Wisconsin
Department of Health Services

Evaluation of the Wisconsin Immunization Registry

Executive Summary

The Wisconsin Immunization Program recently evaluated the completeness and accuracy of the Wisconsin Immunization Registry (WIR) by comparing immunization records from provider offices with immunization records in the WIR. The evaluation focused on children born in 2009 and the immunizations they received during 2009-2011. This report summarizes the results from this project and includes recommendations for how providers can improve the quality of their patients' immunization information in the WIR.

Results Highlights

- **98%** of the 1,863 patient records gathered from 251 participating providers had client records in the WIR.
- **97%** of the immunizations documented in the patient medical records were documented in the WIR.
- In general, the WIR contained a more complete patient vaccination history than did the medical record.
- The percentage of patients up to date with the Advisory Committee on Immunization Practices (ACIP) recommended 4:3:1:3:3:1:4* immunization schedule[1] was **77%** using information from WIR records alone, and **49%** using information from the medical records alone.
- The percentage of patients up to date using WIR records alone was similar to estimates from the National Immunization Survey[2] for Wisconsin children of similar age.
- Accuracy of immunization administration dates, trade names and lot numbers was high.
- Patients seen by providers that shared data with the WIR had more complete and accurate immunization histories in the WIR.
- Data shared with the WIR via an electronic medical record (EMR) were more likely to be complete and accurate than data entered manually into the WIR via the user interface.
- Providers affiliated with a multi-center organization were more likely to have their patients' immunizations documented in the WIR.

Conclusions and Recommendations

- The WIR is largely complete and accurate with client and immunization information for this population of children born in 2009, and is fulfilling its purpose of consolidating immunization histories for patients who receive immunizations from multiple providers. Having a complete immunization history in the WIR allows providers to view all doses received by the patient, including doses administered by other providers, and allows WIR to accurately forecast which immunizations are recommended for the patient. As a result, missed opportunities to vaccinate and the administration of unnecessary doses should both be reduced.
- Because WIR data are more complete and accurate for patients from providers that regularly share information with the WIR, the Wisconsin Division of Public Health encourages all immunization providers in Wisconsin to share client and immunization information with the WIR.
- Having accurate administration dates and trade names in the WIR allows for accurate forecasting of recommended immunizations, and having accurate lot numbers allows for tracing of specific vaccine lots in the event of a vaccine recall. Our results suggest that sharing data with WIR through an EMR may result in more accurate documentation in the WIR of data elements such as trade name.
- Quality assessment and improvement projects on the state level, the organization level, and the provider level would be beneficial to ensure that data continues to be shared with the WIR completely and accurately.
- Providers that enter data into the WIR via the user interface are encouraged to follow the Best Practices data entry guidelines included with this report.
- To begin sharing data with the WIR or to inquire about other methods for improving the quality of your organization's information in the WIR, please contact WIR staff (see next page).

*4:3:1:3:3:1:4 includes 4 doses of DTaP vaccine, 3 doses of polio vaccine, 1 dose of MMR vaccine, 3 doses of Hib vaccine, 3 doses of HepB vaccine, 1 dose of varicella vaccine, and 4 doses of PCV vaccine.

CONTACT INFORMATION

To begin sharing data with the WIR or to ask questions about your current method of sharing data with the WIR, please contact the WIR Help Desk.

Phone: 608-266-9691
Email: dhswirhelp@wisconsin.gov.

If you have questions about this report, please contact Ruth Koepke.

Phone: 608-266-9783
Email: Ruth.Koepke@wisconsin.gov

Evaluation of the Wisconsin Immunization Registry

BACKGROUND

The WIR is a statewide, population-based immunization information system (IIS) that records and tracks immunization information for Wisconsin residents of all ages. Established in 2000 by the Wisconsin Division of Public Health (WDPH) and the Wisconsin Division of Health Care Access and Accountability, the WIR is populated from the WDPH Office of Health Informatics with client demographic information for all Wisconsin births and includes all Wisconsin births since 1995. WIR receives new client and immunization information through direct data entry via the WIR user interface and electronic data exchange with billing systems and EMRs from public and private health care providers, health maintenance organizations, Wisconsin Medicaid, and the Women, Infants, and Children (WIC) program.

In addition to collecting and consolidating immunization information from multiple health care providers, the WIR generates vaccination reminder and recall notices, forecasts client vaccination schedules, and generates vaccination coverage assessment reports by geographical area. For the forecasting, reminder/recall notices, and assessment reports to be accurate, the information held within the IIS needs to be complete and accurate. All patients need to have a client record in the IIS. For each client, the number of doses of each type of immunization received, the dates on which they were received, and in some instances (such as for DTaP, *Haemophilus influenzae* type b, pneumococcal conjugate and rotavirus vaccines) the trade names of the vaccines received will affect how many doses are recommended and when they are recommended. In addition, the correct documentation of lot numbers in the IIS facilitates the identification of specific vaccine lots in the event of a vaccine recall.

The purpose of this project was to evaluate the completeness and accuracy of the immunization information in the WIR. Additionally, we sought to identify provider characteristics associated with completeness and accuracy of WIR data in order to offer recommendations to providers on how to improve the quality of their patients' immunization information in the WIR.

METHODS

Data collection from provider medical records

- All Wisconsin providers affiliated with the Vaccines for Children (VFC) program receiving VFC compliance visits during August 2012 through December 2013 were invited to participate. In addition, all providers within multi-center organizations (defined as three or more provider clinics associated with the same organization) affiliated with the Wisconsin VFC program were invited to participate. Providers that reported documenting immunization information only in the WIR (i.e., providers without immunization records separate from the WIR) and providers that did not regularly immunize children aged <4 years were excluded. Local health departments do not regularly keep immunization medical records separate from the WIR and therefore were not included.
- From each participating provider, a random sample of immunization records from patients born in 2009 was selected based on the number of patients at the provider clinic born in 2009: if the number of patients born in 2009 was <10, 2 patient records were selected; if 10-50, 4 patient records were selected; if 51-500, 8 patient records were selected; if >500, 17 patient records were selected.
- Immunization information on doses administered during 2009-2011 was collected for the following immunization types: DTaP (diphtheria-tetanus-acellular pertussis vaccine), HepA (hepatitis A vaccine), HepB (hepatitis B vaccine), Hib (*Haemophilus influenzae* type b vaccine), MMR (measles, mumps, rubella vaccine), PCV (pneumococcal conjugate vaccine), polio vaccine, rotavirus vaccine, and varicella vaccine. The HepB birth dose was defined as a dose of HepB vaccine received on the date of birth or one or two days after birth.

Data collection from the WIR

- Information on the immunizations received during 2009-2011 among all WIR clients born in 2009 was extracted from the WIR on January 27, 2012, and stored in a confidential electronic file for later comparison with the selected medical records.

Data analysis

- For each selected patient, WIR was searched by patient first name, last name and birth date to identify a client record. The percentage of patients with client records in the WIR was calculated (**Question #1**).
- Among patients with client records in the WIR, the immunization information in the medical record for doses administered during 2009-2011 was compared to immunization information in the WIR.
- For each patient with a client record in the WIR, the total number of doses administered for each immunization type was summed separately using first the medical record only and then the WIR record only. The percentage of patients up to date with the ACIP recommended immunization schedule[1] was calculated using the medical record only and the WIR record only, then compared to estimates from the National Immunization Survey[2] for Wisconsin children of similar age during 2012 (**Question #2**).
- For each patient, we attempted to match each of the immunizations documented in the medical record to immunizations documented in the WIR record by immunization type and date of administration (+/- 10 days). The percentage of immunizations in the medical records matched to immunizations in the WIR was calculated (**Question #3**).
    - Among immunizations in the medical record matched to an immunization in the WIR record, we compared dates of administration and calculated the percentage of immunizations with the same date of administration in both records (**Question #4**).
    - Among matched DTaP, Hib, PCV, and rotavirus immunizations with trade names available in the medical record and the WIR record, we compared trade names and calculated the percentage of immunizations with the same trade name in both records (**Question #5**).
    - Among matched immunizations with lot numbers available in the medical record and the WIR record, we compared lot numbers and calculated the percentage of immunizations with the same lot number in both records (**Question #6**).
- Multivariate models accounting for clustering within providers were used to evaluate the association of provider characteristics [provider size, provider type (whether or not the provider was affiliated with a multi-center organization), and how the provider entered information into the WIR] with two measures of completeness (percentage of the provider's patients with client records in the WIR and percentage of patients' immunizations found in the WIR) and one measure of accuracy (percentage of immunizations with the same trade name).

Confidentiality

Only authorized Wisconsin Immunization Program staff had access to medical record and WIR data. Patient confidentiality was maintained at all times according to the Wisconsin Department of Health Services security and confidentiality standards. Names and other identifying information were used only for the purpose of matching client records to the WIR. The University of Wisconsin - Madison Institutional Review Board (IRB) approved this project as exempt from IRB oversight, because it does not constitute human subjects research.

RESULTS

Completeness

Question #1: How many of the patients had client records in the WIR?

- 1,863 patient records were gathered from 251 participating providers.
- **98%** (N=1,833) of patients were found to have client records in the WIR.

Question #2: Among the patients with client records in the WIR, were the patients up to date with the ACIP recommended immunization schedule?

- The percentage of patients up to date with the ACIP schedule[1] using WIR data only was similar to the National Immunization Survey[2] estimates for children of similar age, whereas the percentage of patients up to date using medical record data only was lower.
- In general, the WIR record contained a more complete vaccination history for each patient than did the medical record.

Percent of patients up to date (UTD) with the ACIP schedule by age 24-35 months (N=1,833 patients)	% UTD, using medical record only	% UTD, using WIR record only	% UTD, NIS 2012†
4:3:1:3:3:1:4* series	49.3	76.5	75.2 ± 6.5
DTaP (4 doses)	60.9	86.4	87.8 ± 5.3
Polio (3 doses)	65.6	92.1	88.9 ± 5.3
MMR (1 dose)	71.7	91.1	89.3 ± 5.2
Hib (3 doses)	66.6	92.1	90.3 ± 5.1
HepB (3 doses)	60.2	89.5	88.4 ± 5.2
Varicella (1 dose)	69.6	88.9	88.5 ± 5.0
PCV (4 doses)	59.8	83.8	84.5 ± 5.8
Hep B birth dose	54.9	70.7	72.2 ± 6.5
Hep A (1 dose)	60.2	74.0	78.6 ± 6.3
Hep A (2 doses)	46.1	58.1	55.6 ± 7.4
Rotavirus (2 doses)	54.6	72.3	67.4 ± 7.1

*4:3:1:3:3:1:4 immunization series includes 4 doses of DTaP vaccine, 3 doses of polio vaccine, 1 dose of MMR vaccine, 3 doses of Hib vaccine, 3 doses of HepB vaccine, 1 dose of varicella vaccine, and 4 doses of PCV vaccine.

†NIS 2012 data shown are for Wisconsin children aged 19-35 months, born during the period January 2009 through May 2011.

Abbreviations: UTD, up to date; NIS, National Immunization Survey; PCV, pneumococcal conjugate vaccine; Hib, *Haemophilus influenzae* type b vaccine.

Question #3: Among the patients with client records in the WIR, how many of their immunizations were documented in the WIR?

- **97%** of the immunizations in the patients' medical records were matched to immunizations documented in the WIR.

Percent and number of immunizations in the medical record that were documented in the WIR		
Immunization type	%	N
DTaP	97.6%	(5,025/5,149)
HepA	95.8%	(1,790/1,869)
HepB	96.7%	(3,799/3,930)
HepB birth dose	96.8%	(755/780)
Hib	97.3%	(4,873/5,008)
MMR	97.3%	(1,275/1,310)
PCV	97.7%	(5,090/5,212)
Polio	97.5%	(4,178/4,284)
Rotavirus	97.3%	(2,785/2,862)
Varicella	96.5%	(1,231/1,275)
All types	97.2%	(30,046/30,899)

Summary: Completeness

- The WIR contained client records for almost all of the selected patients. This reflects a strength of the WIR in that it automatically creates a new client record for each new birth in Wisconsin using demographic information from the WDPH Office of Health Informatics.
- Additionally, the WIR contained 97% of the immunizations documented in the selected patients' medical records.
- In general, the WIR contained more doses per patient than the medical record, indicating that the WIR is serving its purpose of consolidating immunization histories for each client across multiple providers.
- The WIR provided a vaccination coverage assessment for Wisconsin children that is similar to the current national standard of vaccination coverage assessment, the National Immunization Survey.
- Of note, 10% of DTaP, Hib, PCV, and rotavirus immunizations had trade names documented in the medical record but not in the WIR, and 53% of all immunizations had lot numbers documented in the medical record but not in the WIR. Providers are encouraged to enter trade names and lot numbers into WIR. These data elements are important for appropriately forecasting recommended vaccines and for tracing vaccine lots in the event of a vaccine recall.

Accuracy

Question #4: Among immunizations documented in both the medical record and the WIR, did they have the same date of administration?

- **99%** of immunizations in the medical record matched to immunizations in the WIR had the same date of administration.
- HepB birth doses were more likely to have different administration dates in the WIR compared to the medical record.

Percent and number of immunizations with the same date of administration in the WIR as in the medical record		
Immunization type	%	N
DTaP	99.4%	(4,994/5,025)
HepA	99.4%	(1,780/1,790)
HepB	97.8%	(3,714/3,799)
HepB birth dose	91.4%	(690/755)
Hib	99.4%	(4,845/4,873)
MMR	99.1%	(1,264/1,275)
PCV	99.4%	(5,057/5,090)
Polio	99.4%	(4,154/4,178)
Rotavirus	99.6%	(2,773/2,785)
Varicella	99.6%	(1,226/1,231)
All types	99.2%	(29,807/30,046)

Question #5: Among DTaP, Hib, PCV, and rotavirus immunizations documented in both the medical record and the WIR, did they have the same trade name?

- 68% of DTaP, Hib, PCV, and rotavirus immunizations had trade names documented in both the medical record and the WIR.
- **96%** of these immunizations had the same trade name documented in the WIR as in the medical record.
- Rotavirus and DTaP were more likely than PCV or Hib to have the same trade name in the WIR as in the medical record.

Percent and number of immunizations with the same trade name in the WIR as in the medical record		
Immunization type	%	N
DTaP	98.8%	(3,664/3,710)
Hib	96.0%	(2,909/3,030)
PCV	91.8%	(2,960/3,223)
Rotavirus	98.9%	(2,084/2,107)
All types listed above	96.2%	(11,617/12,070)

Question #6: Among immunizations documented in both the medical record and the WIR, did they have the same lot number?

- 35% of immunizations had lot numbers documented in both the medical record and the WIR.
- **95%** of these immunizations had exactly the same lot number in the WIR as in the medical record.

Percent and number of immunizations with the same lot number in the WIR as in the medical record		
Immunization type	%	N
DTaP	95.3%	(1,801/1,889)
HepA	97.2%	(732/753)
HepB	95.2%	(1,181/1,241)
Hib	95.5%	(1,620/1,697)
MMR	93.8%	(466/497)
PCV	97.7%	(1,861/1,904)
Polio	94.5%	(1,387/1,467)
Rotavirus	89.1%	(817/917)
Varicella	97.3%	(465/478)
All types	95.3%	(10,330/10,843)

Summary: Accuracy

- Date discrepancies were rare, but were more common among HepB birth doses. This is expected considering we sampled patient records from clinics only and not from birthing hospitals where most HepB birth doses would have been administered. To facilitate the systematic and accurate recording of HepB birth dose information in the WIR, on January 1, 2011, the WDPH Office of Health Informatics began collecting HepB birth dose information for every birth in Wisconsin and transmitting the information to the WIR.
- Trade name discrepancies were most common among PCV immunizations. This is an important issue because if a PCV13 dose was incorrectly entered into the WIR as PCV7, the WIR would incorrectly forecast that a dose of PCV13 was still needed. WIR staff members have previously conducted data clean-up activities to assign the appropriate trade name for PCV13 immunizations in the WIR based on the manufacturer lot numbers.
- Discrepancies in lot numbers were not uncommon. This is not surprising given lot number complexity and length. Often these discrepancies were minor; for example, a zero was mistakenly recorded as the letter “O”, letters were inverted, or lot numbers were truncated. Every effort should be made to ensure lot numbers are appropriately documented in both the medical record and the WIR in order to trace a vaccine lot if it is recalled. Scanning of vaccine two-dimensional barcodes, a new feature to some vaccine labels and a new functionality in WIR, may facilitate accurate documentation of lot numbers in the WIR.

Provider characteristics associated with completeness and accuracy

Accounting for the other provider characteristics, the multivariate results indicate that:

- Patients of providers that reported regularly sharing immunization information with the WIR were more likely to have their immunizations recorded in the WIR and more likely to have the same trade name in the WIR as in the medical record.
- Compared to patients of providers that share information with the WIR via the user interface, patients of providers that share information with the WIR via an EMR were more likely to have client records in the WIR and more likely to have the same trade name in the WIR as in the medical record.
- Patients of multi-center organizations were more likely to have a higher percentage of their immunizations found in the WIR compared to patients of providers not affiliated with a multi-center organization.

LIMITATIONS

We assessed completeness and accuracy only among children born in 2009 who received immunizations during 2009-2011. Since that time, Meaningful Use[3] initiatives have resulted in changes to how providers transmit information to the WIR. As a result, the findings in this report may not be generalizeable to information in the WIR for children born in a different year or for immunizations received in different years. In addition, we were not able to gather immunization records from all providers that provided immunizations in Wisconsin, and we were not able to assess completeness and accuracy among providers that only enter information into the WIR (i.e., providers with no separate immunization medical record). Furthermore, we gathered information only from VFC-affiliated providers, which may be more familiar with WIR due to VFC/WIR-related activities and therefore may have better quality data in the WIR than non-VFC-affiliated providers. Therefore, our sample may not be representative of all providers and all patients from the 2009 birth cohort in Wisconsin.

CONCLUSIONS AND RECOMMENDATIONS

- The WIR is largely complete and accurate with client and immunization information for this population of children born in 2009, and is fulfilling its purpose of consolidating immunization histories for patients who receive immunizations from multiple providers. Having a complete immunization history in the WIR allows providers to view all doses received by the patient, including doses administered by other providers, and allows WIR to accurately forecast which immunizations are recommended for that patient. As a result, missed opportunities to vaccinate and the administration of unnecessary doses should both be reduced.
- The WIR provides a statewide vaccination coverage assessment similar to the current national standard of vaccination coverage assessment, the National Immunization Survey.
- Because WIR data are more complete and accurate for patients from providers that regularly share information with the WIR, the Wisconsin Division of Public Health encourages all immunization providers in Wisconsin to share client and immunization information with the WIR.
- Having accurate administration dates and trade names in the WIR allows for accurate forecasting of recommended immunizations, and having accurate lot numbers allows for tracing of specific vaccine lots in the event of a vaccine recall. Our results suggest that sharing data with WIR through an EMR may result in more accurate documentation in the WIR of data elements, such as trade name. In addition, scanning of vaccine two-dimensional barcodes, a new feature to many vaccines and a new functionality in WIR, may facilitate accurate documentation of lot numbers in the WIR.
- Quality assessment and improvement projects on the state level, the organization level, and the provider level would be beneficial to ensure that data continues to be shared with the WIR completely and accurately.
- All providers that enter data into the WIR via the user interface are encouraged to follow the Best Practices data entry guidelines included with this report.
- Providers that share data with the WIR via data exchange from an EMR are encouraged to contact WIR staff if they have questions about how to improve and ensure their data quality.
- To begin sharing data with the WIR or to inquire about other methods for improving the quality of your organization’s information in the WIR, please contact WIR staff. Contact information can be found on page 2 of this report.

REFERENCES

1. Advisory Committee on Immunization Practices. Immunization Schedules. http://www.cdc.gov/vaccines/schedules/hcp/child-adolescent.html

2. National Immunization Survey, Children 19-35 Months. 2012. http://www.cdc.gov/vaccines/imz-managers/coverage/nis/child/index.html

3. Meaningful Use. http://www.cdc.gov/ehrmeaningfuluse/introduction.html

ABBREVIATIONS

ACIP, Advisory Committee on Immunization Practices
DTaP, diphtheria-tetanus-acellular pertussis vaccine
EMR, electronic medical record
MMR, measles-mumps-rubella vaccine
HepA, hepatitis A vaccine
HepB, hepatitis B vaccine
Hib, *Haemophilus influenzae* type b vaccine
IIS, immunization information system
NIS, National Immunization Survey
PCV, pneumococcal conjugate vaccine
UTD, up to date
VFC, Vaccines for Children
WIR, Wisconsin Immunization Registry