Implementation of an Interprofessional Vaccine Initiative to Increase Inpatient Pneumococcal Vaccination

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Problem: Pneumococcal vaccination is associated with a 22% risk reduction in mortality in those over age 65, shorter hospital stays, and lower medical expenditures. On a cardiac telemetry unit, only 11 of 726 inpatients were vaccinated against pneumonia during hospitalization from January 2024 through mid-August 2024. Current evidence supports collaboration with pharmacists to implement a unit-based vaccination program to increase vaccination rates. Annually, this unit cares for over 1000 adults and such an intervention could impact the provision of pneumococcal vaccination to over 500 adults. **Purpose:** The purpose of this quality improvement project is to increase pneumococcal vaccination rates among inpatient adults in a cardiac telemetry unit by implementing and evaluating an interprofessional vaccine initiative. **Methods:** In the week preceding implementation, 56% of nursing staff received in-person simulation training and an additional 30% of staff viewed the educational video. The pharmacists were educated separately to accommodate schedule differences. As part of the intervention, five vaccines were stocked on the unit. The two unit-based pharmacists screened patients using a new electronic health record note to order the vaccine. The pharmacists provided patient education and communicated via a TigerConnect ™ message to the assigned nurse on the day of discharge to administer the vaccine. The project lead conducted weekly process audits input in REDCap. Feedback data on intervention adherence, omissions, and barriers to immunization were communicated with nursing staff, unit champions and pharmacists via email. **Results:** During the fifteen weeks of the project, the pharmacists screened 183 of 285 (64.2%) patients. They educated 78 of 137 (56.9%) patients who were eligible for vaccination. Thirty-two of 95 (33.7%) patients who qualified for the vaccination from August 26th, 2024, through December 9th, 2024, received Prevnar 20® pneumococcal vaccinations. Barriers to implementation included patients refusing vaccination, nursing staff forgetting to administer the vaccine, and pharmacist unavailability during weekends, vacations, and assignments to different units. Run charts of data over the implementation period show no shifts or trends. **Conclusions:** Interprofessional vaccine initiatives increase pneumococcal vaccinations; however, barriers to pharmacist screening and patient refusals led to fewer vaccinations than expected. *Keywords:* PREVNAR 20, PCV 20, inpatient vaccination

Implementation of an Interprofessional Vaccine Initiative to Increase Inpatient Pneumococcal Vaccination

The national goal for pneumonia vaccination is 60% for those age 19-64 and 90% for those 65 years of age or older (US Department of Health and Human Services, 2021). Pneumococcal vaccination uptake is associated with a 22% reduction in mortality risk for those over age 65, shorter hospital stays, lower medical expenditures, and protection against mortality while hospitalized (Marra et al., 2020; Naito et al., 2020). Increasing vaccination will reduce morbidity and mortality. On a cardiac/telemetry unit in an academic medical center, only 11 out of 726 (1.5%) patients received pneumonia vaccinations during hospitalization in January 2024 through mid-August 2024. Breakdowns in organizational processes were evaluated through a root cause analysis (Appendix A). Root causes of reduced vaccination rates included time constraints, knowledge deficits, insufficient education, lack of vaccines stocked on the unit, and a complicated admission questionnaire used to determine vaccine eligibility. The primary root cause was partial or incomplete data in the nursing vaccine questionnaire, which prevented the ordering and administration of the vaccine. A quality improvement intervention was developed to target this root cause. The purpose of this quality improvement project was to increase pneumococcal vaccination rates among adults in a cardiac/telemetry unit by implementing and evaluating an evidence-based interprofessional vaccine initiative.

Available Knowledge

A literature search of studies from 2016 to 2024 was conducted using the Embase, Ovid, and PubMed databases. Searched terms included ‘intervention’, ‘quality improvement’, and ‘implementation’ along with ‘immunization’ and ‘hospital’. Based on the results of this search, a pharmacist screening program (Appendix B) was found to be a feasible intervention for the inpatient population. A second search was conducted on pharmacist screening programs. Of the 118 article titles reviewed, 95 were excluded due to a different intervention or setting. Twenty three abstracts were screened and 16 articles were removed for different outcomes or interventions, yielding seven studies for a full text review (Appendix C).

The seven studies were evaluated using the Johns Hopkins Nursing Evidence-Based Practice: Evidence Level and Quality Guide (2017). One study was level I, good quality; one study was level II, high quality; two studies were level II, good quality; and two studies were level III, low quality (Table 1). One systematic review, one randomized controlled trial (RCT), and two cohort studies (level I and II) concluded that the use of pharmacists in inpatient settings significantly increases vaccination rates. Le et al. (2022) found a 3.74-fold increase in the likelihood of vaccination across three RCTs that studied pharmacist screening programs in hospitals. A summary and evaluation of the overall strength and quality of this body of evidence (Table 2) shows reasonably consistent results and definitive conclusions to support a practice change. The specific aim is to implement a pharmacist screening vaccination program to achieve 100% pneumococcal vaccination rates among adult inpatients in the cardiac telemetry unit.

Rationale

The Promoting Action on Research Implementation in Health Service (PARIHS) framework was well suited for a task-oriented implementation project that focused on introducing a new process, such as a pharmacist screening vaccination program (Kitson et al., 1998; Stetler et al., 2011). A modified version of the PARIHS framework adapted from Stetler et al., 2011 was used to evaluate and leverage organizational components to facilitate successful implementation (Appendix D). Evidence-based strategies and tactics from the Accountability, Buy-in, Collaboration, Communication, Data, Education, and Structure Changes (ABCDE’S) were added to the PARIHS framework to guide implementation (Bingham & Main, 2010; Powell et al., 2015). Permission for use of the framework is granted through the Creative Commons Attribution 4.0 International License. Based on this framework, successful implementation is a function of evidence, context, and facilitation. To leverage the evidence, the research supporting practice change and current site performance was disseminated publicly among staff during staff education preceding implementation. To leverage context, the Context Assessment Index (CAI) was used by the facilitator to evaluate the site. Additional support from leadership, unit champions, and pharmacy to implement structural changes was sought to strengthen the project's context. To leverage facilitation, the project lead developed and implemented tools for quality monitoring as well as educational materials to engage with and provide feedback to staff.

Methods

Context

The project was implemented in a cardiac telemetry unit of 20 total beds within an 800-bed academic medical center. The hospital administration frequently partners with local universities to facilitate DNP student-led quality improvement projects. As such, this site offered a strong foundation for implementing practice changes. The unit's contexts were further assessed using the CAI, a tool to evaluate unit strengths in weaknesses in contexts of culture, leadership, and evaluation.

The CAI was administered by the project lead in fall of 2023 (McCormack et al, 2009). Evaluation, or the incorporation of data, evidence, and peer feedback to strengthen context was strongest at 78.3%, followed by unit manager's adherence to transformational leadership at 75% and organizational culture at 73.4%. Organizational facilitators included staff accustomed to feedback on their clinical performance, a leader who allowed for staff autonomy, and a staff that provided care based on a comprehensive assessment (McCormack et al., 2009). A structured practice-evaluation process encouraged staff to reflect on practice changes and acquire necessary skills over time. Organizational barriers included poor relations between clinical and non-clinical staff, a hierarchical organization, and unequal authority in decision-making within the multidisciplinary team (McCormack et al., 2009). Staff voiced a lack of education as a context barrier. An additional barrier was the time required to order the vaccine from pharmacy and the hours' long wait for pharmacy to deliver the vaccine on the day of discharge. Multidisciplinary team collaboration was essential to overcome the barriers of poor relations, hierarchical organization, and unequal authority in decisions (White, 2021).

The historic processes for administration of pneumococcal vaccinations on the unit were evaluated (Appendix E) along with proposed changes to improve vaccination uptake (Appendix F). Opportunities to improve unit processes included stocking the vaccine on the unit, providing staff education, and incorporating pharmacists to independently assess vaccination status and remind nursing staff to vaccinate on day of discharge.

Interventions

Initially, the project lead reached out to the hospital nursing committee to update the electronic health record to order the pneumococcal vaccine from the flowsheets as well as the admission navigator to improve functionality of the nursing vaccine questionnaire; however, this change was rejected by the hospital nursing committee.

The quality improvement project was a pharmacist screening vaccination program implemented over a 15-week timeline (Appendix G). Two unit-based pharmacists who were able and willing to contribute their expertise and time to increase vaccination rates participated. Preceding implementation staff and pharmacists were educated on the intervention. As part of the intervention, five Prevnar 20® vaccines were stocked on the unit by August 1st, 2024. The two unit-based pharmacists screened patients using the Centers for Disease Control and Prevention PneumoRecs VaxAdvisor, filed an electronic health record note using a template named .PCVscreen, and ordered the vaccine (Centers for Disease Control and Prevention, 2023). The .PCVscreen note was developed by the project lead with input solicited from pharmacists to streamline and standardize documentation. Pharmacists also educated patients using a hospital developed educational sheet stapled to the Vaccine Information Sheet. The .PCVscreen note had a space built in for pharmacists to document patient education. Once a patient was deemed eligible for the vaccine, the pharmacist sent a TigerConnect™ message to alert the assigned nurse to administer the vaccine on the day of discharge.

To ensure equity and inclusion, the intervention included all admitted patients. Vaccination inclusion and exclusion criteria were determined by the Advisory Committee on Immunization Practices guidelines (Centers for Disease Control and Prevention, 2023). The provider of record contacted the power of attorney or health care proxy to obtain authorization to administer the vaccine for individuals who did not have medical decision-making capabilities. Individuals who did not speak English as their primary language were screened using a video remote interpreter application on iPads housed on the unit. The pharmacist working on the following Monday screened patients admitted over the weekend. Patients retained the right to refuse all interventions offered by this project including vaccination screening and administration and continued to receive care as usual.

Data was communicated with pharmacists via email weekly to inform them of the percentage of discharged patients screened, educated, and vaccinated, as well as draw awareness to missed vaccination opportunities. A run chart of the number and percentage of patients vaccinated was created, updated weekly throughout the intervention, and posted in the break room for nursing and pharmacy staff to review. Nursing staff were informed of the project's development and results during monthly staff meetings.

The process goals for this quality improvement project were for pharmacists to file a note screening 100% of the patients, educate 100% of patients eligible for vaccination, and order the vaccine if eligible by October 31, 2024. The outcome goal was for nurses to vaccinate 100% of the patients with the Prevnar 20® vaccine if eligible by November 30, 2024. The project will be sustained by the pharmacists and unit champions using the tools developed for the project.

Measures

The presence of five stocked vaccines on the unit was confirmed verbally with pharmacists and physically by the project lead prior to project implementation. The vaccine was added to the unit stocking list by pharmacy and would be continually stocked by pharmacist technicians per hospital protocol.

The measures selected were staff and pharmacist education, percentage of patients screened, percentage of eligible patients educated, and percentage of eligible patients vaccinated. The number of staff members and pharmacists educated was measured using a sign-in sheet at the in-person education and via email for online education. The first process measure was the number of patients screened by unit pharmacists over the total number of patients discharged from the unit, reported as a percentage. The second process measure was the number of patients educated over the number of patients eligible for vaccination, reported as a percentage. Evidence of screening and education by unit pharmacists was demonstrated by the .PCVscreen note filed in the patient's electronic health record, over the number of patients discharged in the SlicerDicer electronic health record tool. The outcome measure was the number of patients vaccinated by discharge over the number of patients eligible for vaccination at discharge, excluding those who refused, reported as a percentage. Data for the vaccination order and proof of vaccination administration was collected from the medication administration record of the electronic chart.

Analysis

The process and outcome goals were measured weekly during the intervention period by the project lead using the Research electronic data capture (REDCap) audit tool (Appendix H) (Harris et al., 2009, 2019). The project lead evaluated each discharged patient's electronic health records for the presence of a pharmacist note screening for vaccination, evidence of pharmacist education, and whether the vaccine was ordered and administered in the electronic medication administration record. Completeness and accuracy of data was ensured by cross referencing the list of patients discharged in SlicerDicer with the charge nurse list of discharged patients; data was collected on all discharged patients. Quantitative measurements of numbers of patients screened, educated, and vaccinated were collected.

Weekly data of percentages of patients screened, percentage educated, and percentage vaccinated were plotted on run charts. The run charts were analyzed by the project lead for special cause variation including shifts, trends, and astronomical points. The median was used to assess statistical process controls. Over the course of the fifteen weeks, interventions and notable events were recorded and plotted on the x-axis of the run charts. This information was evaluated by the project lead for adherence to the intervention, as well as identifying interactions between interventions and data.

Ethical Considerations

Privacy and data confidentiality were safeguarded by collecting data through the secure web application REDCap. To minimize risk for identification, no protected health information (PHI) was collected. The project lead had completed HIPAA training on human research, privacy, and security offered by the University of Maryland School of Medicine, as well as CITI training for the protection of human subjects. A noted conflict of interest was that the project lead was a paid employee at the hospital and worked as a staff nurse on the project unit. Non-human subject’s research determination from the Human Research Protections Office (HRPO) of the UMSON Institutional Review Board (IRB) was obtained preceding implementation (Appendix I). Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines were followed in the preparation of this manuscript (Ogrinc et al., 2016).

Results

Preceding implementation of the project, 56% of nursing staff received in-person simulation training and an additional 30% of staff viewed an educational video. An educational video was developed and disseminated for staff who were unable to attend the in-person training due to summer travel. The pharmacists were educated separately due to scheduling constraints.

At the conclusion of the implementation period, 64.2% (183 of 285) of all patients were screened by pharmacists and 56.9% (78 of 137) of patients eligible to receive the vaccination were educated. In total, 33.7% (32 of 95) of patients who were eligible and did not refuse were vaccinated. There were some barriers to vaccination. Overall, 42 out of 78 (53.8%) of patients eligible for vaccination and educated by pharmacists refused vaccination. More patients aged 65 and over refused (60.4%) compared to patients aged 19 to 64 (50%). Six out of 38 (15.8%) of vaccines ordered by pharmacists and accepted by patients were not administered by nursing staff.

Run charts of the two process measures and the outcome measure show variation over time (Figures 1, 2 and 3). During the implementation period, the percentage of patients screened each week ranged from 46% to 85.7%. The percentage of patients educated each week ranged from 14.3% to 90%. The percentage of patients vaccinated ranged from 0% to 75%. On week four, a new pharmacist started on the unit and needed education to participate in the pharmacist screening vaccination program. On week eight, that pharmacist was required to cover two units and subsequently was unable to screen patients. On week 12, the new pharmacist returned full time to the project unit. There was variation throughout the project period, with no shifts or trends in the process or outcome run charts. There were no astronomical points or special cause variation noted throughout the implementation period for all process and outcome goal run charts. One contextual factor that appears to influence adherence to the intervention was the inconsistent availability of the second unit pharmacist, who found it challenging to screen patients while their unit assignments were changing, along with balancing new job requirements.

Discussion

The inpatient pharmacist screening vaccination project never reached its process and outcome goals due to barriers in screening, education and vaccine administration that persisted throughout the 15 week implementation period. Challenges with scheduling and availability interfered with staff education: 14% of staff were unable to attend either education modality. This may have played a role in the multiple instances where nursing staff forgot to administer the vaccine. Despite visual reminders with updated run charts posted in the breakroom and project updates from the project lead discussed during staff meetings, buy in from staff remained challenging. Completing patient screening and education remained difficult for pharmacists due to scheduling barriers, short admission stays, admissions over the weekend, and limited pharmacist availability. This work was not a part of the routine work requirements for pharmacists and other job duties often took precedence. Anecdotally, it was challenging for pharmacists to evaluate all patients in addition to their other job duties. The pharmacists' screening rate was comparable to reported rates in the literature where 47% of patients were screened (Bourdet et al., 2003).

The 33.7% of patients vaccinated was notably lower than reported rates of 43.3% to 82.5% in the literature (Baucom et al., 2019; Bourdet et al., 2003; Nguyen et al., 2024; Ozdemir et al., 2023). This may be due to patients on the intervention unit refusing the vaccination at a much higher rate than the rates of 7.7% to 10.7% reported in the literature (Baucom et al., 2019; Bourdet et al., 2003; Nguyen et al., 2024). It was not in the scope of this quality improvement project to collect data on patient rationale behind their refusals, though it would have been informative because more patients than expected did refuse vaccination. An additional barrier to vaccination were vaccines ordered by pharmacists that were not administered by nursing staff. The project lead found that reasons given for not administering the vaccine were patient refusals on the day of discharge, or the nursing staff forgot to administer the vaccine despite receiving a texted reminder from the unit pharmacist. Within the context of a large academic medical center with competing priorities for patient care and constant changes in patient conditions, it remains challenging for nursing staff to recall the importance of preventative vaccines including the pneumococcal vaccine prior to discharge.

Run charts of pharmacist screening, education, and vaccination project goals show the impact of pharmacists' availability on process and outcome measures. At week four when the new pharmacist started and was onboarding to the unit as well as the project, screenings, education, and vaccination all decreased. Similarly, when that pharmacist had to cover two units simultaneously, screenings, education, and vaccination all decreased. Interventions like staff reminders in the breakroom and at staff meetings, standardized electronic notes to streamline documentation, and weekly audit and feedback provided to pharmacists were unsuccessful in overcoming these barriers to pharmacist screening implementation.

One limitation of this quality improvement project is that the intervention is context specific, and outcomes are not generalizable to other units or hospitals. The project did not anticipate the challenges of completing screenings on all patients, nor the possibility of a high refusal rate, and there were no safeguards implemented to ensure completeness of screening for all patients. There is the possibility of internal bias due to data omission or misinterpretation as the collected data was not double checked by a second reviewer. The return on investment for implementing this quality improvement project to prevent community acquired pneumonia could be up to $33,380 per patient per pneumonia hospitalization avoided (Weycker et al., 2021).

Conclusions

During the implementation period, 102 vaccines were administered within the 800 bed academic medical center, and 32 (31.4%) of those were administered by the intervention unit. This unit had an 8-fold higher vaccination rate compared with the hospital rate. The project will be sustained by the hardwire changes including stocking the vaccine on the unit, the patient education sheet, and the pharmacist .PCVscreen note (Appendix J). Unit pharmacists and the unit champions will take ownership of measuring vaccines administered (Appendix J). Future project activities should include hard stops in the electronic medical record to administer the vaccine prior to printing discharge documents as a reminder to nursing staff. The project could be spread to other units with unit-based pharmacists within the academic medical center, although it was never successful at achieving 100% screening rates. This interprofessional vaccine initiative increased pneumococcal vaccinations; however, barriers to pharmacist screening and patient refusals led to fewer vaccinations than expected from the literature that supports this intervention. Further evaluation of cause for patient refusals and increasing pharmacist availability would overcome barriers.

References

Baucom, A., Brizendine, C., Fugit, A., & Dennis, C. (2019). Evaluation of a pharmacy-to-dose pneumococcal vaccination protocol at an academic medical center. *Annals of Pharmacotherapy*. *53*(4):364-370. doi:10.1177/1060028018805439

Bingham, D. & Main, E. (2010). Effective implementation strategies and tactics for leading change on maternity units. *Journal of Perinatal and Neonatal Nursing*, *24*(1), 32-42.

Bourdet, S. V., Kelley, M., Rublein, J., & Williams, D. M. (2003). Effect of a pharmacist-managed program of pneumococcal and influenza immunization on vaccination rates among adult inpatients. *American Journal of Health-System Pharmacy*, *60*(17), 1767. https://doi.org/10.1093/ajhp/60.17.1767

Centers for Disease Control and Prevention. (2023, September 21). *Pneumococcal vaccine recommendations*. https://www.cdc.gov/vaccines/vpd/pneumo/hcp/recommendations.html#:~:text=Routine%20Recommendation-,CDC%20recommends%20routine%20administration%20of%20pneumococcal%20conjugate%20vaccine%20(PCV15%20or,of%20PPSV23%20one%20year%20later.

Harris, P.A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J.G. (2009). Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*. *42*(2). 377-381.

Harris, P.A., Taylor, R., Minor, B.L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., Duda, S.N. (2019). The REDCap consortium:

Building an international community of software partners. *Journal of Biomedical Informatics. 95*, 103208. 10.1016/j.jbi.2019.103208

Johns Hopkins Nursing Evidence-Based Practice: Evidence Level and Quality Guide (2017).

King, G. S., & Judd, W. R. (2017). Impact of a pharmacist-led pneumococcal vaccine compliance program. *American Journal of Health-System Pharmacy*, *74*(23), 1948–1952. https://doi.org/10.2146/ajhp160916

Kitson, A., Harvey, G., & McCormack, B. (1998). Enabling the implementation of evidence based practice: a conceptual framework. *Quality in health care*, *7*(3), 149–158. https://doi.org/10.1136/qshc.7.3.149

Le, L. M., Veettil, S. K., Donaldson, D., Kategeaw, W., Hutubessy, R., Lambach, P., & Chaiyakunapruk, N. (2022). The impact of pharmacist involvement on immunization uptake and other outcomes: An updated systematic review and meta-analysis. *Journal of the American Pharmacists Association. 62*(5), 1499–1513.e16. https://doi.org/10.1016/j.japh.2022.06.008

Marra, F., Zhang, A., Gillman, E., Bessai, K., Parhar, K., & Vadlamudi, N. K. (2020). The protective effect of pneumococcal vaccination on cardiovascular disease in adults: A systematic review and meta-analysis. *International Journal of Infectious Diseases*, *99*, 204–213. https://doi.org/10.1016/j.ijid.2020.07.038

McCormack, B., McCarthy, G., Wright, J., Slater, P., & Coffey, A. (2009). Development and testing of the Context Assessment Index (CAI). *Worldviews on Evidence-Based Nursing, 6*(1), 27-35. https://doi.org/10.1111/j.1741-6787.2008.00130.x

Naito, T., Suzuki, M., Kanazawa, A., Takahashi, H., Fujibayashi, K., Yokokawa, H., Kuwatsuru, R., & Watanabe, A. (2020). Pneumococcal vaccination reduces in-hospital mortality, length of stay and medical expenditure in hospitalized elderly patients. *Journal of Infection and Chemotherapy 26*(7), 715–721. https://doi.org/10.1016/j.jiac.2020.03.016

Nguyen, T., & Lam, P. (2024). Pharmacist impact on pneumococcal vaccination rates through incorporation of pharmacist-led opportunistic inpatient vaccination intervention. *Journal of Pharmacy Practice and Research, 1*. https://doi.org/10.1002/jppr.1891

Ogrinc, G., Davies, L., Goodman, D., Batalden, P., Davidoff, F., & Stevens, D. (2016). SQUIRE 2.0-Standards for Quality Improvement Reporting Excellence-revised publication guidelines from a detailed consensus process. *Journal of the American College of Surgeons*, *222*(3), 317–323. https://doi-org/10.1016/j.jamcollsurg.2015.07.456

Ozdemir, N., Aktas, B.Y., Gulmez, A., Inkaya, A.C., Bayraktar-Ekincioglu, A., Kilickap, S. & Unal, S. (2023). Impact of pharmacist-led educational intervention on pneumococcal vaccination rates in cancer patients: A randomized controlled study. *Support Care Cancer 31*:194. https://doi.org/10.1007/s00520-023-07652-3

Pickren, E., & Crane, B. (2016). Impact on CDC guideline compliance after incorporating pharmacy in a pneumococcal vaccination screening process. *Hospital Pharmacy, 51*(11), 894–900. https://doi.org/10.1310/hpj5111-894

Powell, B.J., Waltz, T.J., Chinman, M.J., Damschroder, L.J., Smith, J.L., Matthieu, M.M., Procter, E.K. & Kirchner, J.E. (2015). A refined compilation of implementation strategies: Results from the Expert Recommendations for Implementing Change (ERIC) project. *Implementation Science, 10(*1), 21. Retrieved from https://implementationscience.biomedcentral.com/articles/10.1186/s13012-015-0209-1

Stetler, C. B., Damschroder, L. J., Helfrich, C. D., & Hagedorn, H. J. (2011). A Guide for applying a revised version of the PARIHS framework for implementation. *Implementation Science*, *6*, 99. https://doi.org/10.1186/1748-5908-6-99

U.S. Department of Health and Human Services. (2021). *Vaccines national strategic plan for the United States, 2021-2025*. https://www.hhs.gov/sites/default/files/HHS-Vaccines-Report.pdf

Weycker, D., Moynahan, A., Silvia, A., & Sato, R. (2021). Attributable cost of adult hospitalized pneumonia beyond the acute phase. *PharmacoEconomics*, *5*(2), 275–284. https://doi.org/10.1007/s41669-020-00240-9

White, K.M. (2021). Translation of evidence for health policy. In K.M. White, S. Dudley-Brown, M.F. Terhaar (Eds.) *Translation of evidence into nursing and healthcare* (3rd ed. pp. 149-169). Springer Publishing Company.

Table 1

Evidence Review Table

Citation: Baucom, A., Brizendine, C., Fugit, A., & Dennis, C. (2019). Evaluation of a pharmacy-to-dose pneumococcal vaccination protocol at an academic medical center. *Annals of Pharmacotherapy*. *53*(4):364-370. doi:10.1177/1060028018805439	**Level and Quality:** II B
Purpose or Hypothesis	To introduce a pharmacy-to-dose pneumococcal vaccination protocol to evaluate if this intervention increased the percentage of appropriate vaccine ordered and the percentage of vaccines administered.
Type of Evidence Research Design	Retrospective cohort study, pre- and post- protocol cohorts
Sample Population, Size, Setting	**Eligible Participants:** 19 and older with pneumococcal order placed or alert triggering candidacy for vaccination. Exclusion: contraindication to receiving vaccine. **Setting:** Large academic medical center. **Excluded:** contraindication to receiving vaccine, current vaccine order, pharmacy-to-dose order prior to nursing assessment: 15 excluded from post-protocol group and 8 excluded from pre-protocol group **Accepted:** 327 total **Control:** (pre-protocol) 167 **Intervention: (**post-protocol) 160 **Power analysis/Achieved:** 300 patients per cohort for 80% power to detect 15% difference; achieved **Group Homogeneity:** pre-protocol less likely to be vaccinated with PCV 13 (1.2% vs 5.6%, p .03) and more likely to have chronic heart disease (56.3% vs 35.6%, p <.01) are the only significant differences.
Intervention Procedures	**Control Protocol:** Nurse screens patient for pneumococcal vaccine, if eligible per criteria nurse orders pneumococcal vaccine and administers vaccine if patient agreeable prior to discharge. **Intervention Protocol:** Nurse screens patient for pneumococcal vaccine, if eligible per criteria and patient agreeable, order for pharmacist consultation populates and pharmacist reviews CDC algorithm and vaccine history. Pharmacist documents note in chart and orders vaccine if eligible. Nurse administers prior to discharge. **Treatment Fidelity:** Study does not detail how pharmacists are trained on the intervention nor is the algorithm used by pharmacy to dose vaccines provided; threat to external validity as the intervention is difficult to replicate. History threat (potential confounder) to internal validity as pre- and post-intervention groups sampled one year apart. Liberal exclusion and inclusion criteria mean the conclusions are easily generalized to any inpatient population.
Primary Outcome and Measures	**Dependent Variable:** Correct vaccine ordered; measured through retrospective chart review for accuracy **DV Measure:** Percentage
Results/Conclusions	**Statistical Results:** Correct vaccine ordered: 26.9% in pre-protocol, 83.1% post protocol, (p<.001). Stratified by age – 19-64 age 50% pre-protocol, 79.3% post-protocol, (p<.001). 65+ age 2.47% pre-protocol, 87.2% post-protocol, (p<.001). No pre-protocol rate of vaccination reported; post-protocol vaccination rate 82.5% with barriers to vaccination being vaccine not dispensed, dispensed but returned, patient refused, and patient expired. Nursing failed to order pharmacy to dose in 55.6% (15/27) of missed vaccination opportunities. **Conclusions:** Statistically significant improvement in accuracy of pneumococcal vaccination per ACIP guidelines post intervention demonstrates the pharmacy-to-dose algorithm for inpatient pneumococcal vaccination is a viable intervention. High rate of 82.5% vaccinated is promising, however with no pre-intervention comparator cannot conclude statistical significance.

Citation: Bourdet, S. V., Kelley, M., Rublein, J., & Williams, D. M. (2003). Effect of a pharmacist-managed program of pneumococcal and influenza immunization on vaccination rates among adult inpatients. American Journal of Health-System Pharmacy, 60(17), 1767. https://doi.org/10.1093/ajhp/60.17.1767		**Level and Quality** II B
Purpose or Hypothesis	To evaluate if inpatient pharmacy-based standing orders protocol for vaccination effectively increases vaccination rates.	
Type of Evidence Research Design	Prospective cohort study, intervention and control arms	
Sample Population, Size, Setting	**Sampling Technique:** Randomized to intervention or standard care by unit: general medicine, pulmonary medicine, infectious diseases units received intervention, renal, gastrointestinal, cardiology, and family medicine inpatients received control treatment **Eligible Participants:** Inpatients age 18+ **Setting:** 684 bed teaching hospital **Excluded:** not stated **Accepted:** 1303 **Control:** 542 **Intervention:** 761 **Power analysis/Achieved:** Not stated **Group Homogeneity:** No statistical difference among groups for indications for vaccination	
Intervention Procedures	**Control Protocol:** Immunized if ordered by healthcare provider **Intervention Protocol:** Pharmacist rounds on units to identify patients eligible for vaccination based on patient recall and ordered the vaccine through standing vaccination orders. **Treatment Fidelity:** No power analysis reported is a threat to internal validity and increases risk for type II error.	
Primary Outcome and Measures	**Dependent Variable:** Inpatients screened and inpatients immunized. **DV Measure:** Percentage	
Results/Conclusions	**Statistical Results:** 47% in intervention group screened by pharmacist, 79.5% had indication for vaccination, 46% reported having received pneumococcal vaccination, 71% of eligible patients vaccinated (15% of all patients considered high risk) compared to 0.5% of control group, p<.001 **Conclusions:** Pharmacist screening resulted in statistically significant increase in pneumococcal vaccinations. The study does not state why only 47% of intervention group was screened, but it can be assumed increased screenings would increase vaccination.	

Citation: King, G. S., & Judd, W. R. (2017). Impact of a pharmacist-led pneumococcal vaccine compliance program. American Journal of Health-System Pharmacy, 74(23), 1948–1952. https://doi.org/10.2146/ajhp160916		**Level and Quality:** III C
Purpose or Hypothesis	To introduce a pharmacist evaluation of pneumococcal vaccine eligibility to increase pneumococcal vaccination inpatient.	
Type of Evidence Research Design	Retrospective cohort, pre- and post-protocol cohorts	
Sample Population, Size, Setting	**Eligible Participants:** adults who received pneumococcal vaccination **Setting:** hospital **Excluded:** not stated **Accepted:** not stated **Control:** (pre-intervention) 100 **Intervention:** (post-intervention) 45 **Power analysis/Achieved:** not stated **Group Homogeneity:** not stated	
Intervention Procedures	**Control Protocol:** Computer provider order entry system detected what pneumococcal vaccine was indicated **Intervention Protocol:** Electronic clinical surveillance system notifies pharmacist when vaccine indicated; pharmacist reviews medical history and orders appropriate vaccine **Treatment Fidelity:** Unexplained difference in number of study participants pre- and post-intervention and no report on group homogeneity makes it difficult to compare groups. History threat (potential confounder) to internal validity as pre- and post-intervention groups sampled one year apart. No power analysis reported is a threat to internal validity and increases risk for type II error.	
Primary Outcome and Measures	**Dependent Variable:** Percent of inpatients vaccinated with the correct pneumococcal vaccine per ACIP guidelines **DV Measure:** Percentage	
Results/Conclusions	**Statistical Results:** 40% vaccinated with correct formulation (PCV 13 vs PPSV 23) pre-intervention vs. 95.6% post-intervention, no p-value. **Conclusions:** This study concluded efficacy of a pharmacist vaccine screening protocol to increase the correctness of the vaccine ordered, however due to limitations including no power analysis, no p-value, and no randomization the internal validity of this study is weak and it is possible these results might not be replicable.	

Citation: Le, L. M., Veettil, S. K., Donaldson, D., Kategeaw, W., Hutubessy, R., Lambach, P., & Chaiyakunapruk, N. (2022). The impact of pharmacist involvement on immunization uptake and other outcomes: An updated systematic review and meta-analysis. Journal of the American Pharmacists Association. 62(5), 1499–1513.e16. https://doi.org/10.1016/j.japh.2022.06.008	**Level and Quality** II A
Purpose or Hypothesis	Systematic review and meta-analysis of effects of pharmacist involvement in immunizations outcomes
Type of Evidence Research Design	Included studies: randomized controlled trials and observational studies with comparison group
Sample Population, Size, Setting	**Sampling Technique:** Systematic search of MEDLINE, Embase, and Cochrane Central Registry **Eligible Participants:** Randomized controlled trials and observational studies with comparison group that measured immunization rates **Setting:** Inpatient and community settings **Excluded:** 7336 studies reviewed, 309 assessed for eligibility. Excluded for: abstract only, no comparator group, wrong intervention, duplicates, or no full text available. **Accepted:** 14 RCTs and 79 observational studies. **Data extraction:** Two reviewers independently conducted search and data extraction, with third reviewer involved for discrepancies
Intervention Procedures	**Control Protocol:** Usual care **Intervention Protocol:** Pharmacist involvement in immunization process as facilitators, advocators, or immunizers **Treatment Fidelity:** Reviewers rated quality of evidence using ROB tool from Cochrane for RCTs, ROBINS-I tool for observational studies, and the Grading of Recommendations, Assessment, Development and Evaluation to rate evidence quality.
Primary Outcome and Measures	**Dependent Variable:** Increase in vaccination rate secondary to pharmacist intervention **DV Measure:** Pooled risk ratio in meta-analysis of randomized controlled trials
Results/Conclusions	**Statistical Results:** In the three RCTs conducted in the hospital setting, pharmacists as advocators for vaccination increased likelihood of vaccination by 3.74 times (2.67-5.22), I^2 heterogeneity 0%. In nine observational studies in the hospital, pharmacists as advocators increased the likelihood of vaccination by 2.04 times (1.53-2.72) I^2 97.7% (large heterogeneity). **Conclusions:** Interventions that use pharmacist involvement in vaccination increases the likelihood of vaccination by 2.04 to 3.74 times across randomized controlled trials and observational studies with control groups.

Citation: Nguyen, T., & Lam, P. (2024). Pharmacist impact on pneumococcal vaccination rates through incorporation of pharmacist-led opportunistic inpatient vaccination intervention. Journal of Pharmacy Practice and Research, 1. https://doi.org/10.1002/jppr.1891	**Level and Quality** II B
Purpose or Hypothesis	Evaluate if a “pharmacist-led opportunistic inpatient pneumococcal vaccine intervention” increases pneumococcal vaccinations.
Type of Evidence Research Design	Retrospective cohort study, pre- and post-intervention cohorts
Sample Population, Size, Setting	**Sampling Technique:** Nonrandomized, sequential sampling **Setting:** Subacute rehabilitation facility and tertiary care hospital **Eligible Participants:** Inpatients age 70+ **Excluded:** Already vaccinated for pneumonia; 41 pre-intervention and 37 post-intervention **Accepted:** 282 **Control:** (pre-intervention) 139 **Intervention:** (post-intervention) 143 **Power analysis/Achieved:** sample size needed for CI 95% and power of 80%: 180 screened in each group; achieved **Group Homogeneity:** No statistically significant differences between groups
Intervention Procedures	**Control Protocol:** Pre-intervention protocol not stated **Intervention Protocol:** “pharmacist-led opportunistic inpatient pneumococcal vaccine intervention”: pharmacists screened patients for vaccine eligibility; if eligible, notified medical team immediately, weekly, and on the day of discharge if not vaccinated the pharmacist documented a reason. **Treatment Fidelity:** History threat (potential cofounder) to internal validity as pre- and post-intervention groups sampled sequentially over time.
Primary Outcome and Measures	**Dependent Variable:** Individuals vaccinated against pneumonia. **DV Measure:** Percentages.
Results/Conclusions	**Statistical Results:** 2.2% vaccinated pre-intervention, 43.3% vaccinated post-intervention, $p<.001$. Individuals remaining unvaccinated were due to physician failing to order vaccine (27.3%), discharge prior to vaccination (9.1%), or patient/family refusal (7.7%). **Conclusions:** Pharmacist-led vaccination programs are effective to increase pneumococcal vaccination, although it is unclear what interventions were in place to encourage vaccination pre-intervention. Inclusion criteria of age 70+ is a threat to generalizability of intervention to 18+ age group.

Citation: Ozdemir, N., Aktas, B.Y., Gulmez, A., Inkaya, A.C., Bayraktar-Ekincioglu, A., Kilickap, S. & Unal, S. (2023). Impact of pharmacist-led educational intervention on pneumococcal vaccination rates in cancer patients: A randomized controlled study. Support Care Cancer 31:194. https://doi.org/10.1007/s00520-023-07652-3	**Level and Quality** I B
Purpose or Hypothesis	Evaluate effect of pharmacist involvement on pneumococcal vaccination rates.
Type of Evidence Research Design	Randomized controlled trial
Sample Population, Size, Setting	**Sampling Technique:** Simple randomization, assigned via even and odd numbers on medical files **Eligible Participants:** Age 18+ with cancer in remission and no history of pneumococcal vaccination **Setting:** Two tertiary care hospital's medical oncology clinics **Excluded:** Language barrier, visual/auditory/cognitive impairments, not aware of vaccination status **Accepted:** 235 (228 final due to 7 lost to follow up, 3 in intervention and 4 in control) **Control:** 114 **Intervention:** 114 **Power analysis/Achieved:** N=114 per group for 90% power and 5% error level, achieved **Group Homogeneity:** Only statistical differences between groups were having received previous radiotherapy (p=0.03)
Intervention Procedures	**Control Protocol:** Received care from oncologist, received two follow-up phone call reminders **Intervention Protocol:** Pharmacist assessed vaccination status, provided verbal education and a booklet on vaccination, and recommended the vaccine, received two follow up phone call reminders **Treatment Fidelity:** Does not specify if education provided by one pharmacist or multiple pharmacists; threat to internal validity. Threat to external validity: excluded those with language barrier, visual/auditory/cognitive impairments, those not aware of vaccination status.
Primary Outcome and Measures	**Dependent Variable:** Individuals vaccinated against pneumonia, self reported **DV Measure:** Percentage
Results/Conclusions	**Statistical Results:** 20.2% in intervention group and 6.1% in control group vaccinated (p=.003). Phone call reminders increased vaccination to 46.5% in intervention group. Reasons given by study participants for not receiving vaccination include not being able to access the vaccine, not believing the vaccine is necessary, and fear of side effects. **Conclusions:** In-person pharmacist education significantly increases pneumococcal vaccination. This demonstrates pharmacist education is effective for increasing vaccination. This study would be difficult to apply in other settings due to limitations on external validity and no information about how much time pharmacists spent educating on vaccines or what was included in the educational content.

Pickren, E., & Crane, B. (2016). Impact on CDC guideline compliance after incorporating pharmacy in a pneumococcal vaccination screening process. Hospital Pharmacy, 51(11), 894–900. https://doi.org/10.1310/hpj5111-894	**Level and Quality** III C
Purpose or Hypothesis	"Determine the impact on compliance with the revised pneumococcal vaccination guidelines from the CDC after involving pharmacy in the screening and selection processes"
Type of Evidence Research Design	Retrospective cohort study
Sample Population, Size, Setting	**Sampling Technique:** Rolling selection over two time periods **Eligible Participants:** Inpatients over 19 years old who were screened for vaccine **Setting:** Hospital **Excluded:** 1: <19 age in control group **Accepted:** 148 pre-intervention, 341 post-intervention **Control:** All patients vaccinated January and February 2015; 148: 147 included, 1 excluded <19 age **Intervention:** All patients vaccinated in January and February 2016; 341 assessed, 248 vaccines prescribed, 122 vaccines not received, 126 vaccines received **Power analysis/Achieved:** Not reported **Group Homogeneity:** No statistical difference in groups
Intervention Procedures	**Control Protocol:** Nurse screens for pneumonia vaccine, and sends message to pharmacist to order vaccine, nurse administers ordered vaccine on discharge **Intervention Protocol:** Nurse screens for pneumonia vaccine, medication reconciliation technician screens for vaccine history, nurse determines if vaccine candidate, pharmacist assesses patient as well as patient vaccine history and orders appropriate vaccine, nurse administers ordered vaccine on discharge **Treatment Fidelity:** Control and intervention protocols not well detailed, information only available in chart format. History threat (potential confounder) to internal validity as pre- and post-intervention groups sampled one year apart. No power analysis reported is a threat to internal validity and increases risk for type II error.
Primary Outcome and Measures	**Dependent Variable:** Percent or correct vaccinations administered per ACIP guidelines **DV Measure:** Percentage
Results/Conclusions	**Statistical Results:** Statistically significant difference in ACIP vaccine compliance from control to intervention groups (42%, 97%, $p<.001$). Statistically significant reduction in wrong vaccine prescribed (54% vs 2%, $p<.001$) and duplicates prescribed (16% vs. 2%, $p<.001$). **Conclusions:** Pharmacist intervention increases vaccine guideline compliance as well as reduces errors in vaccination. The study reported since nurses are relied upon to perform the initial screening in both the control and intervention group, potentially some patients who may have been appropriate for vaccination were not screened by pharmacist. Additionally, despite orders placed for 248 vaccinations, only 126 were administered (50.8%). The study fails to address what barriers existed that may have impeded vaccine administration following an order.

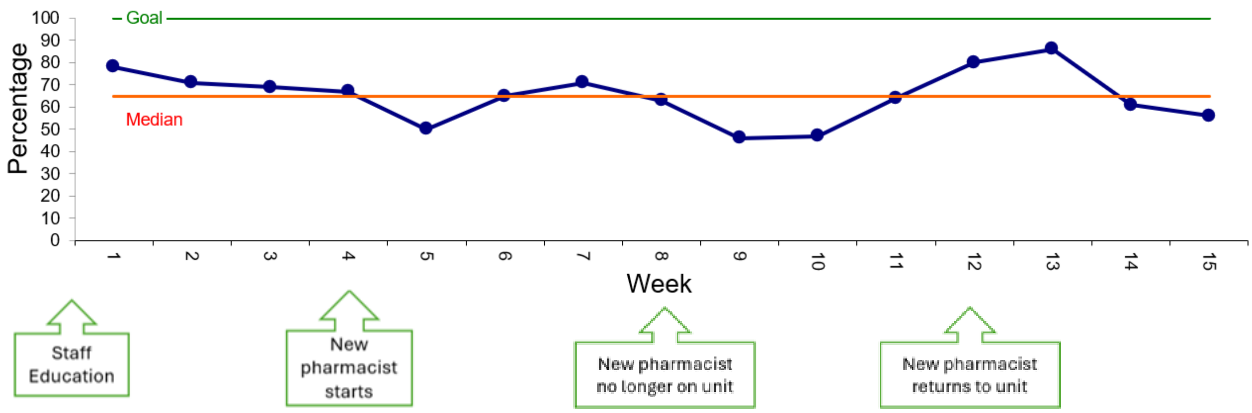
Table 2

Evidence Synthesis Table

Project Title: Interprofessional Pneumococcal Vaccination Program			
PICOT: Why are adult inpatients on a cardiac/telemetry unit at an academic medical center not receiving pneumococcal vaccines despite nursing Standard Operating Procedures and admission documentation requirement?			
JHNEBP Model Level	**Total Number of Sources**	**Author and Quality Rating of each study**	**Synthesis of Findings**
Level I	1 RCT	Ozdemir et al.: B	Ozdemir et al., (2023) found in-person pharmacist education significantly increases pneumococcal vaccination (p=.003).
Level II	1 prospective cohort (Bourdet et al) 2 retrospective cohort (Baucom et al; Nguyen & Lam) 1 systematic review with meta-analysis (Le et al)	Baucom et al.: B Bourdet et al.: B Nguyen & Lam: B Le et al.: A	Baucom et al. (2019) reported a vaccination rate of 82.5% in the post-intervention, although no pre-intervention rate was reported, as well as an increase in ACIP guideline adherence. Bourdet at al. (2003) and Nguyen & Lam (2024) both found pharmacist intervention increased vaccination significantly to 71% and 43.3% respectively. Le et al. (2022) found a 2.04 to 3.74 increased likelihood of vaccination in hospitals that used pharmacists as evaluators among nine observational studies with control groups and three randomized controlled trials.
Level III	2 retrospective cohort	King & Judd: C Pickren & Crane: C	King & Judd (2017) concluded pharmacist involvement in vaccination improved ACIP guideline adherence significantly from 40% to 95.6%, and Pickren & Crane (2016) concluded this intervention improved guideline adherence from 42% to 97%. These studies conclusions are difficult to generalize as they both lack a power analysis and good treatment fidelity.
Overall Quality Rating w/rational and Recommendation: There is good and consistent evidence supported by one systematic review, one randomized controlled trial, and two cohort studies that pharmacists increase vaccination rates. Three additional studies demonstrate pharmacist involvement in immunization increases the percent of correct vaccines administered and reduces duplicates, although these studies are lower quality and have limited external validity. Based on the evidence review and synthesis, a quality improvement project to incorporate a pharmacist-led immunization intervention would increase the percentage of patients who receive a pneumococcal vaccine.			

Figure 1

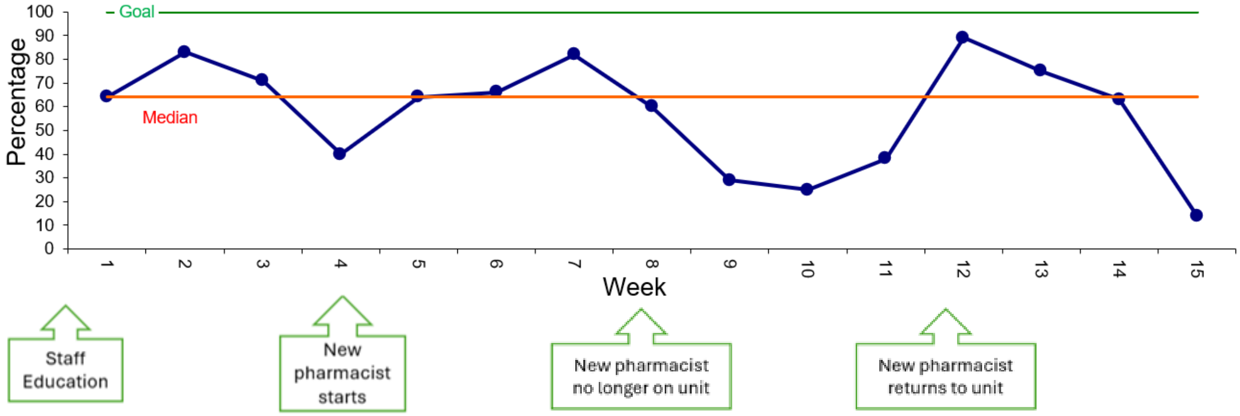
Percentage of Patients Screened by Pharmacist



Note. Number of patients screened ranged from 9 (week 10) to 18 (week 13)

Figure 2

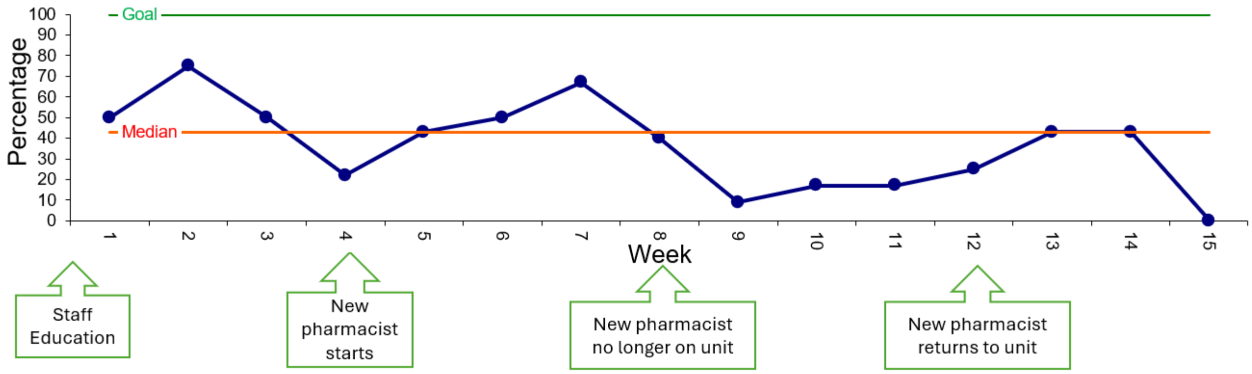
Percentage of Patients Eligible for Vaccination Educated by Pharmacist



Note. Number of patients educated ranged from 1 (week 15) to 9 (week 7 and 13)

Figure 3

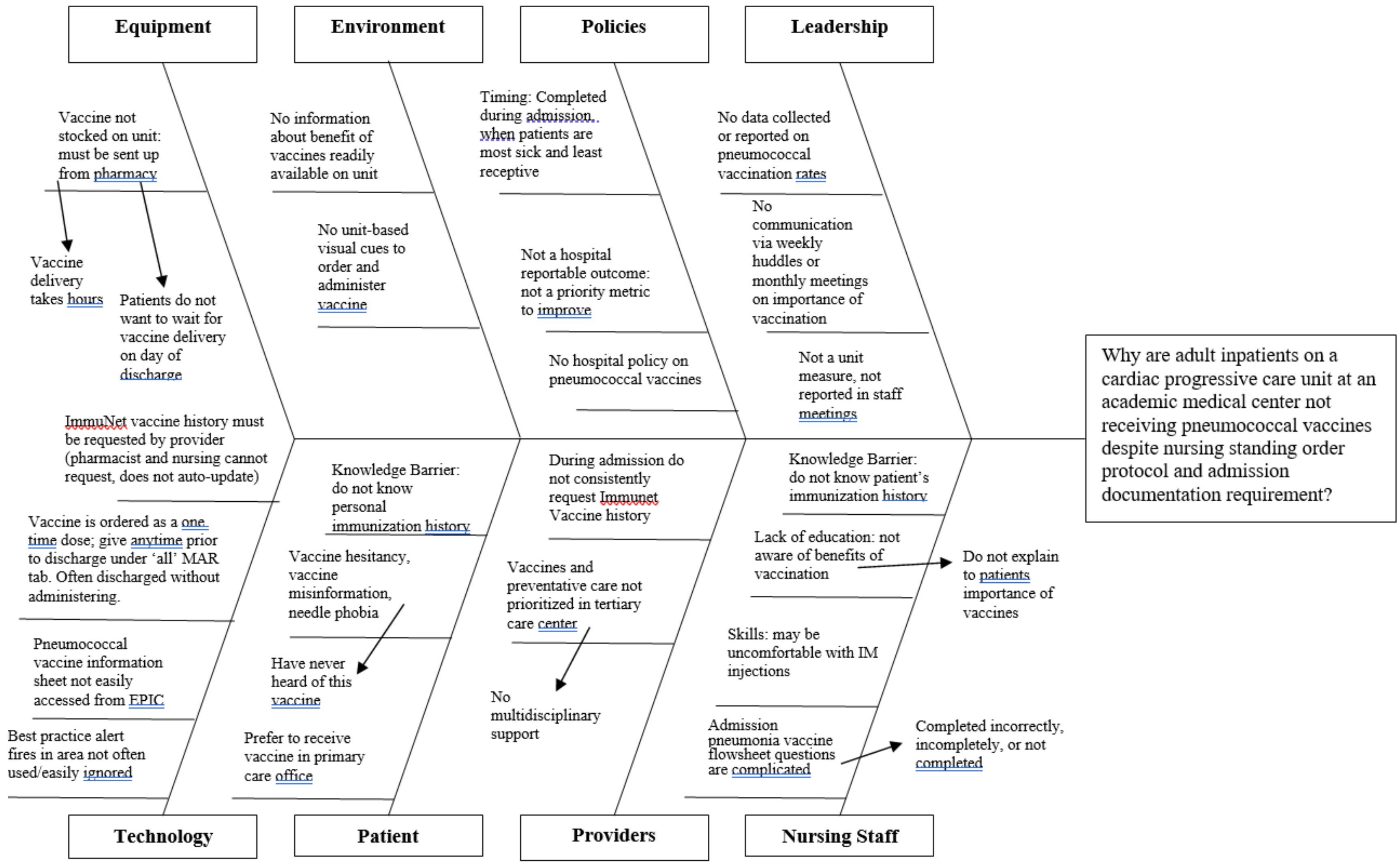
Percentage of Patients Vaccinated



Note. Number of patients vaccinated ranged from 0 (week 15) to 4 (weeks 1 and 7)

Appendix A

Root Cause Analysis



Appendix B

Search Strategy

Embase

History | Save | Delete | Print view | Export | Email | Combine | using And / Or | Collapse

#	Search	Results
#7	#5 AND #6	80
#6	pneumococcal	39,105
#5	#1 AND #2 AND #3 AND [2014-2024]/py	970
#4	#1 AND #2 AND #3	1,395
#3	'pharmacist' OR 'hospital pharmacy'	156,843
#2	'hospital' OR 'hospital patient'	10,590,195
#1	'vaccination' OR 'immunization'	510,056

Ovid

Search History (12) — View Saved

#	Searches	Results	Type	Actions	Annotations
1	Pharmacists/	22368	Advanced	Display Results More	
2	Pharmacy/	10460	Advanced	Display Results More	
3	Pharmacy Service, Hospital/	12610	Advanced	Display Results More	
4	1 or 2 or 3	40407	Advanced	Display Results More	
5	Vaccination/	108535	Advanced	Display Results More	
6	Immunization/	53998	Advanced	Display Results More	
7	5 or 6	157185	Advanced	Display Results More	
8	4 and 7	341	Advanced	Display Results More	
9	Hospitals/	104012	Advanced	Display Results More	
10	Inpatients/	30586	Advanced	Display Results More	
11	9 or 10	132838	Advanced	Display Results More	
12	8 and 11	5	Advanced	Display Results More	

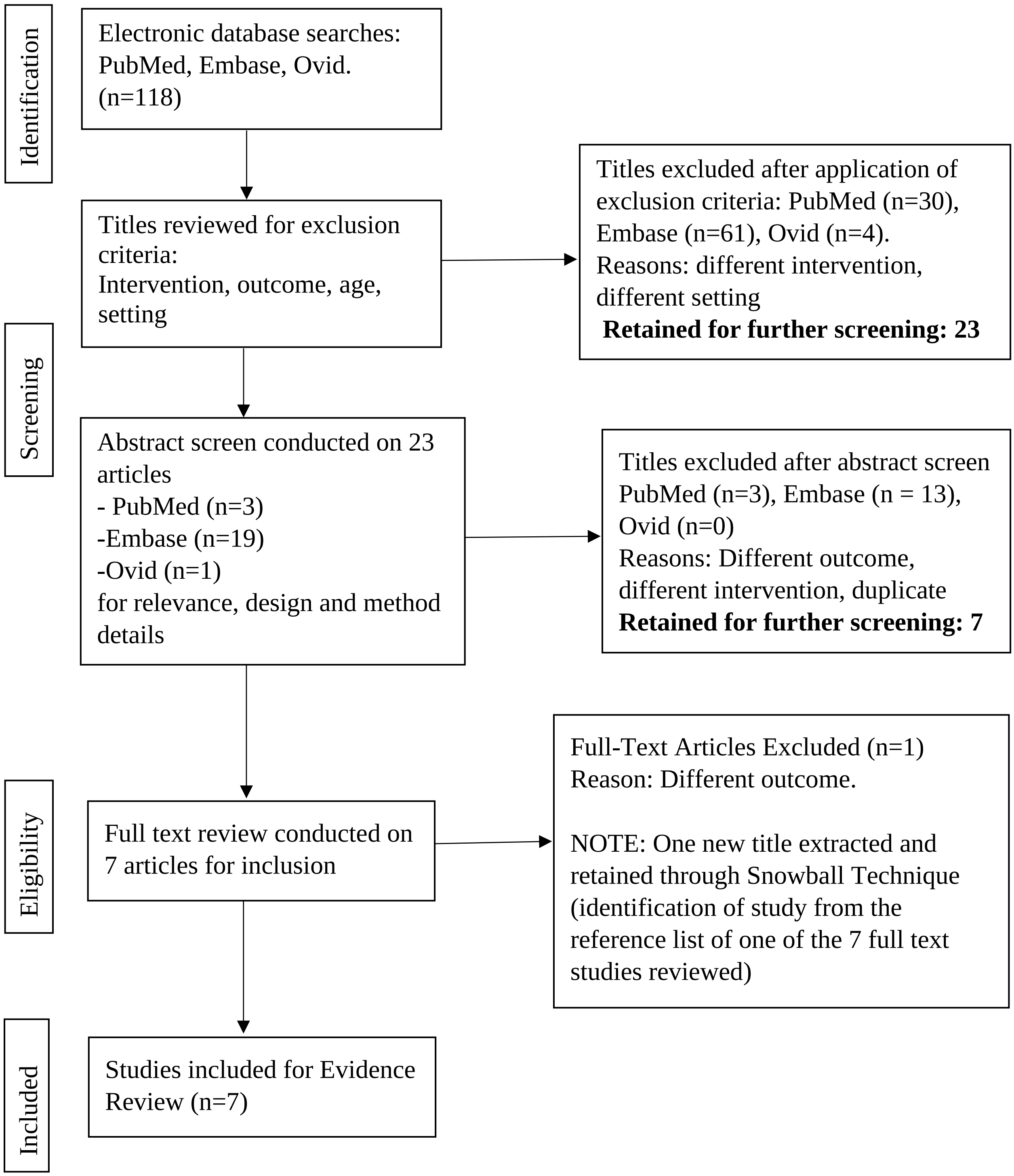
PubMed

History and Search Details — Download | Delete

Search	Actions	Details	Query	Results	Time
#9	•••	>	Search: **#7 AND #8**	33	12:35:15
#8	•••	>	Search: **pneumococcal**	35,025	12:32:23
#7	•••	>	Search: **#1 AND (#2 OR #3) AND (#4 OR #5)** Filters: **from 2014 - 2024**	355	12:31:49
#6	•••	>	Search: **#1 AND (#2 OR #3) AND (#4 OR #5)**	443	12:31:36
#5	•••	>	Search: **inpatient**	170,004	12:30:41
#4	•••	>	Search: **hospital**	7,082,037	12:30:34
#3	•••	>	Search: **immuniz***	213,750	12:30:20
#2	•••	>	Search: **vaccin***	533,429	12:30:01
#1	•••	>	Search: **pharmacist**	52,362	12:29:42

Appendix C

PRISMA Search Flow Diagram



Appendix D

Promoting Action on Research Implementation in Health Services (PARIHS) Framework

Successful implementation = f (E, C, F)
E=evidence C=context F=facilitation

Successful implementation: uptake of intervention (measurement: % of patients screened) and fidelity to intervention (measurement: % of screenings that are accurate) produces desired outcome (measurement: % of patients vaccinated)

Evidence

Research:
- Share supporting research in public and transparent manner

Clinical Experience:
- Seek guidance from CSR with clinical expertise
- Set up simulation training to educate staff on new process and create support for change

Patient Experience:
- Address patient concerns and barriers by providing education at point of care to overcome vaccine hesitancy
- Obtain and use patient feedback in project development

Local Practice Information:
- Share local performance data in public and transparent manner

Characteristics of targeted EBP:
- Project charter: develop a formal implementation blueprint based on the evidence-based practice research

Context

Culture:
- Use Context Assessment Index to identify cultural facilitators and barriers to implementation
- Identify and prepare champions; hold meetings with champions

Leadership support:
- Meetings with leadership to seek their input and keep them informed of project development
- Determine what leadership can do to facilitate practice change: how they will assist in keeping staff informed

Evaluation capabilities:
- Use hospital clinical informatics and technology department to assess capabilities to report out on data

Receptivity to targeted change:
- Consult with pharmacy manager to stock PCV 20 vaccine on unit
- Assess readiness and time requirements for pharmacist to separately evaluate and order vaccines

Facilitation

Role:
- DNP student project lead

Purpose:
- guide implementation of targeted EBP

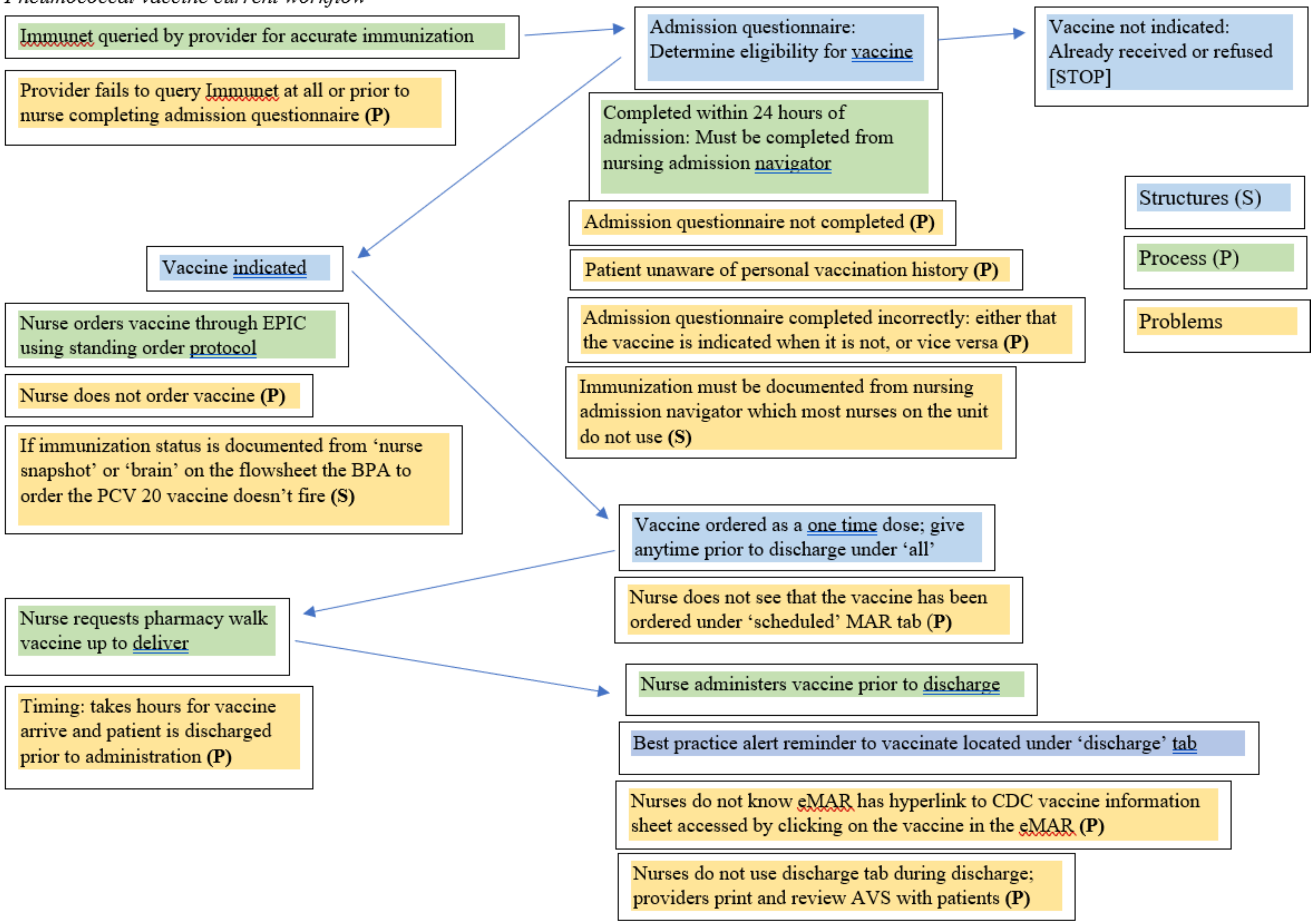
Skills:
- characteristics that enable implementation: openness, responsiveness, empathy, communication skills, organizing skills

Appropriate:
- conduct local needs assessment
- develop and implement tools for quality monitoring
- complete audits and provide feedback
- Conduct cyclical small tests of change
- Revise professional roles: incorporate pharmacy to increase vaccinations
- purposely reexamine the implementation
- provide simulation training, conduct educational meetings, develop educational materials

Note: Stetler et al., 2011. Interventions selected from ABCDE acronym implementation strategies and tactics (Bingham & Main, 2010; Powell et al., 2015)

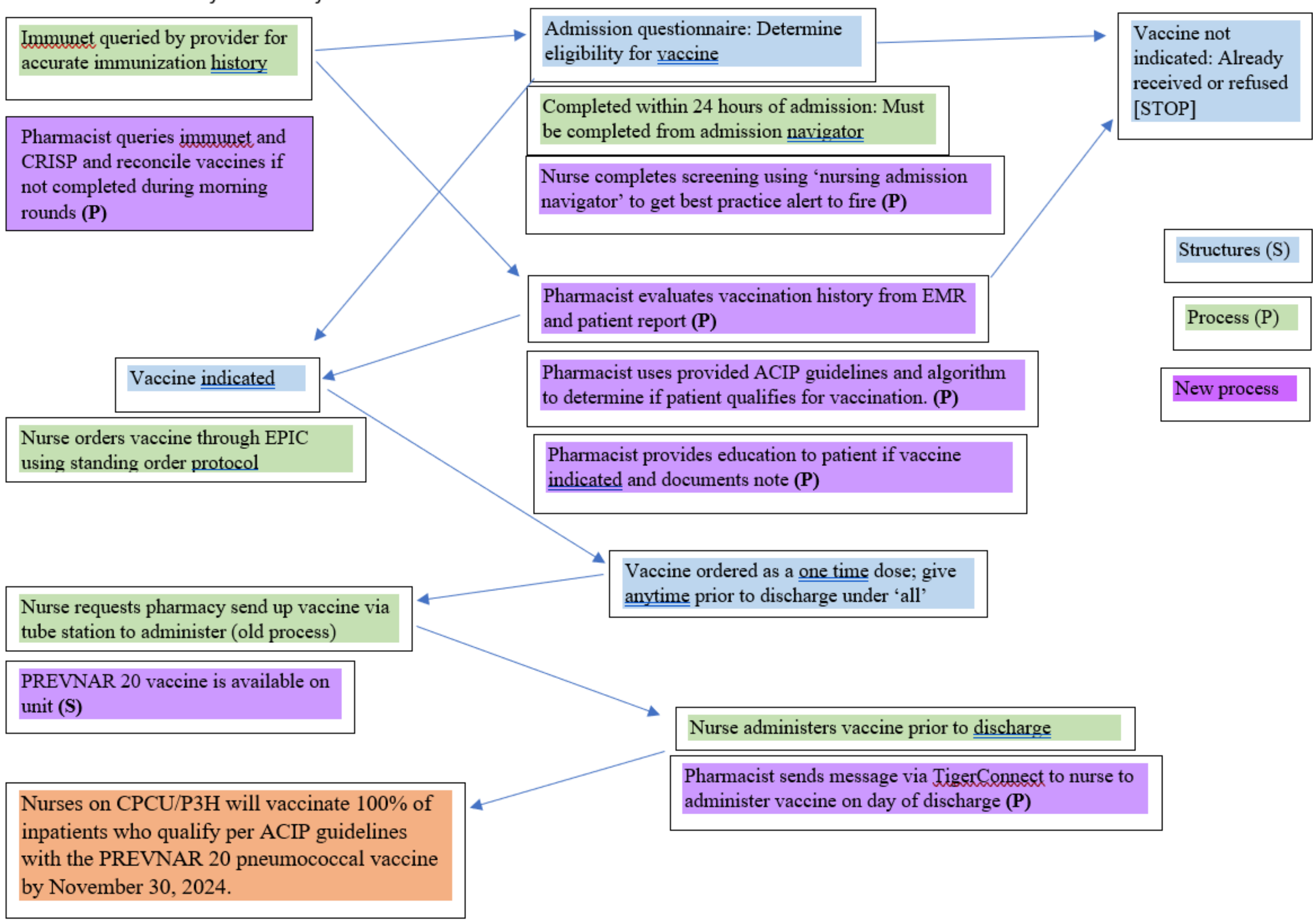
Appendix E

Pneumococcal vaccine current workflow



Appendix F

Pneumococcal vaccine future workflow



Appendix G

Pharmacist-Led Pneumonia Vaccine Program

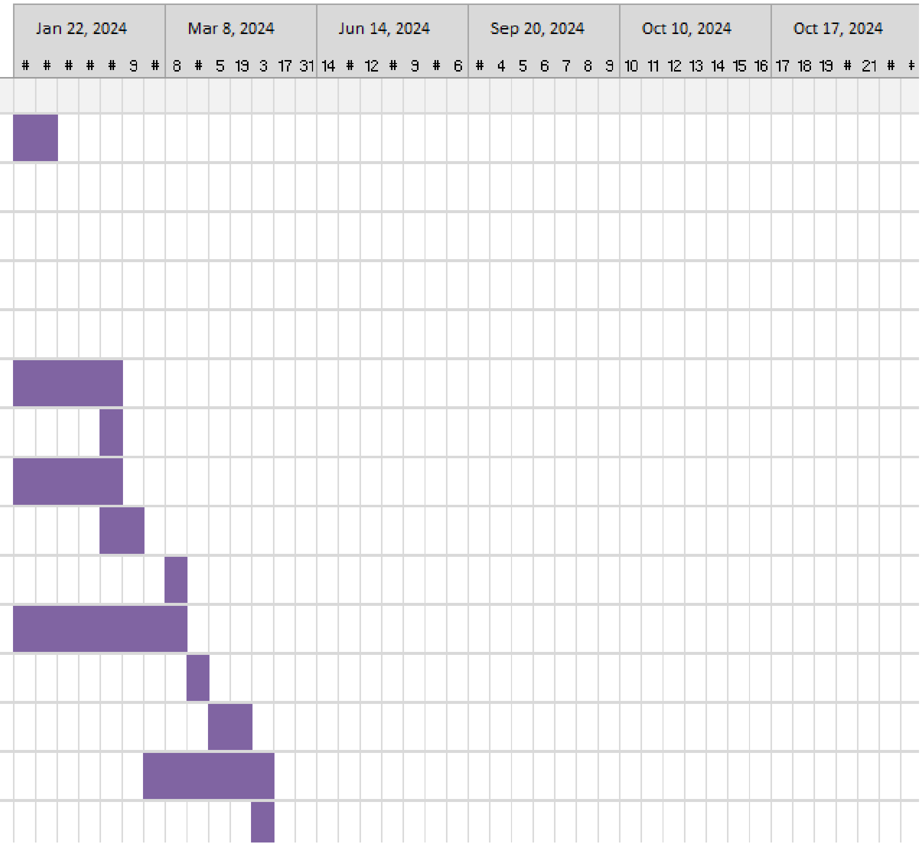
Student: Eleanor Davis

Project Site: UMMC Downtown, CPCU

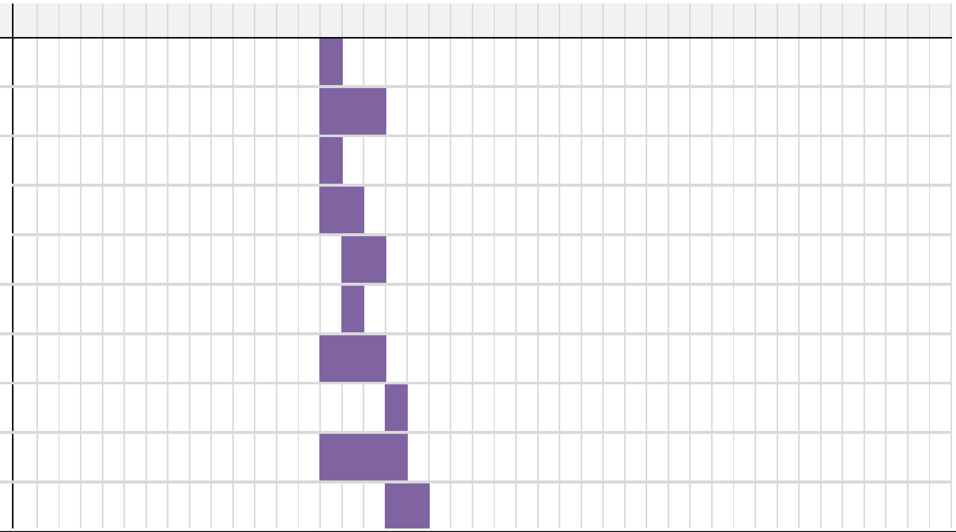
Project Start: Mon, 1/22/2024

Display Week: 1

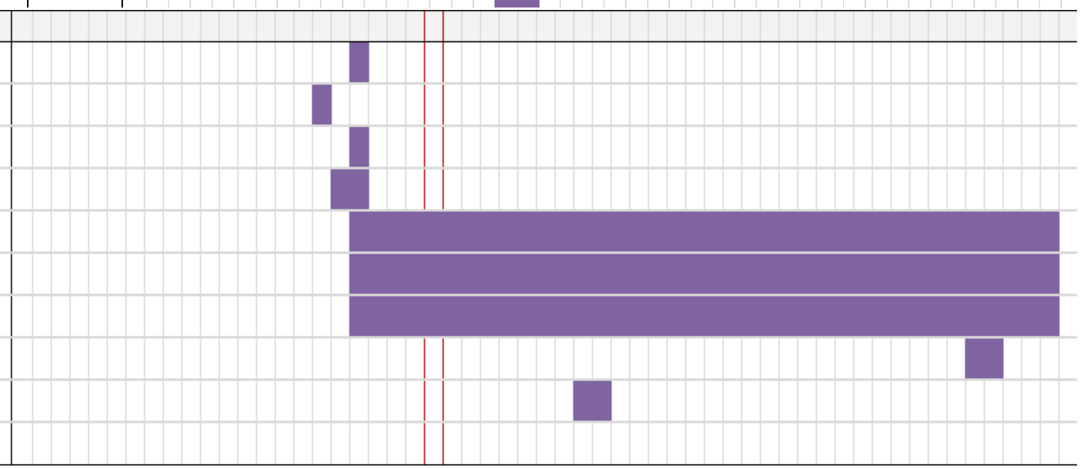
Project Identification (NDNP810)	Responsible	START	END
Start of Spring Term		1/22/24	1/23/24
CITI (enter renewal date as end)	Project Lead	8/19/27	8/20/27
HIPAA (enter renewal date as end)	Project Lead	1/14/26	1/15/26
Identify stakeholders/team	Project Lead	1/11/24	1/19/24
Identify roles/responsibilities	Team/stakeholders	1/11/24	1/19/24
Identify practice problem/root cause	Team/stakeholders	1/19/24	1/29/24
Context Assessment	Project Lead, CSR	1/29/24	2/3/24
Identify scope/goals	Team/stakeholders	1/22/24	1/30/24
Synthesize Evidence	Project Lead	2/1/24	2/12/24
Review intervention, goals with pharmacists	Project Lead, pharmacists	3/18/24	3/19/24
Development project plans	Team/stakeholders	1/22/24	3/11/24
MILESTONE: Submit project proposal	Project Lead	3/31/24	4/1/24
Site IRB Inquiry	Project Lead	4/15/24	4/24/24
REDcap	Project Lead	2/28/24	5/3/24
End of Spring Term		5/14/24	5/15/24



Project Development (NDNP811)			
Start of Summer Term		6/3/24	6/4/24
Develop implemenation plans	Team/stakeholders	6/10/24	7/5/24
Develop dotphrase for pharmacists	Project Lead	6/5/24	6/10/24
Develop educational content patients	Team/stakeholders	6/10/24	6/15/24
Develop implementation site PPT	Project Lead	6/20/24	7/5/24
Develop educational content nurses and pharmacists	Team/stakeholders	6/15/24	6/20/24
Develop REDCap audit tools	Project Lead	6/10/24	7/5/24
MILESTONE: Site Presentation and Approval	Project Lead	7/23/24	7/23/24
MILESTONE: IRB Determination	Project Lead	6/10/24	7/14/24
End of Summer Term		7/25/24	7/26/24



Project Implementation (NDNP812)			
Start of Fall Term		8/26/24	8/27/24
Assess PCV 20 stocked on units	Project Lead	8/1/24	8/1/24
MILESTONE: Project go-live (implement)		8/26/24	8/26/24
Education/Training	Project Lead	8/18/24	8/26/24
Monitor tactics and progress	Project lead, team	8/26/24	12/16/24
Communicate with stakeholders	Project Lead	8/26/24	12/16/24
Data Collection	Project Lead, team	8/26/24	12/16/24
Dissemination Plan	Project Lead	12/1/24	12/2/24
MILESTONE: Manuscript	Project Lead	11/10/24	11/11/24
End of Fall Term		12/19/24	12/20/24



Project Evaluation and Dissemination (NDNP813)			
Start of Spring Term		1/29/25	1/30/25
Analyze, synthesize & evaluate results	Project Lead	1/29/25	2/28/25
Sustainability Plan	Project Lead, team	12/10/24	12/15/24
MILESTONE: Develop Poster	Project Lead	2/15/25	3/1/25
MILESTONE: Site Presentation	Project Lead, team	4/25/25	4/26/25
MILESTONE: Extrernal Dissemination	Project Lead	4/2/25	4/3/25
MILESTONE: Final Manuscript	Project Lead	4/24/25	4/25/25
MILESTONE: UMSON Poster Day	Project Lead	5/5/25	5/6/25
Project Closure w/site	Project Lead, team	5/5/25	5/6/25
End of Spring Term		5/20/25	5/21/25

Appendix H

REDCap intervention adherence audit and evaluation tool

Page 1

Audit Form

Please complete the survey below.

Thank you!

Week Date:	__________________________________
Week Number	◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9 ◯ 10 ◯ 11 ◯ 12 ◯ 13 ◯ 14 ◯ 15
Age	◯ 19-64 ◯ 65+
Already vaccinated with PCV 20, PPSV23+PCV 13, or PPSV 23+PCV 15 per CRISP/immunization history?	◯ Yes ◯ No
Is vaccine indicated per ACIP guidelines?	◯ Yes ◯ No
Was pharmacist note filed?	◯ Yes ◯ No
Was pharmacist education provided?	◯ Yes ◯ No
Was vaccine ordered	◯ Yes ◯ No - failure to order ◯ No - patient refused ◯ No - incorrect documentation
Was vaccine administered?	◯ Yes ◯ No

Appendix I

Not Human Subject Research Determination

University of Maryland, Baltimore
Institutional Review Board
Phone: (410) 706-5037
Fax: (410) 706-4189
Email: hrpo@umaryland.edu

NOT HUMAN RESEARCH DETERMINATION

The IRB and the HRPO, as part of the Office of Accountability and Compliance is committed to excellence and customer service. Please take a moment to tell us how we are doing: HRPO/IRB/OAC Customer Feedback Survey

---

Date: July 16, 2024

To: Ameera Chakravarthy
RE: HP-00111545
Name: NDNP 811: Pharmacist Led Pneumococcal Vaccination Program to Increase Pneumococcal Vaccination on a Cardiac/Telemetry Unit

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This letter is to acknowledge that the UMB IRB reviewed the information provided and has determined that the submission does not require IRB review. This determination has been made with the understanding that the proposed project does not involve a systematic investigation designed to develop or contribute to generalizable knowledge **OR** a human participant (see definitions below).

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are human subject research in which the organization is engaged, please submit a new request to the IRB for a determination.

Definitions –

Human Research: Any activity that either:

- Is "Research" as defined by DHHS and involves "Human Subjects" as defined by DHHS ("DHHS Human Research"); or
- Is "Research" as defined by FDA and involves "Human Subjects" as defined by FDA ("FDA Human Research").

Research as Defined by DHHS: A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

Research as Defined by FDA: Any experiment that involves a test article and one or more human subjects, and that meets any one of the following:

- Must meet the requirements for prior submission to the Food and Drug Administration under section 505(i) of the Federal Food, Drug, and Cosmetic Act meaning any use of a drug other than the use of an approved drug in the course of medical practice;

- Must meet the requirements for prior submission to the Food and Drug Administration under section 520(g) of the Federal Food, Drug, and Cosmetic Act meaning any activity that evaluates the safety or effectiveness of a device; OR
- Any activity the results of which are intended to be later submitted to, or held for inspection by, the Food and Drug Administration as part of an application for a research or marketing permit.

Human Subject as Defined by DHHS: A living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through Intervention or Interaction with the individual, or (2) information that is both Private Information and Identifiable Information. For the purpose of this definition:

- Intervention means physical procedures by which data are gathered (for example, venipuncture) and manipulations of the subject or the subject's environment that are performed for research purposes.
- Interaction means communication or interpersonal contact between investigator and subject.
- Private Information means information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (for example, a medical record).
- Identifiable Information means information that is individually identifiable (i.e., the identity of the subject is or may readily be ascertained by the investigator or associated with the information).

Human Subject as Defined by FDA: An individual who is or becomes a subject in research, either as a recipient of the test article or as a control. A subject may be either a healthy human or a patient. A human subject includes an individual on whose specimen (identified or unidentified) a medical device is used.

Please keep a copy of this letter for future reference. If you have any questions, please do not hesitate to contact the Human Research Protections Office (HRPO) at (410) 706-5037 or HRPO@umaryland.edu.

Appendix J

Institute for Healthcare Improvement Sustainability Planning Worksheet

This worksheet is part of the IHI Quality Improvement Practicum, a 9-week online course in which participants receive tools, coaching, and community support to aid them in running a local improvement project. Learn more at ihi.org/QI.

Sustainability Planning Worksheet

This worksheet offers five areas (which conveniently spell MOCHA) for your team to consider when planning for the long-term sustainability of your improvement effort. Use the questions below to help you plan for success.

Areas for Consideration	Notes
Measurement • What will we continue to measure? • What will we stop measuring? • What will we do if we see a negative signal (i.e., special cause variation)?	The unit will continue to measure vaccines administered with the help of the electronic health record SlicerDicer tool created by the project lead. This tool will be shared with the nurse manager as well as the nurse champions and the pharmacists involved in the project. The audit tool will be decommissioned, so direct measurements of pharmacist adherence to screening for vaccination and providing education will no longer be collected or reported. If a negative signal or special cause variation decrease is seen during the fall implementation, the project lead will conduct a focus group analysis with the pharmacists and the unit champions to assess and address any noted barriers to implementation. This will include evaluation using the ABCDE bundle for any implementation facilitators that could assist in improving screening and vaccine administration.
Ownership • Who will own the new standard work? ○ Is he or she engaged and onboard with the improvement?	The ownership of this project beyond fall implementation will belong to the unit pharmacists as well as three identified nurse champions who have expressed interest in the project and are engaged in the project's planning stages through regular communication and meetings. Ideally unit staff will feel proud of what they have accomplished through increasing vaccinations and will remain motivated to maintain the change.
Communication and Training • How will we communicate about the change and who will be the messengers? • How will we support individuals in the new "right way"? • What type of training will we use?	Staff have been made aware of the change through monthly staff meetings. Prior to implementation, staff have been educated on the change including opportunities for simulation training to ensure the efficacy of education. The change will be supported by the pharmacists and unit champions, who have expressed ongoing enthusiasm and participated in this project since its inception. Staff will be able to see the effects of the intervention and intervention adherence in real time at weekly intervals on a run chart posted in the unit break room.

Hardwiring the Change
• How will we make it hard to do the wrong thing and easy to do the right thing?
  ○ Can we reduce reliance on human memory?
• How will we standardize?
  ○ Do we need new documentation and resources?
	The process has been made easier by stocking the vaccines on the unit to eliminate the extra burden on staff to order the vaccine and wait for its delivery from pharmacy. The project lead has developed multiple tools for both nursing staff and the pharmacists to hardwire the change. The patient education tool is an easy-to-use standardized resource for educating about the vaccine. The pharmacist note is a template for pharmacists to use to evaluate for vaccination which saves them from the burden of typing a new note with each patient assessment.

Assessment of Workload
• Are our changes increasing the overall workload to the system?
  ○ If so, how can we decrease the workload?
  ○ If not, how will we communicate about what is changing and not changing?
	The change is minimally increasing workload for pharmacists, who are key to implementation. The pharmacists have agreed that the expected increase in workload is not too burdensome. The project lead and pharmacists have worked together to determine how best to streamline this quality improvement project with their current workflow by pairing it with their medication reconciliation assessment for each new patient. In this way, the workload burden is minimized.

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