

# Assessment of the Current Reporting Requirements of the Kentucky Immunization Registry

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## Executive Summary

Immunizations are essential to societal health and wellbeing. Throughout one's lifespan, immunizations are to be administered incrementally to decrease the prevalence of preventable diseases. Despite this, there are disparities in the rates of vaccinations across the country. Numerous guidelines and regulations have been published regarding the administration and scheduling of vaccines. Certain vaccinations are mandatory in order to be able to attend school or hold certain occupational positions and normally proof of administration is required.

Immunization registries were created to monitor and record patient-specific data about administered vaccines. These confidential reporting systems were developed to improve population health by allowing for the surveillance of vaccine compliance, disease prevention, and missed opportunities. While some regulations surround individual state registries, most states do not require vaccine reporting by the majority of healthcare providers. The Kentucky Immunization Registry (KIR) requires the reporting of only specific administered vaccines. This reporting gap leaves a large amount of data out of the system. The intent of the immunization registry is to improve vaccination rates, but unless data is submitted to the registry, its full potential cannot be achieved. The purpose of the research is to assess pharmacists' views of the KIR and to determine if there is a need to further increase vaccination reporting requirements.

Out of the 1,000 pharmacists randomly selected to complete a survey, there was a response rate of 142. Pharmacists, on average, agreed that they were in favor of increasing KIR reporting requirements. On average, pharmacists reported being unfamiliar with the KIR, but this did not have a significant impact on how pharmacists responded to questions concerning increasing KIR reporting. It was also discovered that pharmacists who were neutral in opinion or disagreed with the current reporting requirements of the KIR appeared to be more unfamiliar with the KIR compared to other groups. The respondents regarded missed opportunities and preventable diseases as important issues in Kentucky. Those who believed these were important issues also slightly agreed that mandating the KIR would improve missed opportunities and preventable disease rates.

Immunization registries are becoming more prevalent in today's healthcare community. Despite this, unfamiliarity with the KIR is still present. Satisfaction with the current reporting requirements is neutral among those surveyed, but a need for reporting all vaccines to the registry is observed. Surveyed pharmacists, on average, viewed missed opportunities and preventable diseases as issues in Kentucky, but mandating immunization reporting to the KIR as a possible solution for improving rates only received slight support. Implications of these findings suggest that there is a need for increased education and training on the KIR to increase reporting.

## Background

As time has progressed, more emphasis has been placed on immunizations for disease prevention and eradication. Over the 19<sup>th</sup> and early 20<sup>th</sup> centuries, vaccines received heavy criticism because they were not regulated and their safety could not be guaranteed. Over time, vaccine safety was achieved by regulations set forth by the U.S. Food and Drug Administration's Center for Biologics Evaluation and Research. Today, vaccines are an integral part of improving population health.

In 1962, Kentucky passed its first legislative regulations requiring childhood vaccinations before entrance into school. KRS 158.035 states, "Except as provided in KRS 214.036, no child shall be eligible to enroll as a student in any public or private elementary or secondary school without first presenting a certificate from a medical or osteopathic physician licensed in any state" (CHFS, 2015). Currently, under KRS 214.036, Kentucky allows immunization exemptions for qualifying medical or religious reasons. In addition to proof of vaccinations, Kentucky requires retention of these certificates by schools and childcare facilities.

Kentucky recently took the next step in regard to immunizations. On May 16, 2015 Kentucky launched the Kentucky Immunization Registry (KIR). Up until November 15, 2015 the registry was only accessible by health departments. During that time the registry was made available statewide for reporting of patient-specific administered vaccines. Implementation of the KIR did not require vaccines be reported to the registry.

According to Judy Schweitzer, from the Cabinet for Health and Family Services (CHFS), the Kentucky Immunization Registry, mentioned above, became mandatory for providers who administered immunizations provided through the Vaccines for Children (VFC) program beginning January 1, 2016 (2015). These vaccines are administered at little or no cost through the VFC federal program to children 18 years or younger who are receiving a form of Medicaid insurance, have no insurance, or are American Indian or Alaskan Native (Schweitzer, 2015). Not all children meet the criteria to receive VFC vaccines, therefore, not all childhood vaccines are required to be reported to the KIR.

Immunization registries, also known as immunization information systems (IIS), are defined by the Centers for Disease Control and Prevention (CDC) as confidential, population-based, computerized databases that record all immunization doses administered by participating providers to persons residing within a given geopolitical area (2012). Immunization registries offer a consolidation of patient immunization records. Compiling all immunizations in one database allows easy access for healthcare providers. Certificates for proof of immunization are also easier to obtain for the purposes of school and childcare centers. The registry also offers timely reminders for vaccines coming due for patients.

Missed opportunities are another focus area of immunization registries. Missed opportunities are defined by the World Health Organization (WHO) as any contact with a health care provider that did not result in a patient receiving needed

vaccines (2013). The CDC believes this lack of recognition can be improved by the use of immunization registries due to patient reminder alerts when vaccinations are due (2012). These reminder alerts are delivered directly to the patients to ensure they are aware of vaccinations they need to receive.

Immunization registries also offer the ability for program support and data exchange (CDC, 2012). This feature allows for identification of high-risk groups who are most susceptible to contracting vaccine preventable diseases. Vaccine preventable diseases are health conditions that are normally preventable if the proper vaccinations are received. The U.S. Department of Health and Human Services states that vaccine preventable diseases are at record lows in the United States, but that does not mean preventable diseases have been eradicated (2017). In 2016, the CDC estimated that each year in the United States, 900,000 people suffer with pneumococcal pneumonia, 700,000 to 1.4 million people suffer from chronic hepatitis B, and 27,000 people suffer with cancer caused by the human papillomavirus. Deaths associated with these vaccine preventable diseases is estimated to be greater than 25,000 deaths (CDC, 2016). Vaccine preventable diseases also have a global impact. In 2008, the World Health Organization estimated that 1.5 million deaths in children under five were attributed to lack of routine vaccinations (2010). In order to improve vaccination compliance, the Community Preventive Services Task Force has recommended the use of immunization registries as an effective intervention to increase vaccine rates (2015).

## Problem Statement

Immunization registries are intended to be a positive contributor to an individual's clinical care and population-based health outcomes (CDC, 2012). Benefits include consolidating immunization histories to allow for the determination of appropriate patient vaccinations and to guide public health activities that improve vaccination rates and reduce preventable diseases (CDC, 2012). The Office of Disease Prevention and Health Promotion states that for each birth cohort vaccinated with routine vaccinations, society saves roughly 33,000 lives, reduces direct health care costs by \$9.9 billion and saves \$33.4 billion in indirect health care costs (2017). These estimates support the importance of receiving recommended and routine immunizations. Despite best efforts, the Office of Disease Prevention and Health Promotion also claims that each year 42,000 adults and 300 children die as a result of vaccine preventable diseases (2017). This evidence shows the continued need for improved vaccination rates.

Since immunization registries have been established as a method to improve vaccination rates it is important to ensure administered vaccines in Kentucky are being reported to the KIR. The KIR currently only requires that Vaccines for Children (VFC) administered vaccines be submitted to the registry. All other immunizations given are not required to be documented in the state's registry, but have the option of being reported. The intent of the immunization registry is to improve vaccination rates, but unless data is submitted to the registry, its full potential cannot be achieved.

However, mandating the reporting of VFC vaccines only still leaves a large amount of the Kentucky population unaccounted for. The most current VFC data available from the Centers for Disease Control and Prevention (CDC) and the National Center for Immunization and Respiratory Diseases reports that in 2009, 46.6% of children aged 19-35 months in Kentucky qualified to receive VFC vaccines, based on the criteria outlined previously. This left 53.4% of children who did not qualify to receive assistance from the VFC program (Smith, Lindley, & Rodewald, 2009). Assuming data is still comparable, this means that only half of children aged 19-35 months were required to have their immunizations reported to the registry. All other vaccines received by children who did not qualify for VFC vaccines did not require mandatory reporting to the registry. The CDC also reports that in 2015, only 73% of children aged 19-35 months received a combined vaccination series (Hill, Elam-Evans, Yankey, Singleton, & Dietz, 2015). Since all vaccinations given in Kentucky are not required to be reported to the registry, it is difficult to target where more efforts are needed to improve childhood vaccination rates. A solution to increase reporting to the KIR is to increase the mandatory reporting requirements of administered vaccines.

Children and adolescents are not the only intended target of the registry. It is also meant to improve the vaccination rates of the adult population. According to the 2015 census, the population of Kentucky is approximately 4.5 million with only 23% being under the age of 18 (Bureau, 2015). This leaves more than 75% of the

population's immunizations unaccounted for, unless they are optionally reported. This reporting gap leaves a large amount of data out of the system.

The KIR is influenced by numerous amounts stakeholders including physicians, nurses, pharmacists, government bodies, and the community. Pharmacists were the only stakeholder group included in this research study. Kentucky pharmacists have the ability to administer vaccinations pursuant to protocols under KRS 315.500. Until recently, pharmacists could administer immunizations to adults and children ages fourteen to seventeen, the one exception being the influenza vaccine which pharmacists could give to children as young as nine. The patient population in which they are able to immunize recently increased when Senate Bill 101 was signed on March 20, 2017. This bill amended KRS 315.010 to allow pharmacists to administer any immunizations recommended for children who are nine to seventeen years of age. Pharmacists have an important role in improving public health through vaccinations because pharmacists are easily accessible and are able to immunize a large percentage of the population. Due to these factors, it is important to consider pharmacists' opinions when discussing possible expansion of the KIR.

The purpose of conducting this research study was to determine if Kentucky pharmacists believed there is a need to expand the current reporting requirements of the KIR by gaining insight on Kentucky pharmacists' familiarity with the KIR, satisfaction with the current reporting requirements, and agreement or disagreement with increasing reporting requirements beyond VFC administered

vaccines. Views surrounding missed opportunities, preventable diseases, and the KIR's ability to improve these rates were also assessed.

While pharmacists play an important role in immunizations, future studies should examine the attitudes of the KIR by other stakeholders. In order to expand the requirements of the KIR, it would be important to gather the opinions of others involved as well. In addition to stakeholder input, it would also be beneficial to analyze shared data from the registry when it comes available to see if vaccination rates are improving.

### Literature Review

Research pertaining specifically to the Kentucky Immunization Registry is lacking, but research involving other immunization registries has been completed. Previous studies determined that vaccination rates have improved due to the increased number of administered vaccines reported to registries. Studies also revealed that states have expanded their registry reporting requirements in order to increase records of administered vaccine data. The policies and regulations that govern each immunization registry vary by state. Despite evidence supporting the registries' ability to improve vaccination rates, several studies revealed a lack of education and training pertaining to immunization registries.

Evidence that immunization registries are improving vaccination rates is established on a state-by-state basis based on published data. In 2015, the Wisconsin Bureau of Communicable Diseases and the Wisconsin Division of Public

Health evaluated the completeness of the Wisconsin Immunization Registry (WIR). It was discovered that 98 percent of patients in the sample had records available in the registry. It was also concluded that 76.5 percent of patients had an up-to-date vaccination series using the WIR, compared to 49.3 percent for patients using medical records only. This supports the author's statement that vaccination coverage rates can be improved through immunization information systems (Koepke et al. 2015).

In 2013, the CDC published information regarding the progress of the immunization registries. Of the fifty-six immunization program grantees, fifty-four were available to participate in a survey regarding participation in the registries. Results were based on child and adult participation. Child participation was defined as children under the age of six, having two or more vaccines reported to the registry, while adults were defined as being nineteen or older, and having one immunization reported to the registry. Nationally 86 percent of children are covered in the registry while 24.5 percent of adults are covered. This is an increase from 63 percent of children in 2006. The CDC also established functional standards in 2001 that were revised in 2007. Many studies have focused on the pediatric population, but adult participation in receiving vaccinations is also of importance and should not be neglected in research (CDC, 2013).

In 2015, the CDC and National Center for Immunization and Respiratory Diseases conducted a survey of state registry program managers. The purpose of the survey was to gain information relating to individual state laws, policies, and

regulations surrounding each state's immunization registry. The survey determined that thirty-three jurisdictions required at least one form of mandatory reporting to the registry, which is an increase from twelve jurisdictions in 2000. Of those jurisdictions, twelve mandated all immunizations, regardless of age, be reported and seventeen mandated all immunizations for children, adolescents, and young adults be reported (CDC, 2015). As noted earlier, the KIR is only mandatory for childhood vaccines administered through the Vaccine for Children's program and does not mandate reporting for any other population in the state (Schweitzer, 2015).

Hendrickson, Panchanathan, and Petitti (2015) published a study to evaluate completeness of records among the three sources, the Arizona State Immunization System, the electronic health record at a large provider's office in Arizona, and personal immunization records of Arizona citizens. The analysis revealed that state registries were 71.8 percent complete, electronic health records were 81.9 percent complete, and personal records were 87.7 percent complete. The study concluded that while the data systems are incomplete and need communication improvements, increasing compliance with the immunization registries could allow providers to be more dependent on state immunization registries and could improve research utilization of these registries (Hendrickson et al. 2015).

While immunization registries should aid in improving vaccination rates, barriers such as underreporting and a lack of education can inhibit its full potential. Hendrickson, Panchanathan, and Petitti (2015) indicated in their study (mentioned above) that only 11 percent of patients had a complete record across immunization

registries, electronic health record systems, and personal records and at least 89 percent of patients had one administered vaccine missing from one of the three sources (Hendrickson et al. 2015). The study concluded that there is a degree of deficiency in the reporting leading to an underutilization of the registry.

The Academic Pediatric Association conducted a study in southern Michigan assessing the time and cost issues of establishing a mandatory registry within private provider offices (Dombkowski et al. 2012). Offices were tasked with keeping up with recall reports along with labor estimates. Recall reports were available from the Michigan Care Improvement Registry. These reports were used to identify patients through the registry who were overdue for vaccinations. At the end of the study, the researchers conclude that each recall report totaled six dollars and time restraints were a large issue for various practices. Based on survey responses it was concluded by the researchers that further training and technical support is required to efficiently utilize the immunization registry (Dombkowski et al. 2012). While burdens existed with reporting, most practices did claim that they would continue to report to the registry (Dombkowski et al. 2012).

Various aspects of immunization registries have been studied over the last couple of decades. It is evident that registries have increased across the nation and vary by the policies and regulations that surround them. The recognition that immunization registries have the ability to help improve vaccination rates appeared to be increasing based on the number of jurisdictions that now require mandatory reporting.

Despite the continued increase in registry numbers, studies still show provider and patient unfamiliarity with the registry. This lack of knowledge about the registry impairs its ability to be utilized at the highest level. Though some states have published data comparing state immunization rates before and after registry implementation, this is not evident for the majority. This lack of research could be attributed to the inconsistencies of state reporting to the registry and the availability of registry data. Kentucky, for example, will not have data sharing available from the KIR until October 2017 due to the recent implementation of its immunization registry. Immunization registries have been established as a positive component to improving public health, but the lack of familiarity with the registry and lack of data create barriers for the recognition of its full potential.

Health professionals play an integral role in improving patient and population health outcomes through immunizations. Due to their significant role, it is important to gather their feedback regarding the registries. Received feedback could help identify needs surrounding registry operations, policies, and procedures. Identifying any needs pertaining to the registries and identifying solutions would allow immunization registries to function more efficiently.

## Research Design

As evidenced above, utilization of immunization registries is intended to be beneficial to individual and public health. When utilized, these registries encompass data that can be used to improve vaccination rates. In order to assess the relative need for expanding the current reporting requirements of the KIR, I conducted a

survey to assess Kentucky pharmacists' views towards the KIR and related subjects. The target audience included 1,000 randomly selected pharmacists who were licensed in Kentucky. Randomization was based on a pharmacist registry maintained by the Kentucky Board of Pharmacy.

Primary focus points of the survey included knowledge of the KIR, current satisfaction with reporting requirements, and the perceived need to increase reporting requirements. The survey also addressed perceptions of how the KIR could impact missed opportunities, preventable diseases, and the overall health of the Kentucky population if mandated.

Survey questions utilized a Likert scale for responses. Using this scale allowed for a measurement of agreement or disagreement for a particular statement. Ten survey questions and pharmacists' demographics were the independent variables in the study. Pharmacists agreement or disagreement with increasing KIR reporting requirements was the dependent variable. Responses to the survey were exported to Excel to be utilized for descriptive data analysis. In order to aggregate the collected data, responses were averaged over the five point Likert scale. A one sample t-test was used to determine the average mean of the respondents and to compare it to the neutral value, three. This allowed for agreement or disagreement to be determined for each question along with a measurement of how strongly the averaged responses agreed or disagreed. An independent t-test was conducted to determine if statistically significant differences between the means of community pharmacists and non-community pharmacists

existed. A Levene's Test for Equality of Variances was used to determine if variability between responses existed between the two groups.

To test the clarity of the questions in the survey, I administered a pretest to the Bluegrass Pharmacist Association. This sample was selected based on its similarities to the target audience. Fifty pharmacists took the pretest and provided feedback pertaining to question formatting and clarity. Results from this test administration of the survey were not included in the data analysis. The responses were solely used for the purpose of evaluating survey questions and format. Feedback indicated that all survey questions were clear and no modifications to the questions were needed.

A University of Kentucky Institutional Review Board certified survey (Appendix 2) was administered to 1,000 randomly selected pharmacists registered within the state of Kentucky. The survey was available for a period of two months through the Research Electronic Data Capture (REDCap). REDCap is a secure, web-based application designed exclusively to support data capture for research studies. Participant responses (N=142) were exported to Microsoft Excel.

Once the link to the survey in REDCap had been opened, the respondents received a cover letter (Appendix 1) containing the applicable elements of informed consent. This cover letter explained the purpose of the survey. After reading the cover letter, the survey recipients received a unique pin-number that allowed them to log into the REDCap system to enter their survey responses. The pin-number was

used to ensure that surveys would only be entered once. All data received from respondents completing the survey online was anonymous.

Upon survey closure, results were analyzed with Microsoft Excel, STATA, and Statistical Package for the Social Science (SPSS).

## Results

Out of 1,000 survey requests, there was a response-rate of 142. Fifty percent of the respondents have been practicing as a pharmacist for more than 15 years. Approximately fifty-two percent of the pharmacists identified themselves as working in the community setting, followed by twenty-three percent working in the hospital setting. The survey was completed by roughly the same amount of males and females. Additional descriptive statistics for demographic related responses are reported in Table 1.

Table 1. Survey Respondent Demographics

	Responses (%)
<b>Years of Pharmacy Practice</b>	
<b>Less than 5 years</b>	28 (19.7%)
<b>5 to 10 years</b>	23 (16.2%)
<b>10 to 15 years</b>	20 (14.1%)
<b>Greater than 15 years</b>	71 (50%)
<b>Pharmacy Practice Setting</b>	
<b>Community</b>	74 (52.1%)
<b>Hospital</b>	33 (23.2%)
<b>Ambulatory</b>	5 (3.5%)
<b>Managed Care</b>	6 (4.2%)
<b>Pharmacy Law</b>	1 (0.7%)
<b>Academia</b>	2 (1.4%)

<b>Other</b>	21 (14.8%)
<b>Gender</b>	
<b>Male</b>	77 (55%)
<b>Female</b>	63 (45%)

The purpose of the survey was to determine a need for expanding current KIR reporting requirements. Out of 142 survey respondents, 58 respondents were in favor of increasing KIR reporting.

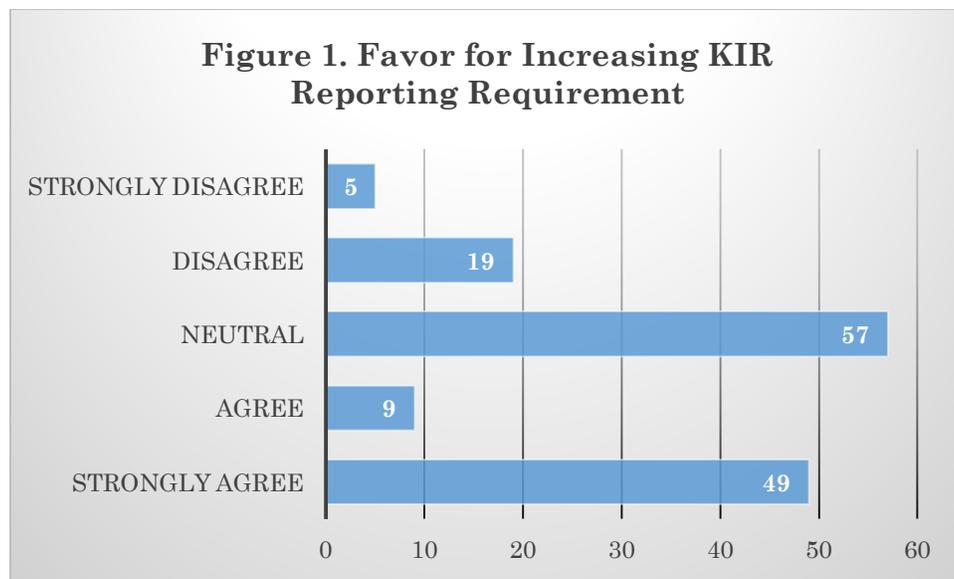


Figure 2 represents a pivot table that was created to help visually summarize all questions analyzed by the one-sample t-test.

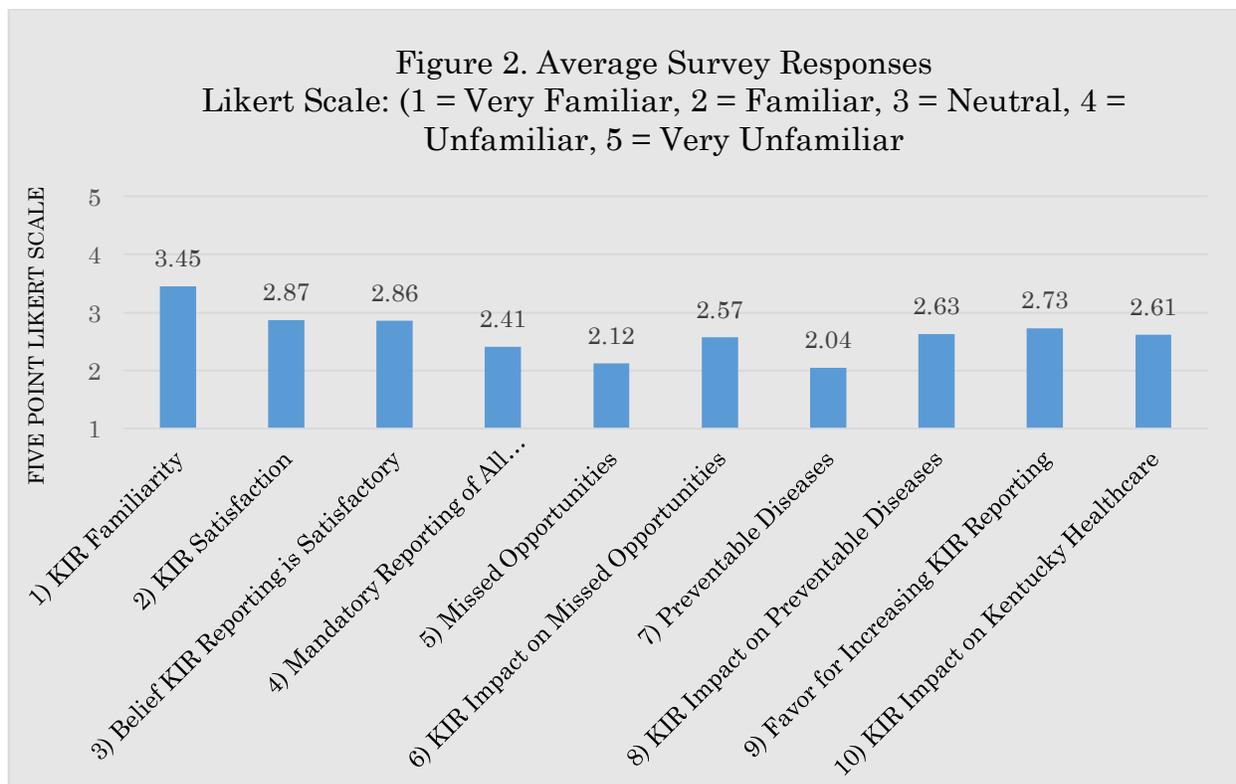


Table 2 reports one sample t-tests with significant findings. While all responses were reported with significance, several important findings were discovered. Question one assessed familiarity with the KIR. The average Likert response was 3.45, indicating the average response was unfamiliar with the KIR. Question two assessed current satisfaction with the KIR. The averaged response was 2.87, indicating the average response was satisfied with the KIR. Question four assessed the belief that it should be mandatory for all vaccines to be reported to the KIR. The averaged response was 2.41, indicating the average response agreed that all vaccines should be reported. Question nine assessed favor for increasing KIR reporting. The averaged response was 2.73, indicating the averaged response agreed

that reporting requirements should be increased. Additional one sample t-test results are reported in Table 2.

Table 2. One Sample t-test

	<b>N</b>	<b>Sig. (2-tailed) (P-Value)</b>
1) KIR Familiarity	142	0.00001
2) KIR Satisfaction	142	0.00859
3) Belief KIR Reporting Satisfactory	142	0.00356
4) Mandatory Reporting of All Vaccines	141	0.00001
5) Missed Opportunities	141	0.00001
6) Potential KIR Impact on Missed Opportunities	142	0.00001
7) Preventable Diseases	142	0.00001
8) Potential KIR Impact on Preventable Diseases	142	0.00001
9) Favor of Increasing KIR Reporting	139	0.00052
10) Potential KIR impact on Healthcare	140	0.00001

Levene’s Test for Equality of Variances was used to determine if the responses of community pharmacists and non-community pharmacists differ for each question in the survey. A t-test for Equality of Means was performed to determine if differences between the two means was likely due to pharmacists identifying as community pharmacist or as non-community pharmacists. The responses for community pharmacists and non-community pharmacists were not significantly different, except with the responses to the fourth question in the survey (Appendix 2). The significance level (Sig.), do you believe the Kentucky Immunization Registry should encompass mandatory reporting of all vaccines administered in the state” was 0.013 (Table 3). When conducting the t-test for Equality of Means, equal variances cannot be assumed for this question. The two-

tailed p-value for this question, however, was 0.177 meaning the differences in means was likely due to chance and not change in the independent variables. Two instances occurred where the t-test for Equality of Means reported two-tailed p-values of less than 0.05, in spite of the significance level for each question being greater than 0.05. The t-test for equality of means reported a sig. (2-tailed) value of 0.004 for the question “Do you feel expanding the required reporting to the Kentucky Immunization Registry would decrease Missed Opportunities” and a value of 0.015 for the question “Would you be in favor of increasing the current Immunization Registry Requirements” (Table 3). Since the values are less than 0.05, it can be concluded that the difference between means is most likely due to differences between community and non-community pharmacists. Appendix 3 reveals community pharmacists believe less than other pharmacist that expanding KIR reporting would improve missed opportunities and are less in favor of increasing KIR reporting requirements. Community pharmacists are the most easily accessible healthcare providers. Normally, pharmacists are involved with immunizations are part of their job description. In response to their previous and current involvement with patient vaccinations, it is possible that community pharmacists may not feel as strongly as other pharmacists due to their already active role in immunizations. Pharmacists who are not involved in the vaccination process are more likely to identify that a need is present for increased reporting because they may not be aware of all the stakeholders involved in ensuring patients are vaccinated.

Table 3. Levene's Test for Equality of Variances

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig	Sig. (2-tailed)
Do you believe the Kentucky Immunization Registry should encompass mandatory reporting of all vaccines administered in the state?	Equal variances assumed	6.360	<b>.013</b>	.180
	Equal variances not assumed			.177
Do you feel expanding the required reporting to the Kentucky Immunization Registry would decrease Missed Opportunities?	Equal variances assumed	.285	.133	<b>.004</b>
	Equal variances not assumed			.004
Would you be in favor of increasing the current Immunization Registry Requirements?	Equal variances assumed	.963	.328	<b>.015</b>
	Equal variances not assumed			.014

Ordinary Least Squares (OLS) regressions were used in order to assess question reliability. Responses to specific questions and demographics were analyzed to determine if they had significant impact on a chosen question assigned to be the dependent variable. For each independent variable, one group was set to be the reference group. Questions assigned as independent variables had reference groups that could be represented by “very familiar”, “strongly agree”, or “very

satisfied”. Demographic categories were assigned reference groups as well. Pharmacists who have practiced less than five years and community pharmacists represented the reference groups for the demographics involving years spent practicing and pharmacy practice settings. If an independent variable has a coefficient that is significant, a positive value increases the possibility of the dependent variable being higher on the Likert scale and a negative value decreases the possibility of the dependent variable. As mentioned above, scores higher than three represent disagreement and scores below three represent agreement based on a five point Likert scale.

An OLS regression was used to determine if the dependent variable, pharmacists’ opinions on favor for increasing KIR reporting, was influenced by defined independent variables (Table 4). Based on the Prob > F equaling 0.0000 it can be determined that the model is significant and can be accepted. Compared to the reference group, “strongly agree”, pharmacists in the “disagree” and “strongly disagree” groups increase the possibility of the dependent variable. These groups represent the only significant responses for this question with a  $p > t$  equaling less than 0.05. Based on results, disagreement with mandatory reporting of all vaccines increases the possibility of pharmacists being in disagreement with increasing KIR reporting.

The next question to show significance is the belief in the potential for the KIR to improve healthcare. Compared to the reference group, all groups, excluding the “agree” group, increases the possibility of the dependent variable based on a

significant p value of less than 0.05. As pharmacists disagree with a mandatory KIR being able to improve healthcare they also disagree more with favoring the increase of KIR reporting. Pharmacists' views of satisfaction with the KIR, missed opportunities, and preventable diseases did not produce significant responses and do not appear to have a relationship with the dependent variable according to the chosen model.

Table 4. OLS Regression of Pharmacists' Favor for Increasing KIR Reporting

	Coefficient	Standard Error	P>t	[95% Conf. Interval]
<b>KIR Familiarity</b>				
<b>Familiar</b>	-0.380	0.288	0.191	-0.952, 0.193
<b>Neutral</b>	-0.466	0.345	0.180	-1.152, 0.220
<b>Unfamiliar</b>	-0.292	0.337	0.389	-0.961, 0.378
<b>Very Unfamiliar</b>	-0.182	0.351	0.605	-0.878, 0.514
<b>KIR Satisfaction</b>				
<b>Satisfied</b>	-0.098	0.333	0.769	-0.760, 0.564
<b>Neutral</b>	-0.081	0.357	0.821	-0.78, 0.627
<b>Unsatisfied</b>	-0.322	0.405	0.429	-1.127, 0.483
<b>Very Unsatisfied</b>	-0.370	0.574	0.521	-1.510, 0.770
<b>Mandatory Reporting of All vaccines</b>				
<b>Agree</b>	0.114	0.149	0.446	-0.182, 0.410
<b>Neutral</b>	0.066	0.186	0.723	-0.302, 0.434
<b>Disagree</b>	0.604	0.203	0.004	0.202, 1.007
<b>Strongly Disagree</b>	1.149	0.390	0.004	0.375, 1.924
<b>Missed Opportunities</b>				
<b>Agree</b>	0.259	0.145	0.077	-0.029, 0.546
<b>Neutral</b>	0.351	0.187	0.064	-0.021, 0.723
<b>Disagree</b>	0.429	0.280	0.129	-0.128, 0.986
<b>Strongly Disagree</b>	0.142	0.676	0.834	-1.200, 1.484
<b>Potential KIR Impact on Missed Opportunities</b>				
<b>Agree</b>	0.134	0.206	0.516	-0.275, 0.544
<b>Neutral</b>	0.376	0.230	0.106	-0.081, 0.833
<b>Disagree</b>	0.323	0.261	0.219	-0.195, 0.840
<b>Strongly Disagree</b>	0.575	0.470	0.225	-0.359, 1.509
<b>Preventable Diseases</b>				

<b>Agree</b>	0.133	0.138	0.336	-0.140, 0.407
<b>Neutral</b>	0.080	0.176	0.651	-0.269, 0.429
<b>Disagree</b>	0.345	0.257	0.182	-0.164, 0.854
<b>Potential KIR Impact on Preventable Diseases</b>				
<b>Agree</b>	0.261	0.224	0.247	-0.184, 0.707
<b>Neutral</b>	0.413	0.232	0.079	-0.049, 0.874
<b>Disagree</b>	0.293	0.288	0.312	-0.279, 0.865
<b>Strongly Disagree</b>	0.588	0.365	0.111	-0.138, 1.313
<b>Potential KIR Impact on Healthcare</b>				
<b>Agree</b>	0.114	0.252	0.651	-0.386, 0.615
<b>Neutral</b>	0.788	0.280	0.006	0.231, 1.345
<b>Disagree</b>	1.125	0.318	0.001	0.494, 1.757
<b>Strongly Disagree</b>	1.939	0.434	0.000	1.078, 2.800
<b>Years Practicing Pharmacy</b>				
<b>5-10 years</b>	0.178	0.169	0.294	-0.157, 0.514
<b>10-15 years</b>	0.237	0.166	0.157	-0.093, 0.567
<b>&gt;15 years</b>	0.178	0.132	0.180	-0.084, 0.441
<b>Practice Setting</b>				
<b>Hospital</b>	-0.055	0.123	0.656	-0.300, 0.190
<b>Ambulatory</b>	0.009	0.283	0.975	-0.553, 0.571
<b>Managed Care</b>	-0.028	0.245	0.908	-0.515, 0.458
<b>Pharmacy Law</b>	-0.031	0.553	0.955	-1.129, 1.067
<b>Academia</b>	-0.048	0.424	0.909	-0.890, 0.793
<b>Other</b>	-0.080	0.142	0.574	-0.363, 0.202
<b>Gender</b>	0.032	0.106	0.762	-0.178, 0.242

Next, another OLS regression was performed to assess the impact of selected independent variables on the dependent variable, KIR familiarity. The model is significant and can be accepted based off the Prob > F equaling 0.000. Table 5 reveals that compared with the reference group, the “neutral” group and “very dissatisfied groups” concerning KIR satisfaction increased the possibility of the dependent variable, KIR familiarity. It is possible that pharmacists who are not satisfied with the registry may feel that way because they are more unfamiliar with the registry and its reporting. Compared to those who answered male, the female

group increased the possibility of KIR familiarity. It appears that males are more informed about the registry than females.

Table 5. OLS Regression on Pharmacists' Opinions of KIR Familiarity

	Coefficient	Standard Error	P>t	[95% Conf. Interval]
<b>KIR Satisfaction</b>				
Satisfied	0.536	0.531	0.315	-0.517, 1.589
<b>Neutral</b>	<b>2.249</b>	<b>0.504</b>	<b>0.000</b>	<b>1.251, 3.246</b>
Unsatisfied	0.385	0.633	0.544	-0.868, 1.639
<b>Very Unsatisfied</b>	<b>2.645</b>	<b>0.843</b>	<b>0.002</b>	<b>0.975, 4.315</b>
<b>Potential KIR Impact on Healthcare</b>				
Agree	-0.259	0.340	0.447	-0.933, 0.414
Neutral	-0.346	0.424	0.417	-1.186, 0.495
Disagree	-0.034	0.496	0.945	-1.016, 0.947
Strongly Disagree	1.017	0.759	0.183	-0.487, 2.520
<b>Favor for Increasing KIR Reporting</b>				
Agree	0.038	0.378	0.920	-0.712, 0.788
Neutral	0.171	0.448	0.704	-0.717, 1.058
Disagree	-0.105	0.512	0.837	-1.120, 0.909
Strongly Disagree	-0.431	0.755	0.569	-1.926, 1.064
<b>Years Practicing Pharmacy</b>				
5-10 years	0.307	0.269	0.257	-0.227, 0.841
10-15 years	0.208	0.283	0.463	-0.353, 0.770
>15 years	0.205	0.212	0.335	-0.215, 0.625
<b>Practice Setting</b>				
Hospital	0.013	0.201	0.948	-0.385, 0.411
Ambulatory	-0.484	0.466	0.302	-1.408, 0.440
Managed Care	0.236	0.398	0.555	-0.553, 1.024
Pharmacy Law	0.142	0.904	0.875	-1.649, 1.933
Academia	-0.080	0.698	0.909	-1.463, 1.303
Other	0.393	0.228	0.088	-0.059, 0.846
<b>Gender</b>	<b>0.405</b>	<b>0.164</b>	<b>0.015</b>	<b>0.081, 0.730</b>

It is important to consider how certain variables impact the dependent variable, KIR satisfaction (Table 6). With a Prob > F of 0.0002, the regression model analyzing the impact of selected variables on KIR satisfaction can be accepted. Compared to the reference group, the group who strongly disagrees with mandatory reporting of all vaccines increase the possibility of the dependent variable. Based on this significant coefficient, it appears that as pharmacists disagree with mandatory reporting of all administered vaccines they are less satisfied with the KIR. If a pharmacist believes that current requirements are too stringent, it is very likely they would disagree with increasing the reporting further. The same scenario is represented by the independent variable concerning the KIR's ability to improve healthcare. Compared to the reference group, all groups minus the "agree" group increase the possibility of KIR satisfaction. All three values are significant and the reported coefficients increase as the disagreement increases (Table 6).

Table 6. OLS Regression on Pharmacists' Opinions of KIR Satisfaction

	Coefficient	Standard Error	P>t	[95% Conf. Interval]
<b>Mandatory Reporting of All vaccines</b>				
Agree	0.118	0.147	0.427	-0.174, 0.409
Neutral	0.243	0.172	0.161	-0.098, 0.585
Disagree	0.085	0.206	0.680	-0.322, 0.493
<b>Strongly Disagree</b>	<b>1.061</b>	<b>0.389</b>	<b>0.007</b>	<b>0.290, 1.832</b>
<b>Favor for Increasing KIR Reporting</b>				
Agree	0.023	0.232	0.922	-0.438, 0.483
Neutral	-0.096	0.272	0.723	-0.635, 0.442
Disagree	-0.250	0.326	0.446	-0.896, 0.397
Strongly Disagree	-0.514	0.491	0.297	-1.487, 0.459
<b>Potential KIR Impact on Healthcare</b>				
Agree	0.086	0.205	0.677	-0.320, 0.492

<b>Neutral</b>	0.557	0.253	0.030	0.056, 1.057
<b>Disagree</b>	0.598	0.296	0.045	0.012, 1.185
<b>Strongly Disagree</b>	1.416	0.419	0.001	0.585, 2.247
<b>Years Practicing</b>				
<b>5-10 years</b>	0.241	0.157	0.128	-0.071, 0.553
<b>10-15 years</b>	0.316	0.168	0.062	-0.016, 0.648
<b>&gt;15 years</b>	0.116	0.131	0.378	-0.144, 0.376
<b>Pharmacy Practice</b>				
<b>Hospital</b>	0.101	0.122	0.408	-0.140, 0.343
<b>Ambulatory</b>	0.065	0.286	0.821	-0.501, 0.631
<b>Managed Care</b>	0.048	0.241	0.842	-0.429, 0.525
<b>Pharmacy Law</b>	-0.665	0.555	0.233	-1.765, 0.434
<b>Academia</b>	-0.543	0.407	0.185	-1.350, 0.264
<b>Other</b>	0.047	0.143	0.743	-0.236, 0.330
<b>Gender</b>	0.165	0.100	0.101	-0.033, 0.364

Table 7 represents an OLS regression analyzing the impact of selected independent variables on the dependent variable, potential impact of KIR on missed opportunities. The model can be accepted based on Prob > F equaling less than 0.05. Favor for increasing KIR reporting is the only independent variable that resulted in significant coefficients. Compared to the ‘very familiar’ reference group, all responses increased the possibility of the dependent variable. Coefficients increased as the level of disagreement increased. The question concerning missed opportunities as an issue did not report any significant p-values, so it cannot be determined from this model that responses to this question impacted how pharmacists answered questions regarding the KIR’s ability to improve missed opportunity rates.

Table 7. OLS Regression on Pharmacists' Opinions Regarding Missed Opportunities

	Coefficient	Standard Error	P>t	[95% Conf. Interval]
<b>Missed Opportunities</b>				
<b>Agree</b>	-0.002	0.180	0.993	-0.358, 0.355
<b>Neutral</b>	0.214	0.230	0.353	-0.241, 0.670
<b>Disagree</b>	-0.064	0.319	0.840	-0.696, 0.567
<b>Strongly Disagree</b>	0.659	0.766	0.392	-0.859, 2.176
<b>Favor for Increasing KIR Reporting</b>				
<b>Agree</b>	0.591	0.280	0.037	0.037, 1.145
<b>Neutral</b>	1.393	0.281	0.000	0.836, 1.950
<b>Disagree</b>	1.784	0.334	0.000	1.123, 2.444
<b>Strongly Disagree</b>	2.689	0.422	0.000	1.853, 3.525
<b>Years Practicing Pharmacy</b>				
<b>5-10 years</b>	-0.087	0.209	0.677	-0.501, 0.326
<b>10-15 years</b>	-0.027	0.219	0.900	-0.461, 0.406
<b>&gt;15 years</b>	0.021	0.175	0.904	-0.325, 0.367
<b>Practice Setting</b>				
<b>Hospital</b>	-0.171	0.168	0.311	-0.504, 0.162
<b>Ambulatory</b>	-0.208	0.385	0.589	-0.970, 0.553
<b>Managed Care</b>	0.242	0.320	0.451	-0.392, 0.877
<b>Pharmacy Law</b>	-0.147	0.737	0.842	-1.606, 1.312
<b>Academia</b>	-0.253	0.537	0.638	-1.317, 0.810
<b>Other</b>	-0.318	0.187	0.093	-0.689, 0.053
<b>gender</b>	-0.045	0.134	0.737	-0.310, 0.220

In order to discover if selected variables impacted the dependent variable, potential impact of KIR on preventable disease, another OLS regression was analyzed. Based on Prob > F equaling less than 0.05 the model can be accepted. According to Table 8, all results reported for the question regarding favor for increasing KIR reporting were significant based on p-values less than 0.05. Compared to the reference group, “strongly agree”, all groups significantly increased the possibility of the dependent variable. If a pharmacist disagrees with increasing

mandatory reporting it can be inferred they would likely disagree with increasing mandatory reporting for purposes of improving preventable diseases. Based on this model it does not appear that the independent variable, preventable diseases, impacted the responses to the dependent variable, potential for KIR reporting to improve preventable disease rates.

Table 8. OLS Regression of Pharmacists' Opinions Regarding Preventable Diseases

	Coefficient	Standard Error	P>t	[95% Conf. Interval]
<b>Preventable Diseases</b>				
<b>Agree</b>	-0.072	0.180	0.692	-0.429, 0.286
<b>Neutral</b>	0.327	0.237	0.171	-0.143, 0.797
<b>Disagree</b>	0.329	0.346	0.344	-0.357, 1.014
<b>Favor for Increasing KIR Reporting</b>				
<b>Agree</b>	0.864	0.305	0.005	0.261, 1.467
<b>Neutral</b>	1.331	0.312	0.000	0.713, 1.948
<b>Disagree</b>	2.218	0.352	0.000	1.521, 2.916
<b>Strongly Disagree</b>	3.111	0.447	0.000	2.226, 3.996
<b>Years Practicing Pharmacy</b>				
<b>5-10 years</b>	0.066	0.224	0.767	-0.377, 0.510
<b>10-15 years</b>	0.079	0.232	0.736	-0.381, 0.538
<b>&gt;15 years</b>	0.093	0.186	0.617	-0.275, 0.460
<b>Practice Setting</b>				
<b>Hospital</b>	0.023	0.175	0.897	-0.324, 0.370
<b>Ambulatory</b>	-0.106	0.407	0.795	-0.911, 0.699
<b>Managed Care</b>	0.457	0.334	0.173	-0.203, 1.118
<b>Pharmacy Law</b>	-0.555	0.803	0.491	-2.145, 1.035
<b>Academia</b>	-0.030	0.579	0.959	-1.176, 1.117
<b>Other</b>	0.071	0.198	0.721	-0.321, 0.463
<b>Gender</b>	-0.112	0.145	0.442	-0.400, 0.176

## Discussion

Immunization registries are recognized as a positive component of healthcare by many organizations. Research conducted by the CDC revealed more states are

requiring mandatory reporting to the registry to further improve vaccination rates and public health (2015). Kentucky pharmacists were surveyed to assess their opinions towards the possible need to expand the current reporting requirements of the KIR. Insight was gained on KIR familiarity, satisfaction with current KIR reporting, and agreement or disagreement surrounding support for mandating reporting to the KIR. All survey questions analyzed by the one sample t-test resulted in significant p-values and the majority of averaged Likert scale responses agreed with the survey questions.

Overall, pharmacists agreed that there was a need to increase reporting requirements to the KIR. Though they were satisfied with reporting, based on the descriptive statistical information, pharmacists agreed by a slight margin that increasing reporting requirements should occur. When an OLS regression was run to determine if KIR satisfaction impacted the dependent variable, favor for increasing KIR reporting, no significant p-values could be reported. Despite no significance being found with KIR satisfaction, favor for increasing KIR reporting was impacted by responses concerning mandatory vaccine reporting and the KIR's ability to improve public health.

Descriptive statistical information revealed that pharmacists were in agreement with the three questions above. The regression determined that significance existed between how each impacted favor for increasing KIR reporting. It appears that if pharmacists disagree with mandatory vaccine reporting or the KIR's ability to improve Kentucky healthcare, they will also be less likely to agree

with increasing KIR reporting requirements. This result is not surprising, because all three questions involve modifying KIR reporting.

Further analysis of respondent demographics, using the t-test for Equality of Means, discovered that community pharmacists did not express as much favor for mandating the registry as non-community pharmacists. The differences in means is possibly attributed to differences in job roles that each area of pharmacy encompasses. Community pharmacists' exposure to immunizations, current workplace documentation, and sharing of immunization records to patients' providers could possibly lessen the view that mandatory reporting to the KIR would be beneficial. These factors were not assessed in the survey and are only meant to provide possible insight into why different pharmacists' identified area of pharmacy practice resulted in a difference of means. On average, pharmacist agreed that the KIR could improve healthcare in Kentucky. This view is in alignment with the CDC's purpose for immunization registries (2012). It is the belief that registries will improve healthcare by providing immunization reminders and data that will assist in public health efforts to improve vaccine rates.

The survey revealed that pharmacists, on average, were unfamiliar with the KIR. This averaged response is expected due to the recent rollout of the registry in Kentucky. Implementation and the dissemination of knowledge takes time and resources. It was also discovered that pharmacists who were neutral in opinion or disagreed with the current reporting requirements of the KIR appeared to be more unfamiliar with the KIR compared to other groups. This relationship identifies a

need for educating pharmacists on the KIR and its role in health care. If pharmacists are aware of the registry and understand its purpose they may have a different view of satisfaction.

In the process of determining a need for increased reporting requirements to the KIR, it was important to assess how pharmacists viewed the current reporting requirements and the idea of mandating all vaccines to the registry. The intention of the survey question regarding KIR satisfaction was to associate dissatisfaction with current reporting requirements as a sign that further reporting is needed. Pharmacists, on average, responded that they were satisfied with the current reporting requirements of the KIR and agreed that all vaccines should be reported to the registry. Upon review of the question, it does appear that satisfaction with current reporting could still yield support for mandating all vaccines to the registry. It is possible that survey respondents interpreted the question differently. As a result of the OLS regression it did appear that pharmacists who strongly disagreed with mandating all vaccines to the registry also seemed to be less satisfied with current reporting. It was also noted that pharmacists who were indifferent and in disagreement with the ability of the KIR to improve Kentucky healthcare appeared to be less satisfied with the registry. Future studies should assess pharmacist's attitudes about immunization registries in general and not just reporting requirements. This is another example of how important education and awareness is to the function of the registry.

Missed opportunities, as mentioned above, have the possibility to be improved by immunization registries (CDC 2013). The analysis of the survey revealed that Kentucky pharmacists' responses were generally in agreement that missed opportunities are issues that Kentucky faces (Figure 2). This agreement is likely the result of various experiences dealing with patients who have not received recommended vaccines and treating illnesses that may have been prevented in the presence of vaccinations. This data was not obtained through the survey so a variety of different factors could have influence the averaged response. The awareness of this issue did warrant the agreement that the KIR would improve missed opportunities.

Since pharmacists agreed with both questions regarding missed opportunities, a regression was conducted to determine if a relationship existed between the two. Analysis of the regression revealed no significant relationship between how pharmacists viewed missed opportunities and the KIRs ability to improve them. A relationship did result between pharmacists' opinions regarding favor for increasing KIR reporting and the possibility of the KIR improving missed opportunity rates. Pharmacists who support increasing KIR reporting likely recognize the benefit it can have on missed opportunities. Alternatively, pharmacists who do not agree with increasing requirements likely do not see the benefits it can have on missed opportunities.

Further analysis of respondent demographics, using a t-test for Equality of Means, discovered that community pharmacists did not express as much confidence

in mandatory KIR reporting for decreasing missed opportunities compared to other pharmacists (Appendix 3). Community pharmacists and non-community pharmacists viewed mandatory reporting to the KIR as a way to avoid missed opportunities differently. This difference in viewpoints can likely be attributed to differences in job roles and individual professional opinions that have developed over their careers.

Similar to missed opportunities, pharmacists agreed that preventable diseases were an issue in Kentucky and agreed mandatory reporting to the KIR would improve these rates. This opinion is aligned with information provided above by the Office of Disease Prevention and Health Promotion and by the CDC. These organizations recognize the significance of preventable diseases and the financial cost associated with them. Based on descriptive statistical information, it appeared pharmacists agreed with more strength that preventable diseases were an issue than agreement that KIR can decrease these rates. Potential reasoning for this observed decrease in agreement is lack of familiarity with immunization registries ability to influence preventable disease rates and the lack of data currently available from the KIR. It is evident that pharmacists view preventable diseases as an issue, but more data and knowledge may be required before they view the KIR as being a valuable resource for decreasing these disease rates. Data sharing is currently unavailable from the KIR and will become available October 2017. A regression was used to determine if the two questions regarding preventable diseases were related to one another. The analysis did not reveal a significant

relationship between how pharmacists viewed preventable diseases and the KIR's ability to improve rates. There was, however, significant relationship between pharmacists' opinions regarding favor of increasing KIR reporting and the KIR's ability to improve preventable diseases rates. As pharmacists disagreed more with expanding KIR reporting, they also appeared to disagree more with the KIR's impact on disease rates.

### Limitations

The performed study does have limitations that must be addressed. First, the study is not a reflection of every pharmacist licensed within the state of Kentucky. According to the Kentucky Board of Pharmacy, roughly 9,000 pharmacists are registered within the state of Kentucky. The survey was administered to 1,000 pharmacists and 142 participants responded within the time frame established. This is a very low response rate, which affects the representativeness of the survey.

The second limitation to address is the possibility of a pharmacist being licensed in Kentucky without actually practicing in the state or being familiar with Kentucky policies. There are instances where a pharmacist may hold a Kentucky license, but not physically be present within the state. This is a commonality among mail order pharmacists or pharmacists who hold a federal position. In these instances, it would be uncommon that these pharmacists are familiar with the KIR and associated policies. This limitation may have led to an averaged Likert score that did not accurately reflect the opinions of Kentucky pharmacists who actively practice under Kentucky law.

A third limitation is the exclusion of other stakeholders who also report to the KIR. While pharmacists are a major component of vaccinations, other stakeholders are involved with the administration and documentation of immunizations. The survey administered is solely from the perspective of pharmacists and excluded the opinions of others. In 2015, the CDC reported that the most common place to receive a vaccination for children (63.7%) and adults (33.0%) was the doctor's office. Data also showed that 47.9% of adults received their flu vaccination at a provider's office while 24.8% received this vaccination at a pharmacy. This does not discredit the opinions of pharmacists, but it does show that the opinions of other medical professionals are valuable and needed.

The last limitation to address is the inability for the survey to address views surrounding vaccination rates and the KIR's ability to impact those rates. The CDC and Task Force specifically target the improvement of vaccination rates through the use of immunization registries. Without obtaining data on the views surrounding vaccination rates, it cannot be assumed that Kentucky pharmacists view vaccination rates as an area that needs improvement. It also cannot be assumed that Kentucky pharmacists would find the KIR beneficial to improving these rates.

## Conclusion

The CDC and the Community Preventive Services Task Force have deemed the registry as a positive tool to improving patient-specific and population health. It is believed that the registry would positively impact immunization rates, missed opportunities, and preventable disease (CDC, 2012). Evidenced by the survey, it is

clear that, on average, Kentucky pharmacists agree that missed opportunities and preventable diseases are issues in Kentucky. The purpose of the survey was to establish if a need existed for mandating the reporting of all vaccines administered to the KIR compared to current reporting requirements. Based on the descriptive statistical information it was determined by the survey that pharmacists are in favor of increasing the KIR reporting requirements to encompass all vaccines given in Kentucky.

### Recommendations

This survey was conducted to determine if a need for expanding mandatory reporting to the Kentucky Immunization Registry existed. Based on the descriptive analysis of the survey data, I do believe a need for increased reporting can be established at this time. In order to assess this need on a larger scale, opinions of a variety of KIR stakeholders need to be obtained. Continuous data would also be beneficial to determine if the KIR was actually impacting vaccination rates compared to traditional methods used prior to its existence. Initial sharing of data reported to the KIR will be available October 2017. Once this data is released, it will be possible to analyze and help better determine the impact that the registry is having on the healthcare of Kentucky.

Based on pharmacists' averaged response of unfamiliarity with the KIR, a need for education was revealed. The data showed a relationship between pharmacists' responses regarding KIR satisfaction and KIR familiarity. Compared to the reference group, pharmacists who were neutral to KIR satisfaction appeared

to be less familiar with the KIR. The registry cannot be utilized at its full potential to improve patient and public health unless pharmacists are familiar with its purpose, policies, and operations.

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## Appendices

### Appendix 1: Cover Letter

You are invited to participate in a research project collecting information about the Kentucky Immunization Registry reporting requirements. Lindsey Lewis, UK College of Pharmacy 2017 PharmD/MPA candidate, is conducting this survey. If you voluntarily complete the survey you will be one of approximately 1,000 pharmacists in Kentucky to do so. You have been asked to participate in this survey because you are a licensed pharmacist in Kentucky. The survey will take approximately 10 minutes to complete. The survey asks for your opinions about the current reporting requirements of the Kentucky Immunization Registry and general demographic information. The information generated from this research will be used to complete a capstone project required for graduation. Taking part in this research is completely voluntary. If you choose not to participate, there will be no penalty. Your responses to the survey are anonymous. Nobody will know if you respond to this survey and nobody will be able to trace the information that you provide back to you. Completing the survey entails no known risks. You are free to skip any question that you do not want to answer and you can discontinue at any time. Although you will not personally benefit by completing the survey the information that you provide may help inform future discussions about the topic of the Kentucky Immunization Registry. Please be aware, while we make every effort to safeguard your data once received on our servers via REDCap, given the nature of online surveys, as with anything involving the Internet, we can never guarantee

the confidentiality of the data while still en route to us. The University of Kentucky Medical Institutional Review Board has reviewed this study. If you have questions about this study, you may email [lindsey.lewis92@uky.edu](mailto:lindsey.lewis92@uky.edu). If you have any questions about your rights as a volunteer in this research, you may contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. Thank you for your time and we appreciate your consideration in completing this survey.

Sincerely,

Lindsey Lewis

*College of Pharmacy, University of Kentucky*

PHONE: 606-231-0025

E-MAIL: [lnle223@uky.edu](mailto:lnle223@uky.edu)

## Appendix 2: Survey

How familiar are you with the current mandatory reporting requirements of the Kentucky Immunization Registry?

1. How familiar are you with the current mandatory reporting requirement of the Kentucky Immunization Registry?
  - a. Very Familiar
  - b. Familiar
  - c. Neutral
  - d. Unfamiliar
  - e. Very Unfamiliar
  
2. How satisfied are you with the current mandatory reporting requirements of the Kentucky Immunization Registry?
  - a. Very Satisfied
  - b. Satisfied
  - c. Neutral
  - d. Dissatisfied
  - e. Very Dissatisfied
  
3. Do you believe the current Kentucky Immunization Registry reporting requirements are satisfactory?
  - a. Strongly Agree
  - b. Agree
  - c. Neutral

- d. Disagree
  - e. Strongly Disagree
4. Do you believe the Kentucky Immunization Registry should encompass mandatory reporting of all vaccines administered in the state?
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
5. Do you view “Missed Opportunities” for vaccinations as an important issue in Kentucky?
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
6. Do you feel expanding the required reporting to the Kentucky Immunization Registry would decrease “Missed Opportunities”?
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree

- e. Strongly Disagree
7. Do you believe preventable diseases are an issue in the state of Kentucky?
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
8. Do you believe mandatory reporting of all vaccines administered in Kentucky would decrease the occurrence of preventable diseases?
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
9. Would you be in favor of increasing the current Immunization Registry Requirements?
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree

10. Do you believe increasing the Kentucky Immunization Registry requirements would improve healthcare for the state of Kentucky?

- a. Strongly Agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly Disagree

#### Demographics

1. How long have you been practicing as a pharmacist?
2. What pharmacy setting do you currently practice in?
  - a. Community Pharmacy
  - b. Hospital Pharmacy
  - c. Ambulatory Pharmacy
  - d. Managed Care Pharmacy
  - e. Pharmacy Law
  - f. Academia
  - g. Other
    - i. Please describe
3. Are you male or female?

### Appendix 3: IBM SPSS Statistics (version 23) Data

Group Statistics	Group	N	Mean
<b>How familiar are you with the current mandatory reporting requirements of the Kentucky Immunization Registry?</b>	Community Pharmacy	74	3.38
	Other	68	3.53
<b>How satisfied are you with the current mandatory reporting requirements of the Kentucky Immunization Registry?</b>	Community Pharmacy	74	2.86
	Other	68	2.87
<b>Do you believe the current Kentucky Immunization Registry reporting requirements are satisfactory?</b>	Community Pharmacy	74	2.86
	Other	68	2.85
<b>Do you believe the Kentucky Immunization Registry should encompass mandatory reporting of all vaccines administered in the state?</b>	Community Pharmacy	73	2.52
	Other	68	2.29
<b>Do you view Missed Opportunities for vaccinations as an important issue in Kentucky?</b>	Community Pharmacy	74	2.14
	Other	67	2.102
<b>Do you feel expanding the required reporting to the Kentucky Immunization Registry would decrease Missed Opportunities?</b>	Community Pharmacy	74	2.780
	Other	68	2.340
<b>Do you believe preventable diseases are an issue in the state of Kentucky?</b>	Community Pharmacy	74	2.080
	Other	68	2.000

<b>Do you believe mandatory reporting of all vaccines administered in Kentucky would decrease the occurrence of preventable diseases?</b>	Community Pharmacy	74	2.73
	Other	68	2.51
<b>Would you be in favor of increasing the current Immunization Registry Requirements?</b>	Community Pharmacy	73	2.90
	Other	66	2.53
<b>Do you believe increasing the Kentucky Immunization Registry requirements would improve healthcare for the state of Kentucky?</b>	Community Pharmacy	74	2.74
	Other	66	2.47

**Appendix 4: Independent T-Test; IBM SPSS Statistics (version 23) Data**

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig	Sig. (2-tailed)
<b>How familiar are you with the current mandatory reporting requirements of the Kentucky Immunization Registry?</b>	Equal variances assumed	.132	.717	.440
	Equal variances not assumed			.440
<b>How satisfied are you with the current mandatory reporting requirements of the Kentucky Immunization Registry?</b>	Equal variances assumed	.043	.836	.978
	Equal variances not assumed			.978
<b>Do you believe the current Kentucky Immunization Registry reporting requirements are satisfactory?</b>	Equal variances assumed	1.793	.183	.901
	Equal variances not assumed			.900
<b>Do you believe the Kentucky Immunization Registry should encompass mandatory</b>	Equal variances assumed	6.360	.013	.180
	Equal variances not assumed			.177

<b>reporting of all vaccines administered in the state?</b>	not assumed			
<b>Do you view Missed Opportunities for vaccinations as an important issue in Kentucky?</b>	Equal variances assumed	.227	.634	.826
	Equal variances not assumed			.825
<b>Do you feel expanding the required reporting to the Kentucky Immunization Registry would decrease Missed Opportunities?</b>	Equal variances assumed	.285	.133	.004
	Equal variances not assumed			.004
<b>Do you believe preventable diseases are an issue in the state of Kentucky?</b>	Equal variances assumed	.304	.582	.547
	Equal variances not assumed			.546
<b>Do you believe mandatory reporting of all vaccines administered in Kentucky would decrease the occurrence of preventable diseases?</b>	Equal variances assumed	.163	.687	.195
	Equal variances not assumed			.194
<b>Would you be in favor of increasing</b>	Equal variances assumed	.963	.328	.015

<b>the current Immunization Registry Requirements?</b>	Equal variances not assumed			.014
<b>Do you believe increasing the Kentucky Immunization Registry requirements would improve healthcare for the state of Kentucky?</b>	Equal variances assumed	.640	.425	.086
	Equal variances not assumed			.083