2	1.9787	0.3718
Mantel-Haenszel Chi-Square	1	1.8738	0.1710
Phi Coefficient		0.1337	
Contingency Coefficient		0.1325	
Cramer's V		0.1337	

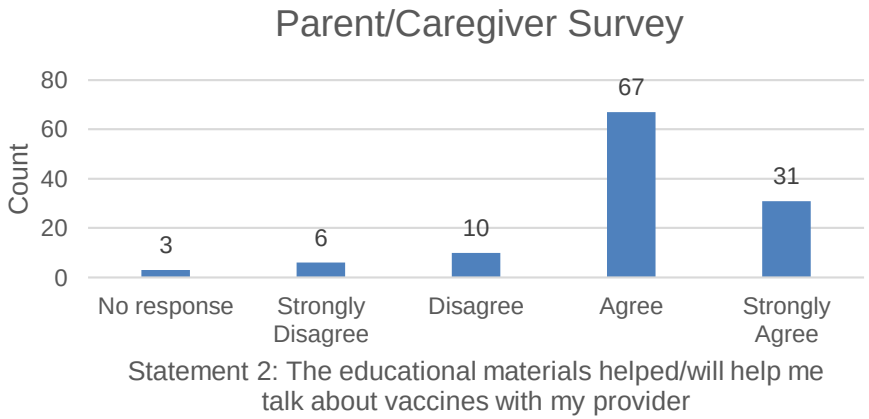
Results: Parent/Caregiver Survey

- N (total) =117
- 88.8% Agree/Strongly agree the materials were educational



Results: Parent/Caregiver Survey

- 83.7% Agree/Strongly agree the materials helped talk to their provider about vaccines



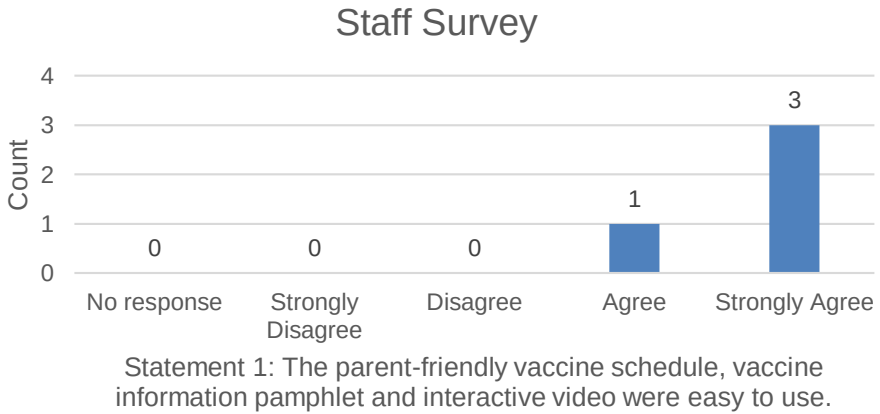
Results: Parent/Caregiver Survey

- 24.8% watched the interactive video
- 47% already received information at another visit
- 3.4% refused information

Survey Statement	Count
I watched the educational video.	29
I have already received this educational information from another visit.	55
I refused the educational materials.	4
No response	29
Total:	117

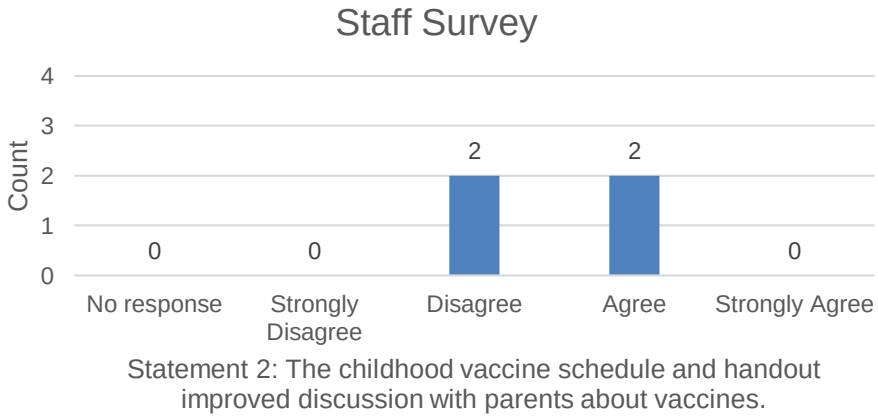
Results: Staff Survey

- N=4 (3 MAs, 1 provider)
- 100% Agree/Strongly agree the materials were easy to use



Results: Staff Survey

- 50% Agree the educational materials improved discussion with parents about vaccines.



Statement 2: The childhood vaccine schedule and handout improved discussion with parents about vaccines.

Results: Staff Survey

- Strengths and weaknesses

Survey ID #	Strengths	Weaknesses
1	“Making parents aware of office schedule.”	“(Parents) not watching video in the room (maybe attach to AVS too?)"
2	N/A	"I think adding QR code to handout would be helpful and help it be utilized better"
3	“I think you can get some great data from this! You also gave parents a hard copy to look at”	“The project is too short of a time frame to get a lot of data (but this could be because of school)"
4	QR code app was very neat & if time allowed more, I think parents would explore it-having a link to this app via MyChart where parents could access in their time"	“Most of the parents who brought their kids in for the well visits were already committed to vaccinating & didn't want additional info on the diseases they prevent. I feel this would have benefited parents more to have it ahead of their appointment”

Discussion

- Limitations
- Advance research about vaccine compliance
- Strengths
- Anticipated vs. observed results

Implications for Practice

- Alternative evidence-based interventions
- Longer implementation period
- Target families not regularly coming to visits
- Parent/caregiver survey results

Sustainability Plan

- Improvements based on Parent and Staff Surveys
- Buy-in for improved vaccine compliance and reimbursement
- Discussions with staff about the feasibility (staff survey)
- Attaching materials to AVS in EMR
- Involve future DNP students

Sustainability

- Staff survey

Survey ID #	Sustainability Comments
1	"Having them uploaded to EPIC. Already attach VIS to AVS"
2	" If we need to do it (hand out materials) we will. Maybe something that could point out with AVS"
3	"The QR code is a great resource (I think) because some parents don't like the papers"
4	"If this could be uploaded into epic to attach to their AVS, then they'd have time at home to review prior to their next appointment with shots"

Dissemination

- DNP project defense
- Share results with project site/ key stakeholders
- Submit to Journal for Healthcare Quality

Doctor of Nursing Practice Essentials

- Essential I: Scientific underpinnings for practice
- Essential II: Organizational and systems leadership for quality improvement and systems thinking

Doctor of Nursing Practice Essentials

- Essential III: Clinical scholarship and analytical methods for evidence-based practice
- Essential IV: Information systems/technology and patient care technology for the improvement and transformation of healthcare
- Essential V: Health Care Policy for Advocacy in Health Care

Doctor of Nursing Practice Essentials

- Essential VI: Interprofessional collaboration for improving patient and population health outcomes
- Essential VII: Clinical prevention and population health for improving the Nation's health.
- Essential VIII: Advanced nursing practice

Summary

- Combination 10 percentages
- Survey results
- Future insight
- Longer timeline
- Future sustainability

References

All Answers Ltd. (2018). Pender's Health Promotion Model. Retrieved from https://nursinganswers.net/essays/penders-health-promotion-model.php?vref=1

Bundy, D., Persing, N., Solomon, B., King, T., Murakami, P., Thompson, R., Engineer, L., Lehmann, C., & Miller, M. (2013). Improving immunization delivery using an electronic health record: The improve project. *Academic pediatrics, 13*(5), 458-465. https://doi-org.ezproxy.gvsu.edu/10.1016/j.acap.2013.03.004

Centers for Disease Control and Prevention. (2014). Vaccines for Children Program. Retrieved from https://www.cdc.gov/vaccines/programs/vfc/pubs/methods/index.html#table2

Centers for Disease Control and Prevention (2014). Report shows 20-year us immunization program spares millions of children from diseases. Retrieved from https://www.cdc.gov/media/releases/2014/p0424-immunization-program.html

Centers for Disease Control and Prevention. (2018). Vaccine coverage among children aged 19-35 months- united states, 2017. Retrieved from https://www.cdc.gov/mmwr/volumes/67/wr/mm6740a4.html

Centers for Disease Control and Prevention. (2019). Estimated influenza illnesses, medical visits, and hospitalizations averted by vaccination. Retrieved from https://www.cdc.gov/flu/vaccines-work/burden-averted.htm

Centers for Disease Control and Prevention. (2020). Pinkbook: Immunization strategies. Retrieved from https://www.cdc.gov/vaccines/pubs/pinkbook/strat.html

Connors, J. T., Slotwinski, K. L., & Hodges, E. A. (2017). Provider-parent communication when discussing vaccines: A systematic review. *Journal of pediatric nursing*, *33*, 10–15. https://doi.org/10.1016/j.pedn.2016.11.002

Frew, P. M., & Lutz, C. S. (2017). Interventions to increase pediatric vaccine uptake: An overview of recent findings. *Human vaccines & immunotherapeutics*, *13*(11), 2503–2511. https://doi.org/10.1080/21645515.2017.1367069

References Cont.

Harvey, H., Reissland, N., & Mason, J. (2015). Parental reminder recall and educational interventions to improve early childhood immunisation uptake: A systematic review and meta-analysis. *Vaccine*, *33*(25), 2862–2880. https://doi.org/10.1016/j.vaccine.2015.04.085

Hofstetter, A. M., DuRivage, N., Vargas, C. Y., Camargo, S., Vawdrey, D. K., Fisher, A., & Stockwell, M. S. (2015). Text message reminders for timely routine MMR vaccination: A randomized controlled trial. *Vaccine*, *33*(43), 5741–5746. https://doi.org/10.1016/j.vaccine.2015.09.042

Kurosky, S. K., Davis, K. L., & Krishnarajah, G. (2017). Effect of combination vaccines on completion and compliance of childhood vaccinations in the United States. *Human vaccines & immunotherapeutics*, *13*(11), 2494–2502. https://doi.org/10.1080/21645515.2017.1362515

Mccauley, M., Kennedy, A., Basket, M., & Sheedy, K. (2012). Exploring the choice to refuse of delay vaccines: A national survey of parents of 6-though 23-month-olds. *Academic Pediatrics*, *12*(5), 375-383. https://doi-org.ezproxy.gvsu.edu/10.1016/j.acap.2012.06.007

XXX. (2020). County quarterly immunization report card. Retrieved from https://www.XXX.gov/documents/mdch/XXX_447463_7.pdf

Pender, N. (2011). Pender's health promotion model. (n.d.) Retrieved from http://blogthumb2.naver.net/MjAxNzA0MjhfMTMw/MDAxNDkzMzM4NzgyMTgx.UIlh1YRHWxlnRTVwsA4XGIAfNAcraBWCINkpHQ-ghSUg.DvxHusMOwCfDIbyRvpVXJYjwNGb5RibtgI3KMNPP3iEg.JPEG.mssim1987/se3_image_1200495351.jpg?type=w2

References Cont.

Powell, B., Waltz, T., Chinman, M., Damschroder, L., Matthieu, M.,...& Kirchner, J. (2015). A refined compilation of implementation strategies: Results from the expert recommendations for implementing change (ERIC) project. Implementation Science. 10(1), doi: 10.1186/s13012-015-0209-1

Robison S. G. (2013). Sick-visit immunizations and delayed well-baby visits. *Pediatrics*, *132*(1), 44–48. https://doi.org/10.1542/peds.2012-3866

Smartsheet. (2020). The essential guide to PDSA: Models, worksheets, and templates. Retrieved from https://www.smartsheet.com/content/plan-do-study-act-guide

Stockwell, M.S., Irigoyen, M., Andres Martinez, R., & Findley, S.E. (2014). Failure to return: Parental, practice, and social factors affecting missed immunization visits for urban children. *Clinical Pediatrics*, 53(5), 420-427. https://doi-org.ezproxy.gvsu.edu/10.1177.0009922814527497

Ventola C. (2016). Immunization in the United States: Recommendations, Barriers, and Measures to Improve Compliance: Part 1: Childhood Vaccinations. *P & T : a peer-reviewed journal for formulary management*, *41*(7), 426–436.

Wagner, A. L., Eccleston, A.M., Potter, R.C., Swanson, R.G., & Boulton, M.L. (2018). Vaccination timeliness at age 24 months in Michigan children born 2006-2010. *American Journal of Preventive Medicine, 54*(1), 96-102. https://doi-org.ezproxy.gvsu.edu//10.1016/j.amepre.2017.09.014

Womack, J. (2010). Safety and adherence: Issues that hinder childhood vaccination. *JAAPA: Journal of the American Academy of Physician Assistants (Haymarket Media, Inc.),* 23(1), 42-47. https://doi-org.ezproxy.gvsu.edu/10.1097/01720610-201001000-00010

World Health Organization. (2019). Ten threats to global health in 2019. Retrieved from https://www.who.int/news-room/feature-stories/ten-threats-to-global-health-in-2019

Questions?