



The Value of the State Immunization Registry towards Improving Vaccination Rates and Quality of Care in Retail Pharmacies

Achieving Patient-Centered, Quality Care through the Application of Immunization Registry Information when Combined with Best Practices

White Paper
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INTRODUCTION

Retail pharmacies are playing an increasingly important role in immunization practices in the United States (Uscher-Pines, Harris et al. 2012). Pharmacists provide easy access to immunizations and their services can increase coverage rates, particularly for at-risk and under-served populations whom traditional health providers are unable to reach (Grabenstein, Guess et al. 2001, Higginbotham, Stewart et al. 2012).

Traditional vaccinators, such as private providers and pediatricians, have long accessed their state's immunization registry to gain information on their patients' immunization records and vaccines that they need. The state immunization registry, or immunization information system (IIS), is an important resource for consolidated patient immunization records housed in an electronic database, and exists in all 50 states. Vaccination providers may access this information, and over the years IIS's have evolved into sophisticated data management and clinical decision support tools for vaccination providers (American Immunization Registry Association, 2004).

Retail-based pharmacist vaccinators, however, have not taken up using the IIS as part of their daily vaccination workflow. The reasons for this vary and involve system-level barriers such as technology accessibility issues, lack of registry use training, and simply not being informed that they have access to their patient's vaccination information in the IIS. Pharmacist vaccinators do not receive similar training nor have similar responsibilities to report as their traditional vaccinator counterparts. For example, a recent white paper by American Immunization Registry Association (AIRA) documented that while pharmacies are able to provide vaccinations in 93% of service areas, they are only currently required to report vaccinations in 49% of those areas.

When providers do not access IIS information at the point-of-care, missed opportunities are frequent – up to 62% of the time for influenza vaccination (Allred, Poehling et al. 2011). The Centers for Disease Control and Prevention (CDC) has recognized the need for intervention to reduce prevalence of missed opportunities, and sent a letter to pharmacists and community vaccinators in 2012, requesting that they take advantage of IIS tools to raise immunization rates. However, up until this STC project and to our knowledge, there have been no studies that identify the benefits experienced by using the IIS or how the IIS information is best used to reduce missed opportunities. Further, it is not well-understood whether and how the IIS is best used in daily practice by retail pharmacists.

In this study, we sought to identify the benefits to using the IIS from the pharmacist's perspective, and the potential that IIS information has on increasing the number of additional vaccinations administered in the pharmacy. Since pharmacists are not traditional registry users, we sought to understand the level of acceptability in using the registry for pharmacy vaccinators, and what barriers to use may arise that may inhibit their use of registry information as part of their patient care. To accomplish this, we observed vaccinations given at several

Bartell Drugs pharmacies in the greater Seattle, Washington, area. Our specific objectives were to determine the impact that access to the registry by vaccinating pharmacists at the point-of-care has on additional vaccines administered, determine barriers to registry use in pharmacy practice, and determine how well the registry is received by pharmacist vaccinators and its potential impact on work-flow.

In Washington, pharmacists are allowed to both prescribe and administer vaccinations. Additionally, pharmacist vaccinators in the state have been encouraged to utilize the WA IIS to record the vaccinations they provide, for example, during the state's 2013 CDC Adult Immunization Grant activities. The system is designed to record vaccines administered, queue vaccine recommendations and reminders, and facilitate review of immunization histories. Most importantly, other health care professionals, such the patient's physician, can access the vaccinations that the pharmacists enter. In Washington, pharmacists have access, but it requires the arrangement of a special agreement between the pharmacist and the state. In fact, it has been estimated that only about 35-40% of pharmacists use the registry. For example at Bartell Drugs, a retail chain in the greater Seattle area, only 5 out of 8 pharmacists have ever used the registry, even though all their pharmacists have been administering vaccinations since 2011, with some pharmacists vaccinating for as long as 15 years.

Little is known about whether patients would opt in to receive additional vaccinations if they knew they were due or overdue for them. While making recommendations to patients based on their immunization histories aligns well working toward a patient-centered approach to care, almost nothing is known about how pharmacists use the registry or how vaccination information is shared with patients in practice. As such, a rigorous study was recommended to better understand the workflows, pharmacist utilization of a state IIS, patient interactions, and what opportunities and gaps exist in this area that can be addressed to increase population vaccination coverage rates. Bartell Drugs in the State of Washington agreed to participate and provide test locations in which to formalize a study.

METHODS

Locations, Pharmacists and Inclusion criteria

STC observed how 8 pharmacists interacted with the WA registry during their daily work routines at 5 stores in the greater Seattle area. Stores were located in a range of neighborhoods and in both urban and suburban areas, and patients represented over 18 ZIP codes from the Seattle, Redmond, and Kirkland areas. Participating pharmacists self-reported 9.44 average years' experience as a licensed pharmacist.

We observed pharmacist administer vaccinations to all patients arriving in the pharmacy to receive a vaccination. We included all patients of any age, gender, or race who gave consent.

Vaccinations offered at stores included influenza, Hep A, Hep B, Hep A/B combo, HPV, Polio, Pneumococcal, Meningococcal, MMR, Shingles/Zoster, Varicella, Dtap, Tdap, and HIB.

Upon signing informed consent forms and enrollment into the study, all pharmacists received training and orientation on using the registry. There were several scheduled meetings for pharmacists to learn about the study, how to search records and use decision support to pull history and forecasts following Advisory Committee for Immunization Practice (ACIP) guidelines from the IIS, and ask any questions they had about the study. Access to the IIS was granted by the State of Washington Department of Health's Immunization Program, which is within their purview and ability to grant.

Observers were trained on how to use the IIS to find patients and obtain their vaccination status and forecasts. Some additional help was given by observers to pharmacists on-site as needed. All observers received human subjects training with emphasis on HIPAA and confidentiality before study observations began.

Observations

When a patient arrived for a vaccination, the pharmacist recorded the information into their existing record system as part of their normal patient enrollment process. The required patient demographic data was shared with the observer. The pharmacist would then access the IIS – generally from a separate, designated computer terminal – to search for that patient's vaccination record on a separate computer. Vaccination records are easily viewable on a designated "Vaccination History" screen. In addition, the IIS has a "Vaccination Forecast" view, which lists vaccinations that are categorized as "Due" or "Overdue" based on patient age and Advisory Committee on Immunization Practices (ACIP) guidelines.

Once the Forecast was viewed, the pharmacist would decide whether to recommend any additional vaccinations to their patients. The pharmacist used his or her own judgment to determine whether the patient should be recommended or offered any additional vaccinations. If pharmacists wanted to print out copies for themselves or to share with their patients, or wanted report their administered vaccinations into the ISS, we allowed that.

The patient had the opportunity to obtain one, all or none of any recommended vaccinations. Observers recorded which vaccinations the pharmacist recommended, and which vaccines the patient chose to receive. Observers also recorded if no recommendations were given, and the reason for not recommending those vaccines. If a patient refused any recommended vaccinations, those were recorded as was the reason for refusal. The entire process is outlined in the figure below (Figure 1).

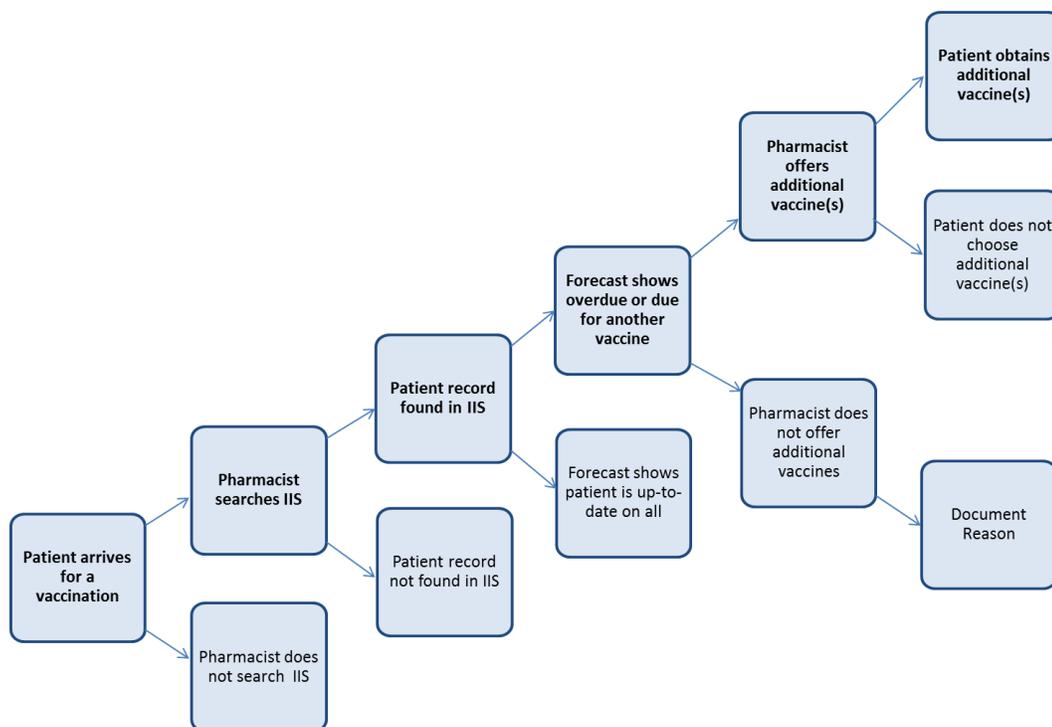


Figure 1. Pharmacist registry use, recommendation and vaccination decision tree.

Data Collection and Analysis

Pharmacists were surveyed before (pre) and after (post) the observation period to gain insight into their experiences and opinions on having the registry as a decision tool during the study period. The survey was posted online through SurveyMonkey® and was anonymous. Refer to Appendix A for the complete list of Pre survey questions, and Appendix B for all post-study survey questions. Survey answers were collated to assess pharmacist opinions and descriptive comparisons were made on answers provided before and after the study.

On-site observers recorded data for each patient who received at least one vaccination during the period of observation: age, race/ethnicity, gender, insurance/VFC status, zip code of home, presence of the patient in the IIS registry (yes or no), what vaccines the patient come in for and receive, what vaccinations were the patient due/overdue for, what additional vaccinations did the patient receive, date and time that patient was in pharmacy, patient volume in the retail pharmacy at time of vaccination, and patient’s reason for refusing a recommended vaccination, if applicable (for patients who are offered additional vaccines, but choose not to obtain them).

Other information recorded included: time the pharmacist spent querying the IIS registry and obtaining the necessary patient information, and whether the patient was due or overdue for any additional vaccinations according the registry forecast. If so, the observer

recorded whether the provider offered the patient additional vaccinations as a result of viewing the registry forecast. If not, the observer recorded the reasons why the provider chose not to offer the patient any additional vaccinations that were shown as due or overdue in the registry. The number of people present or waiting in the retail pharmacy area was estimated by taking a visual count at the time a given patient approached for a vaccination.

Pearson Correlations were used to determine whether any correlations existed between certain pharmacy and patient attributes. Comparisons were made between the following variables: store, pharmacist, date, time, number in pharmacy, age, gender, race, insurance status, home ZIP code, vaccination patient came for, if searched registry, time searched, if found in registry, whether patient was advised or offered additional vaccinations, whether a direct offer was given, and whether patient opted in for additional vaccination.

Poisson regression modeling was used to predict the number of patients in the pharmacy based on the date, zip code of the patient's home, and the vaccination the patient came in for. Poisson model was also used to predict the time pharmacists spent looking up a patient in the IIS based on date, pharmacist, total patients in pharmacy, patient race, age, gender, and whether the patient record was found in the registry.

Logistic regression was used to predict whether a patient chose to opt in for an additional needed vaccination based on received a direct offer from the pharmacist. We then also modeled patient opt-in by whether they received advisement, time pharmacist spent searching the IIS, patient race, gender, age and the number in the pharmacy at the time of vaccination.

RESULTS

General Findings

Overall, pharmacists reported themselves as “confident” to “extremely confident” in their skills in providing immunizations in daily practice, according to their pre-study survey responses. They also reported themselves to be “neutral” to “very comfortable” following ACIP recommendations. Overall, pharmacists reported that they are primarily motivated to give immunizations for the purpose of improving public health (as opposed to increasing revenue or to adhere to requirements). Five of the eight pharmacists responded to post-study survey questions. Overall they reported favorable feelings regarding their registry use experience, and on the value of the registry in terms of investment of time required and benefits gained (Figure 2).

The Value of the State Immunization Registry towards Improving Vaccination Rates and Quality of Care in Retail Pharmacies

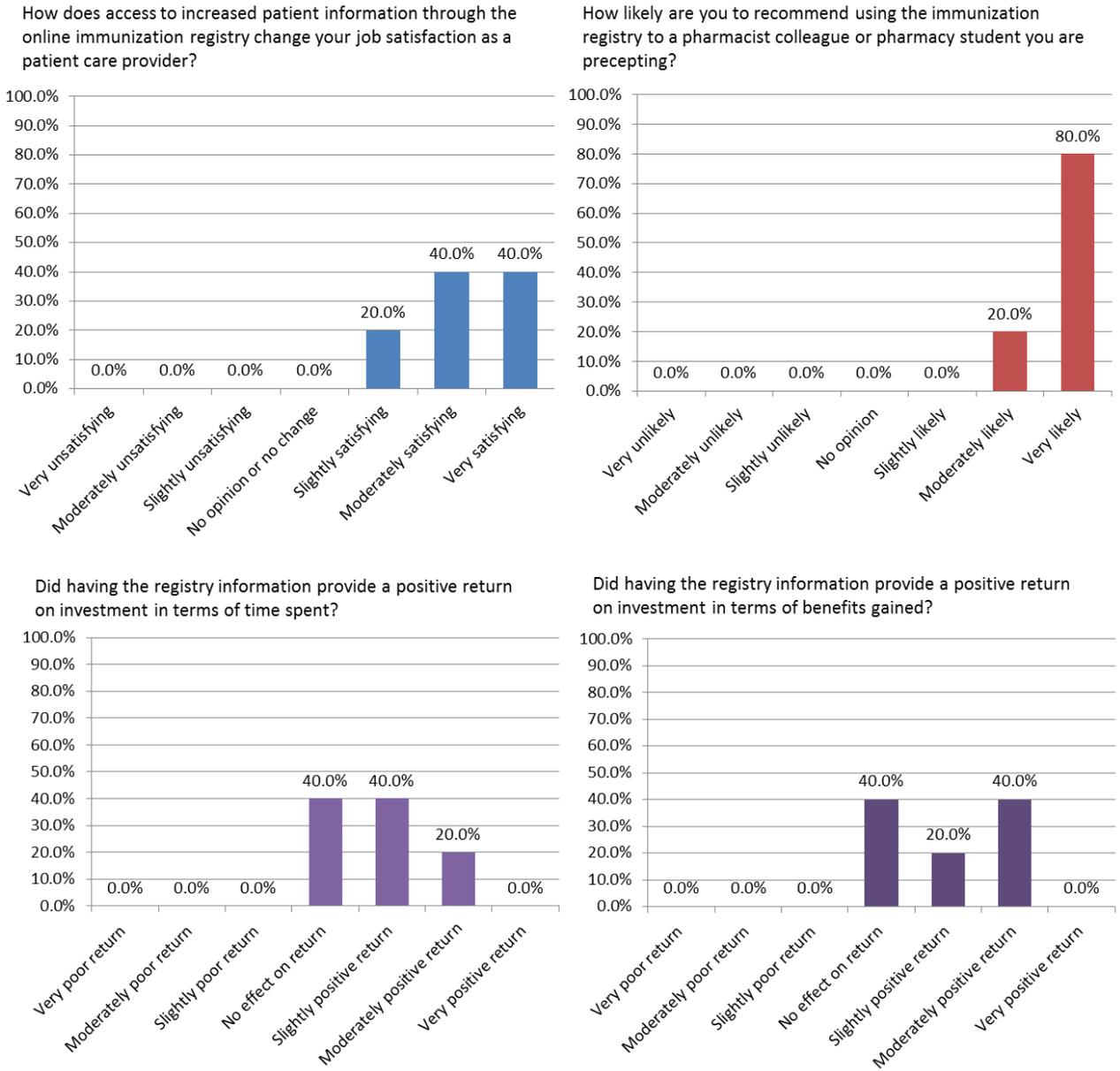


Figure 2. Survey responses from pharmacists following using the immunization registry as part of their patient care process when administering vaccinations (n=5).

From December 2013 through February 2014, information from a total of 66 patients was collected from between 2-6 observation days per pharmacist. We observed 42 female and 24 male patients ranging in age from 3 to 85 years old (mean = 37.67 years). The overall results of our observations following the pharmacist registry use, recommendation and vaccination decision tree from Figure 1 are shown in Table 1 below.

Table 1. Results from each step in the pharmacist registry use, recommendation and vaccination decision tree.

Number of Patients	Proportion of total	Step in Registry Use and Recommendation Decision-Tree
66	100%	Patients arriving for a vaccination
63	95.45%	Patients searched in IIS*
49	74.24%	Patients found in IIS*
41	62.12%	Patients Due or Overview in vaccination forecast
33	50.00%	Patients receiving advisement or recommendation
22	33.33%	Patients receiving a direct vaccination offering
3	4.55%	Patients opting-in for additional vaccination

* IIS – Immunization Information System or immunization registry.

Pharmacists searched for 63 of the patients in the IIS, and records for 49 of those (77.8%) were located. Forty-six patient IIS records indicated overdue or due for one or more additional vaccinations (average 3.22 vaccinations overdue or due per patient with a forecast). The most common overdue vaccinations were influenza, Varicella and MMR (see Figure 2). Pharmacists were most likely to recommend Meningococcal (66.7%), Pneumococcal (50.0%), Hep A (50.0%) and Tdap (50.0%) if those vaccinations were shown as overdue in the IIS (Figure 3).

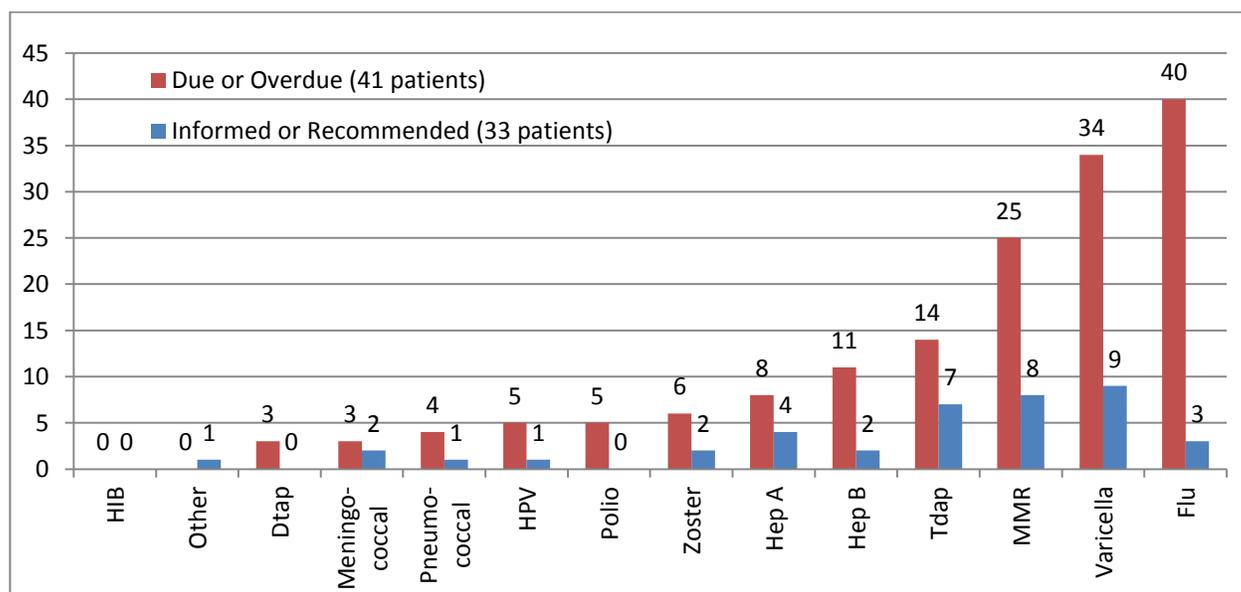


Figure 3. Number of patients overdue for a given vaccine according to their IIS records compared with vaccine-specific recommendations by the pharmacist.

No differences were observed between the time pharmacists spent searching the registry, the type of vaccinations people came in for, and whether a patient record was found in the registry. There was also no direct association between pharmacist and making a direct recommendation for a needed vaccination. This indicates was variability in how pharmacist makes a specific recommendation and this interaction somehow differs patient to patient.

There was a strong association between the pharmacist and whether or not the patient chose an additional needed vaccination. This could indicate that patient choice was influenced by their pharmacist, so that certain pharmacists were more likely to elicit a patient choice of opting for additional vaccination. However, additional data is needed to better understand the specific role the pharmacist plays in convincing a patient to receive an additional needed vaccination.

Busy-ness

On average there were 3.26 people waiting in pharmacies when vaccinations were administered (range 0 to 12 people). There were significantly more people visiting the pharmacy earlier in the study period in December than later (Corr. Coeff. = -0.44; $p=0.0002$). There were also more people in the pharmacy correlated with younger vaccination patients (Corr. Coeff. = -0.36, $p=0.003$). This may be because children were always accompanied by at least one parent, while older patients were more likely to come in by themselves. Finally, we found a correlation with number in pharmacy and zip code of the patient's home (Corr. Coeff. = -0.26, $p=0.043$). This could indicate that families arrive together for vaccinations, contributing to more people in the waiting area of the pharmacy, all coming from the same home location.

Neither store location nor pharmacist was associated with the number of people in pharmacy, so there is no evidence that certain stores or even certain pharmacists were busier than others when vaccinations were administered. There was also no correlation between the store and what vaccinations patients came in for, but there was by pharmacist, so some pharmacist may see more of certain type of patient than others.

The vaccination that patients came in for was not associated with whether they received a recommendation, and was also not associated with whether they opted in to receive an additional vaccination.

Poisson Regression showed that the factors most influential in the amount of busy-ness (# of people in store) were the observation date and the ZIP code of patient's home (Table 2). But the ability to predict how busy a store was based upon these factors was weak, even when other factors (store, Date, ZIP code, and/or vaccination patient came in to receive) were considered. The prediction is weak because these other factors were not significant, and although significant predictors were identified, it is unknown whether they strongly predict on their own. Therefore, there are other unknown factors affecting busy-ness of a given pharmacy.

Table 2. Factors predicting the number of people in the pharmacy during vaccinations.

	IRR*	P-value	lower 95% CI	upper 95% CI
Pharmacist	1.00	0.99	0.91	1.09
Observation Date**	0.98	0.00	0.97	0.99
ZIP of Home**	0.99	0.01	0.99	1.00
Vaccination Came For	0.94	0.20	0.85	1.03
<i>constant</i>	.	0.00	0.00	.

* IRR = Incidence Rate Ratio.

** significant predictors for number of people in pharmacy at $p < 0.05$ at 95% confidence.

Time Spent Searching

Pharmacists looked up 63 of 66 patients in the registry. The 3 patients who were not looked up in the registry were with different pharmacist (not all from the same pharmacist). The reasons given for not looking up a patient were because there were log in problems at the time the patient came in (1 patient), or they were “too busy” to look up the patient in the registry at that time (2 patients).

Observers did not have stop-watches so registry use was not officially timed. However, observers recorded an estimate, in minutes, for the time spent using the registry for each patient. The time ranged from a few seconds to as high as 6 minutes. The majority of patients were found immediately upon logging in and entering their name and date of birth in the *Search* field. Occasionally, the pharmacist had to sort through a list of candidate records or re-type a patient’s name for spelling purposes. Still, this generally took no more than about a minute. Based on observer’s time estimates, the time spent to pull up a patient’s record averaged 1.40 minutes (std. dev. = 1.13 min). Post-study survey responses indicated that pharmacists felt they spent more time searching than what was observed: two respondents said they spent an average of 2-4 minutes per patient.

There was a correlation between the time spent searching the registry and the observation date (Corr Coeff = -0.58, $p < 0.0001$), indicating that pharmacists spent more time searching in the beginning (Dec) than in the end in Feb. This suggests that pharmacists become quicker using the registry as they gain experience using it. The time spent was longer, however, when there were more people in the pharmacy (Corr. Coeff. = 0.52, $p < 0.0001$). That is, more people waiting in the pharmacy were associated with longer times spent searching registry for a given patient. It is possible that pharmacists were more likely to be interrupted mid-registry search when the pharmacy was really busy.

The number of people in the pharmacy and the observation date are predictive of the overall time spent searching the registry. Finding the patient in the registry does not predict

how long the pharmacist spends looking, nor do patient’s age, race and gender have any influence over the time spent searching. This indicates that external and pharmacy-level factors are more influential in determining how long a pharmacist spends looking for a patient in the registry than any factors related to the patient themselves. The factors evaluated do not strongly predict the amount of time spent searching a patient in the registry, which means other unknown factors are also influencing this (Table 3).

Table 3. Influence of variables on the time spent searching the registry.

	Coefficient	P-value	lower 95% CI	upper 95% CI
Pharmacist*	-0.02	< 0.01	-0.03	-0.01
Observation Date	0.07	0.30	-0.60	0.20
Number in Pharmacy*	0.08	0.04	0.00	0.16
Race	0.07	0.50	-0.15	0.31
Age	0.00	0.86	-0.01	0.01
Gender	0.04	0.86	-0.40	0.48
Patient Located in IIS	-0.09	0.75	-0.66	0.47
Constant	399.4	< 0.01	118.32	680.48

* Significant at $p < 0.05$ with 95% confidence.

Advising and Recommending

Of the 49 patients with records located in the registry, 33 (67.35%) received an advisement of some kind from the pharmacist regarding vaccination history and/or forecasted overdue vaccinations; however, only 22 (44.90%) received a direct offer or recommendation for a vaccination marked as due or overdue in the vaccination record. A total of 3 of those 22 patients (13.64%) opted in to receive an additional needed vaccination. All patients who opted in received a direct recommendation by the pharmacist and were told they could get it right away. We were not able to evaluate if cost plays a role for opt in/out for patients, due to sample size.

The only factors that predicted patients receiving a recommended additional needed were whether the pharmacist searched the registry, the patient’s record was found in the IIS, and the patient being designated as due or overdue for at least one additional vaccination in their vaccination forecast. No other factors (i.e., patient age, gender, race, insurance status, home ZIP, observation date, time of observation, number of people in the pharmacy, or the time spent searching the registry) could predict whether a pharmacist advised or recommended additional vaccinations.

CONCLUSIONS/ DISCUSSION

Study Conclusions

Our results show a need for developing a best practices and proving training on how to make that recommendation is this best possible way to improve the patient's care and to administer additional vaccines. The Washington IIS reports that 449,495 unique patients received a vaccination at a pharmacy between June 2013 and 2014. This number shows there is potential to impact quality of care, quality and completeness of the registry data, and immunization rates among Washington residents who use pharmacies for their immunization services. Our study showed that pharmacists using the IIS and providing recommendations on needed vaccinations does influence patients to opt-in for those needed vaccinations, reducing missed opportunities among populations who access pharmacies for their immunizations.

The relationships observed between pharmacists, time spent searching the registry, and the busy-ness show that these may represent barriers to improving vaccination efficiency and pharmacist satisfaction in level of care. Streamline technology through bi-directional interfaces eliminates these barriers. It is difficult to make conclusion on what factors specifically impacted patient choice to opt in for additional vaccinations. The observed correlation between the pharmacist and patient opt-in for additional vaccination is due to the fact that only two pharmacists of the 8 were able to get a patient to opt in for additional vaccinations. Since only three people opted in for additional vaccinations, we cannot say that those opt-ins are due to the pharmacist, or whether certain pharmacists were more likely to elicit a patient choice of additional vaccination. Additional data is needed to understand the specific role the pharmacist plays in convincing a patient to receive an additional needed vaccination, particularly when their interaction and conversations vary greatly.

Need for Best Practices

We observed that pharmacists vary in their approach to discussing vaccination needs with their patients, even though all have the same registry access and forecast vaccination information. Some simply showed patients their forecasts, but did not make a recommendation that a patient would actually need any of those overdue vaccinations. Sometimes, they specifically suggested that a patient should get a vaccination marked as due or overdue in the forecast "at some point" or "within the next year." Only occasionally did a pharmacist phrase their recommendation in a manner that suggested or directly stated that the patient could or should get a needed vaccination right there and then.

Such variability in patient recommendations existed not only between pharmacists, but also from patient to patient. Pharmacists seemed to "experiment" with different recommendation strategies themselves, or if they were not completely comfortable with the registry information, they would resort to a vague acknowledgement of the registry information but avoid an outright recommendation.

The high variability in patient-pharmacist interactions shows the need to develop best practices for how pharmacists should navigate this interaction. Certainly, receiving information on how to use the registry and training on ACIP recommendations does not prepare pharmacists to share and discuss forecasts with patients, and providing registry information alone does not substitute for making specific recommendations to a patient.

The time spent searching was noted as a major barrier to both administering vaccinations as part of pharmacy daily work, and using the registry to find patient immunization information. Our study observations indicated that when pharmacies were busier, pharmacists took generally longer to look up patients in the registry. In addition, while our observations noted that on average pharmacists spent just over 1 minute to locate a patient in a registry (1.4 minutes on average), our survey saw that pharmacists' perception of the time spent was higher than that in reality. This is a major barrier to get pharmacists to use the registry as part of their daily practice. Integration into their daily workflow would be nearly impossible.

Overcoming Barriers in Support of a Patient-Centered Approach

These barriers can be removed by streamlining technology through bi-directional interfaces. The ultimate goal is not just to get pharmacists to use the registry, but for pharmacists to use the registry information as part of their patient-centered approach to care. Technology advancements that directly remove critical barriers and can be widely implemented will increase the likelihood of successful adoption (Wermeille Bennie Brown and McKnight. 2004 Pharmacy World and Science:26 (a); Christensen CM The Innovator's Dilemma... Disruptive strategies: Transformation of pharmacy practice from a dispensing model to a patient care model... Conference summary online: <http://www.pharmacist.com/disruptive-strategies-transformation-pharmacy-practice-dispensing-model-patient-care-model> .)

Adoption of a streamlined technology solution coupled with best practice vaccination recommendations directly assists pharmacies in moving toward a patient-centered care model. Patient-centered care is a core component of healthcare quality, and as part of which providers and families partner together to identify and satisfy the full range of patient needs and preferences (*Patient-Centered Care Improvement Guide, online*). Pharmacies are part of this model, and pharmacists are powerful when giving vaccination recommendations to their patients (Holman, Benard et al. 2014).

Pharmacies are effective within the patient-centered care model. For example, a study at family-practices patient-centered communication influences patients' health through perceptions that their visit was patient centered, and especially through perceptions that common ground was achieved with the physician. Patient-centered communication was correlated with the patients' perceptions of finding common ground (Stewart, Brown et al. 2000). Studies have also shown that pharmacy-administered are cost-effective (Grabenstein, Hartzema et al. 1992, Ogilvie, Khoury et al. 2009), providing a suitable foundation for adding additional vaccinations based on registry record-informed, patient-pharmacist conversations.

Final Remarks

Pharmacists are ready and willing to use the information from the registry. Our surveys found that pharmacists using the registry felt a neutral to slightly positive impact in number of times patients will return to receive vaccinations. After using the registry and making recommendations, pharmacists in our study felt positive about using the registry as part of their normal routines: one felt slightly positive, two moderately positive, and two very positive. During observations, pharmacists expressed interest in the registry information, took initiatives to share vaccination histories with their patients, and expressed desire to report administered vaccinations to the registry. Pharmacists also expressed their concern for data quality and this motivated many to enter their vaccinations immediately after administering them.

Providing universal access to the WA IIS across the state and making its use a routine part of care will significantly influence the future public health, especially in regards to vaccine preventable diseases and quality of care. The combination of keeping track of this information and sharing it with other healthcare professionals will help increase the number of individuals up-to-date with their vaccinations. In addition, the personal nature of the WA IIS forecast strengthens the relationship between pharmacists, their patients, and the community, and creates another avenue of health promotion. This is beneficial for public health as a whole, as pharmacists are uniquely positioned in the community to provide public health services, for they are readily accessible and convenient (American Public Health Association [APHA], 2006). As noted by the APHA (2006), “this convenience creates a large window of opportunity in which to provide public health services, therefore filling a void related to access to care and prevention.”

Considering the many benefits to registry use and acceptance by vaccinating pharmacists, they need training on how to best use the registry information. Specifically, best practices are needed to guide pharmacists on how to discuss recommendations with their patients and let patients know they can offer these services. Integrating systems through bi-directional interfaces will help to remove the time barriers and work interruptions so pharmacists can concentrate on patient care.

REFERENCES

Allred, N. J., K. A. Poehling, P. G. Szilagyi, F. Zhang, K. M. Edwards, M. A. Staat, S. Donauer, M. M. Prill and G. Fairbrother (2011). "The impact of missed opportunities on seasonal influenza vaccination coverage for healthy young children." J Public Health Manag Pract **17**(6): 560-564.

American Immunization Registry Association (2014). Survey of Immunization Reporting to Immunization Information Systems by Major U.S. Pharmacies. White Paper. A. I. R. Association, American Immunization Registry Association: 50.

Grabenstein, J. D., H. A. Guess, A. G. Hartzema, G. G. Koch and T. R. Konrad (2001). "Effect of vaccination by community pharmacists among adult prescription recipients." Med Care **39**(4): 340-348.

Grabenstein, J. D., A. G. Hartzema, H. A. Guess, W. P. Johnston and B. E. Rittenhouse (1992). "Community pharmacists as immunization advocates. Cost-effectiveness of a cue to influenza vaccination." Med Care **30**(6): 503-513.

Higginbotham, S., A. Stewart and A. Pfalzgraf (2012). "Impact of a pharmacist immunizer on adult immunization rates." J Am Pharm Assoc (2003) **52**(3): 367-371.

Holman, D. M., V. Benard, K. B. Roland, M. Watson, N. Liddon and S. Stokley (2014). "Barriers to human papillomavirus vaccination among us adolescents: A systematic review of the literature." JAMA Pediatrics **168**(1): 76-82.

Ogilvie, I., A. E. Khoury, Y. Cui, E. Dasbach, J. D. Grabenstein and M. Goetghebeur (2009). "Cost-effectiveness of pneumococcal polysaccharide vaccination in adults: a systematic review of conclusions and assumptions." Vaccine **27**(36): 4891-4904.

Stewart, M., J. B. Brown, A. Donner, I. R. McWhinney, J. Oates, W. W. Weston and J. Jordan (2000). "The impact of patient-centered care on outcomes." J Fam Pract **49**(9): 796-804.

Uscher-Pines, L., K. M. Harris, R. M. Burns and A. Mehrotra (2012). "The growth of retail clinics in vaccination delivery in the U.S." Am J Prev Med **43**(1): 63-66.

APPENDICES

Appendix A – Pre-study Survey Questions

Pre Registry-Use Survey (All pharmacists enrolled get same survey; to be completed prior to observations beginning)

1. How many years have you been a licensed pharmacist? (Answer is drop down, insert number of years)
2. How confident do feel about your skills in providing immunizations in your daily practice? (Answer is Likert scale 1-7)
3. What motivates you to give immunizations? Please rank the following list accordingly.
 - Increasing overall public health.
 - Disease prevention.
 - Patients request.
 - Increased revenue.
 - Company requirement to provide immunizations.
 - Marketplace or professional competition.
 - Other – free text.
4. How comfortable are you using Centers for Disease Control and Prevention (CDC) and Advisory Committee on Immunization Practices (ACIP) guidelines to make recommendations regarding vaccinations to your patient's? (Likert)
5. What are the biggest barriers for you to provide immunization services in community practice? (Please rank)
 - Need for additional training as far as administration of vaccines.
 - It's challenging to find time in my day.
 - Need for additional knowledge around ACIP and CDC immunization guidelines.
 - Insurance and/or billing issues.
 - Lack of complete and easily accessible immunization histories.
 - Other – free text.
6. Have you used the state immunization registry before? (Answer: Yes, or No)
7. What comes to mind when you think about the state immunization registry? (Answer is choice boxes, multi-choice allowed, with free text add-on: Centralized, Confusing, Intuitive, Complete, Accurate, Forecasts Vaccine Needs, Demanding, Expensive, Easy-to-Use, Lacking Data, Logical, Functional, Useless, Necessary, Improves Health, Unreliable, Life-Saving, Efficient, Convenient, Valuable, Pediatrics Focused, Family Oriented, Easily Accessible, Time-Saving, Innovative, Authority on Vaccinations, Well-supported, Clunky, Challenging, and Free Text Option to add others.)

8. Of the following features or functions of the registry, which are you most interested in using? (Answer: Rank in order from most to least interest)
- Search for and find patient records in the registry.
 - Obtain/View vaccination histories for patients.
 - Obtain/View recommended vaccines for which patients are currently due or overdue.
 - Obtain/View contraindications against vaccination for a given patient.
 - Discuss vaccination needs with a patient, based on their vaccination record.
 - Administer additional vaccines to patients otherwise due or overdue for that vaccine.
 - Report vaccinations administered to the registry.
 - Other (fill in free text).
9. What motivates you to want to utilize the registry the most? Rank:
- Forecast vaccination needs with ACIP guidelines.
 - Reduce missed opportunities for vaccinations.
 - Improve public health.
 - Increase vaccine sales.
 - Learn how to use the registry.
 - Be more informed when giving patients vaccination recommendations.
 - Other (free text).
10. How likely are you to recommend using the immunization registry to a pharmacist colleague or pharmacy student you precept? (Answer is Likert scale 1-7)

Appendix B – Post-study Survey Questions

Post Registry-Use Survey (to be completed after observations at the store are done, some questions are study Arm specific, so that only pharmacists enrolled in that study arm will get those questions).

1. How many years have you been a licensed pharmacist? (Answer is: insert number of years)
2. How confident do you feel about your skills in providing immunizations in your daily practice? (Likert scale 1-7, where 1 = very unconfident, 7 = very confident)
3. How comfortable are you using Centers for Disease Control and Prevention (CDC) and Advisory Committee on Immunization Practices (ACIP) guidelines to make recommendations regarding vaccinations to your patients? (Answer is Likert scale 1-7)
4. Have you used the state immunization registry before the study? (Yes/No)
5. What comes to mind when you think about the state immunization registry? (Answer is choice boxes, multi-choice allowed, with free text add-on: Centralized, Confusing, Intuitive, Complete, Accurate, Forecasts Vaccine Needs, Demanding, Expensive, Easy-to-Use, Lacking Data, Logical, Functional, Useless, Necessary, Improves Health, Unreliable, Life-Saving, Efficient, Convenient, Valuable, Pediatrics Focused, Family Oriented, Easily Accessible, Time-Saving, Innovative, Authority on Vaccinations, Well-supported, Clunky, Challenging, and Free Text Option to add others.)
6. Of the following features or functions of the registry, which did you find most useful? (Answer: Rank in order from most to least interest)
 - Search for and find patient records in the registry.
 - Obtain/View vaccination histories for patients.
 - Obtain/View recommended vaccines for which patients are currently due or overdue.
 - Obtain/View contraindications against vaccination for a given patient.
 - Discuss vaccination needs with a patient, based on their vaccination record.
 - Administer additional vaccines to patients otherwise due or overdue for that vaccine.
 - Report vaccinations administered to the registry.
 - Other (fill in free text)
7. What motivates you to continue to utilize the registry the most? (Answer is to rank)
 - Forecast vaccination needs with ACIP guidelines.
 - Reduce missed opportunities for vaccinations.
 - Improve public health.
 - Increase vaccine sales.
 - Learn how to use the registry.
 - Be more informed when giving patients vaccination recommendations.
 - Other (free text).
8. Were any aspects of the registry frustrating? (Answer is: Yes, No)
9. (Only if answered “Yes” for #8) If so, why? (Answer is free text)

10. Is there anything that you wish the registry allowed you to do that you couldn't do? (Answer is: Yes, or No)
11. (Only if answered "Yes" for #10) If so, please explain: (Answer is free text)
12. What features or functions would make the registry easier to use? (Answer is free text)
13. How much did using the registry impact the quality of care to your patients who received immunizations? (Answer is Likert scale 1-7; where 1 very negative impact, 2 moderately negative impact, 3 slightly negative impact, 4 no impact, 5 slightly positive impact, 6 moderate positive impact, 7 very positive impact.) (Quality: providing recommended vaccines per ACIP guidelines)
14. How much did using the registry impact the efficiency of care of your patients receiving immunizations? (Answer is Likert scale 1-7; where 1 very negative impact, 2 moderately negative impact, 3 slightly negative impact, 4 no impact, 5 slightly positive impact, 6 moderate positive impact, 7 very positive impact.) (Efficiency: time and effort spent per patient to meet their needs)
15. How much did using the registry impact the efficiency in terms of the number of times patients returns to receive vaccinations? (Answer is Likert scale 1-7; where 1 very negative impact, 2 moderately negative impact, 3 slightly negative impact, 4 no impact, 5 slightly positive impact, 6 moderate positive impact, 7 very positive impact.)
16. How much did using the registry impact the number of vaccinations you were able to provide? (Answer is Likert scale 1-7; where 1 very negative impact, 2 moderately negative impact, 3 slightly negative impact, 4 no impact, 5 slightly positive impact, 6 moderate positive impact, 7 very positive impact.)
17. On average how much time did you spend looking up patients in the registry per patient? (Answer is Multi-choice: Not applicable, I never looked up any patient in the registry, Less than 1 minute, About 1 minute, A few (2-4) minutes, About 5 minutes, More than 5 minutes)
18. On average how much time did you spend looking up patients in the registry per day? (Answer is Multi-choice: Not applicable, I never looked up any patient in the registry, Less than 5 minutes, 5-10 minutes, 10- 30 minutes, More than 30 minutes but less than 1 hour, About 1 hour, More than 1 hour but less than 2 hours, More than 2 hours)
19. How easy was it to navigate the registry to find the vaccination record for the patient needing vaccination services? (Likert)
20. How positive do you feel about using the registry as part of your normal routine for patients coming in to receive a vaccination? (Answer is Likert scale 1-7: 1 very negative, 2 moderately negative, 3 slightly negative, 4 no opinion, 5 slightly positive, 6 moderately positive, very positive)
21. Did looking up patients in the registry disrupt your workflow? (Answer is Yes/No)
22. (Only if answer to #21 is Yes) If so, how much? Multi-choice answer, choose 1: very disruptive, moderately disruptive, slightly disruptive, no opinion, unsure, had a positive effect on workflow)
23. Did having the registry information provide a positive return on investment in terms of time spent? (Answer is Likert scale 1-7: 1 very poor return on investment, 2 moderately

- poor return on investment, 3 slightly poor return on investment, 4 no effect on return on investment, 5 slightly positive return on investment, 6 moderately positive return, 7 very positive return on investment.
24. Did having the registry information provide a positive return on investment in terms of benefits gained? (Answer is Likert scale 1-7: 1 very poor return on investment, 2 moderately poor return on investment, 3 slightly poor return on investment, 4 no effect on return on investment, 5 slightly positive return on investment, 6 moderately positive return, 7 very positive return on investment.)
 25. How does access to increased patient information through the online immunization registry change your job satisfaction as a patient care provider? Answer is Likert 1-7: 1 very unsatisfying, 2 moderately unsatisfying, 3 slightly unsatisfying, 4 no opinion or no change, 5 slightly satisfying, 6 moderately satisfying, 7 very satisfying.
 26. How likely are you to recommend using the immunization registry to a pharmacist colleague or pharmacy student you are precepting? Answer is Likert 1-7: where 1 = very unlikely, 4 = no opinion, 7 = very likely)
 27. Anything else you would like to tell us about your experience having access to the registry? (Answer is: Free text)