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# Utilizing pharmacy intervention in asplenic patients to improve vaccination rates

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ABSTRACT

*Purpose:* Asplenic patients are at increased risk for post-splenectomy infection caused by *Streptococcus pneumoniae, Neisseria meningitidis,* and *Haemophilus influenzae* type B (Hib), and vaccination rates against these organisms remain low. The purpose of this study was to evaluate vaccination rates before and after implementation of a pharmacist-driven electronic vaccination tracking system.

*Methods:* This retrospective cohort analysis compared adult splenectomy patients before and after implementation of a pharmacist-driven tracking system with a primary outcome of complete initial vaccination. The system included use of an i-Vent to track and communicate vaccination status and a bundled vaccination order set. Complete initial vaccination was defined as documented administration of the following vaccines: pneumococcal, meningococcal, and Hib. Secondary outcomes included complete follow-up vaccination and factors associated with incomplete vaccination.

*Results:* A total of 261 patients were included for analysis (142 pre-intervention, 119 post-intervention). The most common indication for splenectomy was malignancy (52.1% pre-intervention, 47.9% post-intervention). Complete initial vaccination rates increased by almost 10% post-intervention from 68.3% to 77.3% ($p = 0.11$). There was a statistically significant increase with guideline recommended pneumococcal (13-valent) as part of the initial vaccination series ($p < 0.001$).

*Conclusion:* Implementation of a pharmacist-driven electronic vaccination tracking system and bundled order set may increase rates of vaccination among asplenic patients. Although this improvement was not statistically significant, it is still clinically impactful. One limitation of the study was many outpatient oncology pharmacists were not utilizing the tracking tool at the time of data collection. Projected vaccination rates are likely higher now that more pharmacists are aware of this tool.



## 1. Introduction

Overwhelming post-splenectomy infection (OPSI) is a rare disease that carries a significant mortality risk in asplenic patients.[1] Although OPSI carries only a 5% lifetime risk, once a patient becomes infected the mortality rate ranges from 50 to 70%.[2] The spleen is an important organ for host defense due to its unique ability to filter encapsulated organisms out of the blood and protect the body from foreign pathogens through the process of opsonization.[1] Patients who undergo splenectomy are at an increased risk of infection caused by encapsulated organisms including *Streptococcus pneumoniae*, *Neisseria meningitidis*, and *Haemophilus influenzae* type B (Hib).

Vaccinations have become a critical step in perisplenectomy

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care to prevent OPSI in asplenic patients. The Centers for Disease Control and Prevention (CDC)[3] recommend initial vaccination with the pneumococcal 13-valent, meningococcal conjugate, meningococcal serogroup B, and Hib vaccines at least 14 days prior to a planned splenectomy. The CDC does not provide guidelines for vaccination in cases of emergent splenectomy required for cases of trauma or splenic rupture. Follow-up vaccination is recommended post-splenectomy with pneumococcal 23-valent and meningococcal vaccination at least eight weeks after initial vaccination. Studies have demonstrated that patients post-splenectomy have the best immunologic response to vaccination 2 weeks following surgery.[4] Despite these recommendations, literature has found that most asplenic patients do not receive complete vaccinations.[5,6]

Based on the importance of vaccination and literature demonstrating poor compliance with vaccination guidelines, this institution implemented a pharmacy-driven electronic tracking system.[5,6] Trauma and surgical intensive care unit pharmacists at this institution began using a hand-off communication tool in the electronic medical record (EMR) called an i-Vent to track patients' perisplenectomy vaccination status. This documentation is visible to pharmacists across the health system and ensures communication and accountability for vaccine administration. At this time a bundled vaccination order set exists in the EMR to direct physicians to order appropriate initial vaccinations. This order set includes prebuilt orders for the initial vaccines recommended by the CDC post-splenectomy. The primary objective of this study was to evaluate the difference in complete initial vaccination rates in asplenic patients before and after implementing this pharmacy-driven electronic tracking system.

## 2. Material and methods

### 2.1. Study design and population

This was a retrospective cohort chart review of adult splenectomy patients at an academic Level 1 Trauma Center that was approved by the Institutional Review Board (IRB). This study included patients aged 18–89 years who underwent splenectomy between November 1st, 2011 and September 30th, 2015. Patients were identified electronically using an Information Warehouse Operating Room Database based on procedure codes for open, robotic, and laparoscopic splenectomy. Patients were excluded if they were incarcerated or pregnant based on IRB requirements since these patients are considered a protected patient population. The pre-intervention period was identified as November 1, 2011–October 1, 2013 and the post-intervention period was identified as October 2, 2013–September 30, 2015. Patients in the pre- and post-intervention groups were compared with a primary endpoint of complete initial vaccination. At this institution, initial vaccinations are given either 14 days prior to planned splenectomy, or at least 14 days after splenectomy in cases of emergent splenectomy (Fig. 1). Complete initial vaccination was defined as documented administration of all three of the following vaccines: pneumococcal 13- or 23-valent, at least one form of meningococcal, and Hib. Secondary endpoints included complete follow-up vaccination and a description of barriers identified to achieving complete vaccination. Complete follow-up vaccination was defined as second doses of the pneumococcal 23-valent and any meningococcal vaccine at least 8 weeks after initial vaccination. This institution had not updated its protocol to specifically give pneumococcal 13-valent and both meningococcal conjugate and serogroup B in the initial vaccination bundle until part way through the study period, so all forms were accepted for the purposes of the primary objective.

### 2.2. Pharmacy intervention process

The Ohio State University Wexner Medical Center (OSUWMC) is a 1300 bed tertiary care academic medical center located in Columbus, Ohio. The pharmacy department at OSUWMC employs approximately 200 pharmacists and dispenses over 8 million doses of medication per year. Beginning in October 2013, the rounding clinical pharmacists in the trauma/surgical intensive care and medical/surgical units at our institution began utilizing i-Vents as a documentation and tracking tool within the EMR to ensure appropriate vaccinations were administered to asplenic patients (Fig. 2). An i-Vent is a built-in pharmacy intervention tracking feature of the EMR that allows pharmacists to document events to be acted upon in the future. These are linked to the patient's profile and can be accessed in both inpatient and outpatient settings. In essence, it acts as a hand-off communication between pharmacists across all patient encounters. In emergent cases, patients who underwent splenectomy were identified by the pharmacist during daily chart review. Once identified, the pharmacist “opens” an i-Vent and documents which vaccines are indicated and the appropriate timing of administration. At this institution, physicians often choose to vaccinate patients who underwent emergent splenectomy at discharge rather than at the return visit post-discharge for fear of patients being lost to follow-up. The physician is verbally notified by the pharmacist on the date vaccines are due or prior to discharge, whichever occurs first. The vaccines are then ordered utilizing the bundled order set by the provider. Once the initial vaccinations are administered, the pharmacist can edit the i-Vent with appropriate follow-up vaccine dates in a similar fashion. After all appropriate follow-up vaccines are administered, the pharmacist “closes” the i-Vent and marks it as complete.

In planned splenectomy cases, a pharmacist “opens” the i-Vent prior to splenectomy after verifying the patient has received their initial vaccinations. The i-Vent indicates the vaccinations and timing for follow-up vaccinations. In a similar fashion, the i-Vent is “closed” once vaccination is complete.

### 2.3. Data collection

A chart review was performed to collect pertinent data regarding patient characteristics including: age, gender, indication for splenectomy, Charlson Comorbidity Index, type of splenectomy (emergent versus planned), admitting service, whether the patient required an intensive care unit (ICU) admission, length of hospital stay, time to clinic follow-up, and incidence of i-Vents both initial and follow-up. I-Vents were identified in the EMR by searching the patient's profile for pharmacist documentation of vaccine due dates. If an i-Vent was opened more than 500 days prior to chart review, a separate report was run to pull this data from a storage database. I-Vent information older than 500 days from the time of data collection no longer populates into the EMR without running a separate report. The patient's medication list and the immunizations list were reviewed for documentation of vaccination. Vaccines were considered administered if the medication was charted as administered by a nurse or other healthcare professional. If this documentation was not found, the chart was further reviewed for any documented reason for incomplete vaccination. For example, if a physician note stated the patient had received vaccinations, but there was no EMR documentation of vaccine administration, patients were not considered to have a complete initial vaccination.

### 2.4. Statistical analysis

The final sample size was determined by the number of qualifying patients from the pre-determined interval 11/1/2011 to 9/30/

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